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A new genus and species of soldier beetle from Upper Cretaceous Burmese amber (Coleoptera, Cantharidae, Malthininae)

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ABSTRACT

A new Upper Cretaceous genus and species of soldier beetles, *Archaeomalthodes rosetta* gen. et sp. nov., is described and illustrated from an individual preserved in Upper Cretaceous (Cenomanian, ca. 99 Ma) amber from northern Myanmar. It is undoubtedly placed in extant subfamily Malthininae based on its small-sized body, somewhat abbreviated elytra and fusiform terminal maxillary palpomere, representing the oldest documented occurrence of Malthininae. It suggests that this subfamily is an ancient group, which originated at least in the earliest Late Cretaceous. Our discovery sheds light on the palaeodiversity of Cantharidae in the Late Mesozoic. Together with other previously reported fossil cantharids, it is likely that Malthininae has been fairly diverse during the early evolution of Cantharidae. On the other hand, a morphological similarity between *Archaeomalthodes* and Recent malthinines and the occurrence of flowering plants in the Burmese amber implies a potential flower-visiting behaviour of this fossil species.

1. Introduction

The family Cantharidae is a moderately large group of soft-bodied, often brightly colored terrestrial beetles, also known as soldier beetles. The family consists of five subfamilies, over 130 genera and 5000 species, occurring on all the world's habitable continents (Delkeskamp, 1977, 1978; Ramsdale, 2010). Cantharids are usually found in forested habitats and are often observed visiting flowers. The adults are opportunistic predators of foliage-frequenting invertebrates and also feed on nectar or pollen (Ramsdale, 2010). The monophyly of Cantharidae is supported by the following synapomorphic characters: (1) reduced wing venation; (2) membranous labrum; (3) larval velvety appearance caused by dense and minute cuticular processes; (4) presence of paired lateral glandular pores on abdominal tergites 1–8 of adults, and thoracic and abdominal tergites 1–8 or 1–9 of larvae (Šulc, 1949; Fitton, 1975; Brancucci, 1980; Ramsdale, 2010). Branham and Wenzel (2000) performed cladistics analysis of Lampyridae and related Cantharoid families using adult characters and recovered non monophyletic Cantharidae embedded in a clade consisting of Omethidae, Phengodidae and Telegeusidae. However, all recent molecular phylogenetic studies support the monophyly of Cantharidae (Bocakova et al., 2007; Kundrata and Bocak, 2010; Kundrata et al., 2014; McKenna et al., 2015), but the results are not conclusive because of insufficient number of Cantharidae included in studies focused on other elateroid groups. Bocakova et al. (2007) proposed the Lampyridae as the sister group of Cantharidae and such relationship was also agreed by Kundrata et al. (2014), while Kundrata and Bocak (2010) supported the relationship Cantharidae + (Lampyridae + Lycidae). McKenna et al. (2015) recovered Cantharidae as the sister group to the clade including Omalisidae, Drilidae, Elateridae, Rhagophthalmidae, Phengodidae and Lampyridae.

Brancucci (1980) published the only comprehensive phylogeny of Cantharidae based on morphological characters of adults and divided it into five subfamilies. The subfamily Malthininae is a diverse group of Cantharidae with four tribes (three extant and one extinct) and fourteen genera (one extinct) (Brancucci, 1980; Kazantsev and Brancucci, 2007; Kazantsev, 2013). It is

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characterized by small-sized body (1.2–5 mm); radially symmetrical terminal maxillary palpomere, with pointed apex; somewhat abbreviated elytra, with mostly exposed metathoracic wings; basal piece of aedeagus (=phallobase) enlarged, strongly sclerotized, and expanded ventrally. Malthinines are distributed worldwide, appearing mainly in spring and visiting flowers diurnally, with phototaxis at night as other cantharids. Malthininae assume end-to-end position during copulation (Fig. 1), as opposed to the male-above female position in the remaining subfamilies. The placement of Malthininae within Cantharidae varies between morphological and molecular phylogenetic studies. According to the morphological phylogeny of Brancucci (1980), Malthininae was regarded as a derived group and sister taxon to Dysmorphocerinae. However, the molecular phylogenies revealed its basal position in this family (Bocakova et al., 2007; Kundrata and Bocak, 2010; Kundrata et al., 2014).

Up to date, twenty-five fossil species in sixteen genera of Cantharidae have been described, classified in all extant subfamilies except Chauliognathinae. The oldest, unnamed, fossil classified in Cantharidae was reported by Kirejtshuk and Azar (2013) from the Early Cretaceous amber outcrop of Hammana/Mdeirij in Central Lebanon (Barremian-lowermost Aptian, 125–135 Ma; Azar, 2012) but most of fossil cantharids were recorded from the Baltic amber with few taxa described from Chiapas, Dominican, Rovno, Burmese amber and Tertiary outcrop of Brunstatt (France) (Förster, 1891; Schaufuss, 1892; Iablokoff-Khnzorian, 1960; Wittmer, 1963; Kuśka, 1992, 1996; Kuśka and Kupryjanowicz, 2005; Kuśka and Kania, 2010; Kazantsev, 2010, 2013; Alekseev and Kazantsev, 2014; Kazantsev and Perkovsky, 2014; Poinar and Fanti, 2016).

Burmese amber is the important fossiliferous resin from the Upper Cretaceous and is renowned for yielding rich and exquisitely preserved insects (Grimaldi et al., 2002; Engel et al., 2007; Engel and Grimaldi, 2008, 2014; Ross et al., 2010; Cai et al., 2016). In the present paper, we describe a new genus and species of Cantharidae based on an individual preserved in the Upper Cretaceous Burmese amber. The new genus belongs to the extant tribe Malthodini (subfamily Malthininae), representing the oldest fossil record for this subfamily.

2. Material and methods

The single specimen is derived from amber deposits in Kachin (Hukawng Valley) of Northern Myanmar, approximately 100 km southwest of the Village of Tanai. The age of the amber deposits generally considered to be the earliest Cenomanian (Grimaldi et al., 2002) or possibly latest Albian (Ross et al., 2010). However, the recent U–Pb zircon dating constrained the Burmese amber to a maximum age of 98.79 ± 0.62 Ma, which is equivalent to the Upper Cretaceous (earliest Cenomanian; Shi et al., 2012).

The fossil-containing amber was prepared using a mini table-saw, polished with emery papers with different grain sizes, and finally lustrated with polishing powder. The type specimen is housed in the Key Laboratory of Insect Evolution & Environmental Changes, Capital Normal University in Beijing, China. The specimen was examined using a Leica M205 C stereomicroscope and the photographs were taken using a Leica DFC490 digital camera or Nikon COOLPIX P310 digital camera. Images were post-processed using the software Helicon Focus 6.3.5 (Helicon Soft Ltd.). The morphological terminology follows Ramsdale (2010), and the classification of subfamilies and tribes of Cantharidae follows Brancucci (1980) and Kazantsev (2013). The nomenclatural acts established herein are registered under ZooBank LSID urn:lsid:zoobank.org:pub:342D2322-7F64-4146-A5CA-23A233D7754B.

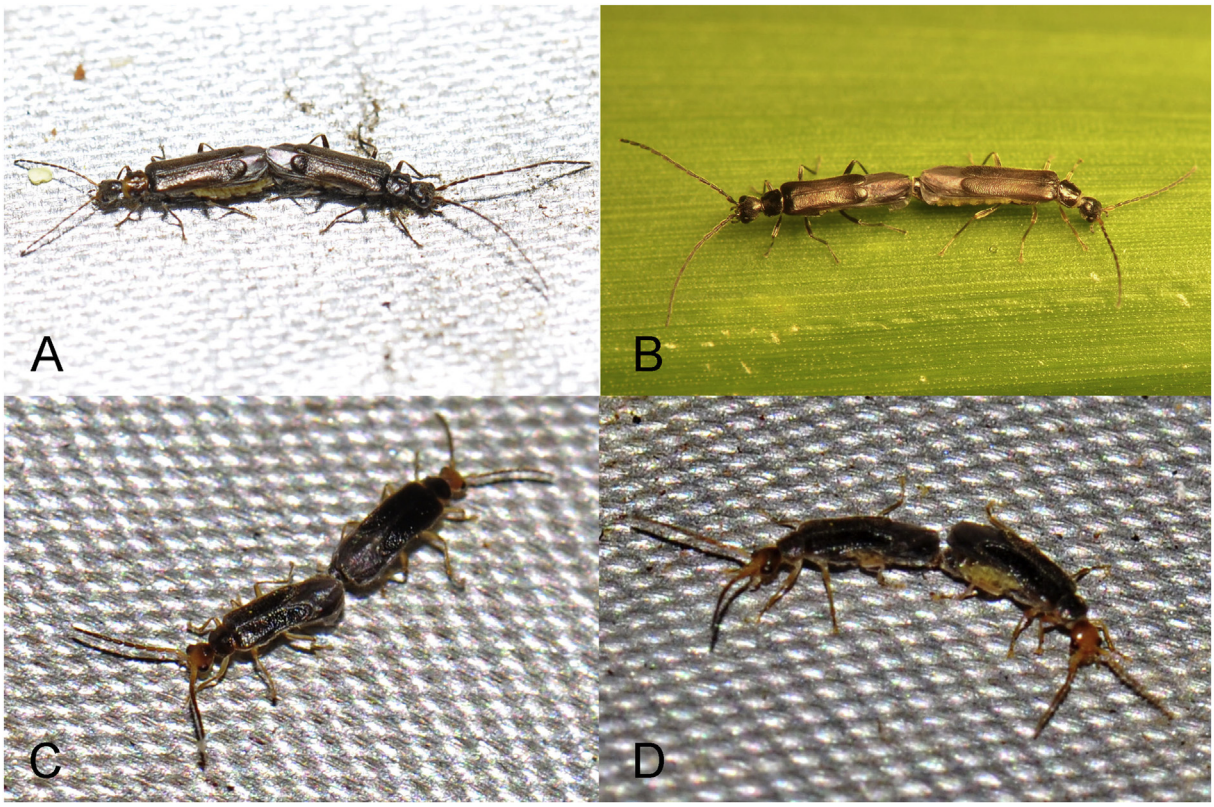

Fig. 1. The copulation of extant malthinine species, showing the end-to-end mating position. A–B. *Malthodes* spp.; C–D. *Maltypus* sp. A, C–D. Photographed by Wen-Chuan Liao; B. Photographed by Ren-Hou Liou.