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Murcybolus gen. nov., a new net-winged beetle genus from mid-Cretaceous Burmese amber (Coleoptera: Lycidae: Burmolycini)

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Abstract

A new lycid beetle, *Murcybolus longiantennus* **gen. et sp. nov.**, is reported from mid-Cretaceous Burmese amber (ca. 99 Ma). *Murcybolus* is placed in the recently erected fossil tribe Burmolycini based on the fully metamorphosed female, 10-segmented antennae, and pronotal disc with deep rounded punctures but without carinae. *Murcybolus* differs from the other genus in Burmolycini, *Burmolycus*, by its antennal morphology and elytral venation.

Key words: Lycidae, *Murcybolus*, fossil, Cretaceous, Burmese amber

Introduction

Lycidae, or net-winged beetles, is a cosmopolitan family in the beetle superfamily Elateroidea, with about 4,600 species known to date (Bocak & Bocakova 2008, 2010; Masek *et al*. 2018). Similar to other soft-bodied elateroids, the cuticle of lycids is not fully-sclerotised, and their females are sometimes neotenic. Lycidae has been recovered as the sister group of a newly discovered family, Iberobaeniidae (Bocak *et al*. 2016). They together are sister to a group consisting of Cantharidae, Elateridae and the lampyroid clade (Kusy *et al*. 2018, 2021; McKenna *et al*. 2019). The relationship among lycids have been contentious for a long time (see Kusy *et al*. 2019). A recent study divided Lycidae into seven subfamilies based on phylogenomic analyses, with Dexorinae reconstructed as the basalmost lineage (Kusy *et al*. 2019).

The fossil record of lycids is sparse, impeding our understanding of the timing and pattern of their diversification (Bocak *et al*. 2019). Almost all lycid fossils come from amber deposits (Kazantsev 2019), and the first Mesozoic lycids were not described until 2019 (Bocak *et al*. 2019; Tihelka *et al*. 2019). In this study, we describe the third net-winged beetle from mid-Cretaceous Burmese amber, which broadens our knowledge about the early diversity of this family.

Material and methods

The Burmese amber specimen studied herein originates from amber mines near Noije Bum Village (26°20’ N, 96°36’ E), Hukawng Valley, Kachin State, northern Myanmar. The specimen is deposited in the Nanjing Institute of Geology and Palaeontology (NIGP), Chinese Academy of Sciences, Nanjing, China. The amber piece was trimmed with a small table saw, ground with emery papers of different grit sizes, and finally polished with polishing powder. Readers may refer to Sidorchuk & Vorontsov (2018) for detailed methods of preparing amber specimens.

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Photographs under incident light were taken with a Zeiss Discovery V20 stereo microscope. Widefield fluorescence images were captured with a Zeiss Axio Imager 2 light microscope combined with a fluorescence imaging system. Confocal images were obtained with a Zeiss LSM710 confocal laser scanning microscope, using 488 nm Argon laser excitation line. Images under incident light and widefield fluorescence were stacked in Helicon Focus 7.0.2 or Zerene Stacker 1.04. Confocal images were stacked with colour coding for depth in ZEN 2.3 (Blue Edition), or without colour coding in Helicon Focus 7.0.2. Images were further processed in Adobe Photoshop CC to enhance contrast.

Systematic palaeontology

Order Coleoptera Linnaeus, 1758

Superfamily Elateroidea Leach, 1815

Family Lycidae Laporte, 1836

Subfamily Dexorinae Bocak & Bocakova, 1989

Tribe Burmolycini Bocak, Li & Ellenberger, 2019

Genus *Murcybolus* Li & Cai gen. nov.

Type species. *Murcybolus longiantennus* **sp. nov.**

Etymology. The generic name is an anagram of "*Burmolycus*", the type genus of Burmolycini. The name is masculine in gender.

Diagnosis. Eyes large; antennae 10-segmented, longer than half of body; antennomeres 3–10 elongate, filiform. Pronotal disc with deep rounded punctures, without carinae; posterior angles acute. Elytra long, completely covering abdomen, with eight longitudinal costae. Femora obliquely attached to trochanters. Female fully metamorphosed.

Comparison. *Murcybolus* has a similar general appearance to *Burmolycus* Bocak *et al*. However, it can be easily differentiated from *Burmolycus* by the antennal and elytral morphology. The antennomeres 3–9 of *Burmolycus* are comparatively short and serrate, and antennomere 3 is not significantly longer than antennomere 2. By contrast, the antennomeres 3–10 of *Murcybolus* are elongate and rather filiform, with antennomere 3 apparently longer than antennomere 2. The elytra of *Burmolycus* are shortened, not completely covering the abdomen, whereas the elytra of *Murcybolus* are complete, without exposed abdominal tergites. According to the description of Bocak *et al*. (2019), there are nine longitudinal costae on the elytra of *Burmolycus*, with costae 9 and 7 (counted from the suture) shortened apically. The elytra of *Murcybolus*, however, have only eight longitudinal costae and nine rows of cells in intercostal intervals, with costae 2 and 3 interrupted in the posterior quarter of elytra, not reaching elytral margin. In addition, the posterior angles of the pronotum are relatively acute and project laterally in *M. longiantennus*, while the posterior pronotal angles of *B. compactus* Bocak *et al*. are closer to a right angle.

Murcybolus longiantennus Li & Cai sp. nov.

(Figs 1–3)

Etymology. The specific name refers to the beetle's relatively long antennae.

Material. Holotype, NIGP173914, adult female.

Locality and horizon. Amber mine located near Noije Bum Village, Tanai Township, Myitkyina District, Kachin State, Myanmar; unnamed horizon, mid-Cretaceous, Upper Albian to Lower Cenomanian.

Diagnosis. As for the genus.

Description. Adult female. Body presumably weakly-sclerotised, slender, almost parallel-sided, 2.2 mm long and 0.6 mm wide at humeri, covered with long fine hairs.

Head including eyes wider than anterior margin of pronotum, hypognathous, without any longitudinal grooves; exposed portion in dorsal view 0.21 mm long. Compound eyes lateral, large, strongly protuberant, finely faceted, without interfacetal setae. Antennal insertions located frontally, separated by projecting frontal part of cranium. Antennae moderately long, longer than half of body, with 10 antennomeres; antennomere 1 robust, with oblique apical margin; antennomere 2 short, about 0.4 times as long as antennomere 3; antennomeres 3–10 elongate, filiform, slightly asymmetrical. Mouth cavity rounded. Labrum free, located inside mouth cavity. Mandibles simple, gradually curved mesally. Maxillary palps 4-segmented; palpomere 1 short, palpomeres 2–4 filiform. Mala well-developed, setose. Labial palpi 3(?)-segmented.

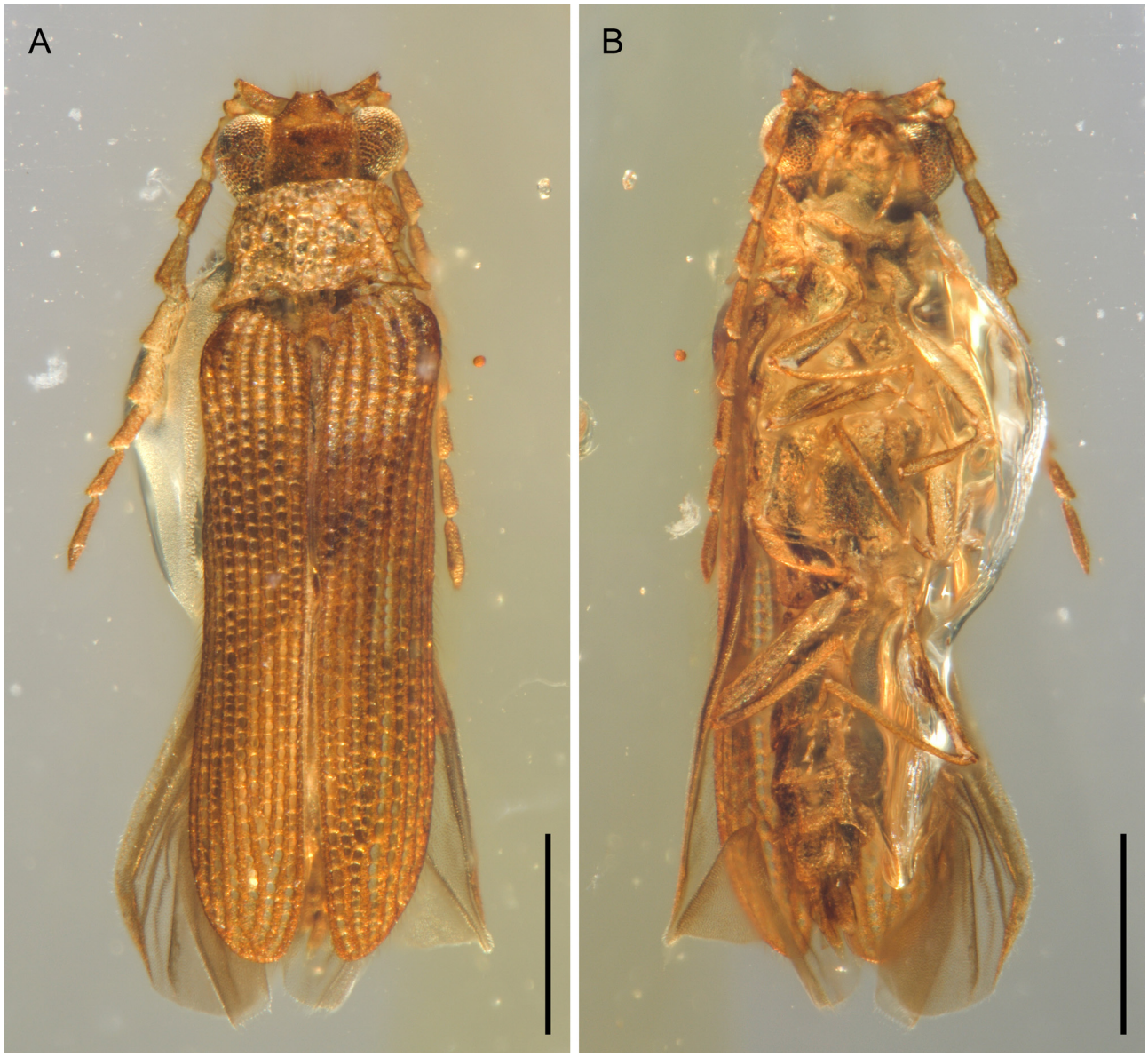

FIGURE 1. General habitus of *Murcybolus longiantennus* **gen. et sp. nov.**, female, holotype, NIGP173914, under incident light. **A**, Dorsal view. **B**, Ventral view. Scale bars: 500 μm.

Pronotal disc narrower than elytra, 0.27 mm long, 2.0 times as wide as long, subtrapezoidal; anterior angles obtuse; posterior angles acute, projecting laterally; surface without longitudinal carinae, with irregular deep rounded punctures. Prosternum strongly transverse, short; prosternal process narrow and acute apically. Scutellum well-developed, parallel-sided, with posterior margin emarginate. Metaventrite large.

Elytra parallel-sided, 1.7 mm long, about 2.7 times as long as their combined width, completely covering abdomen; apices separately rounded; surface with eight longitudinal costae and nine rows of rounded cells in intercostal intervals; costae 2 and 3 (counted from elytral suture outwards) interrupted in posterior quarter of elytra. Hind winds fully developed. Legs slender; procoxae narrowly separated; trochanters obliquely attached to femora; both femora

and tibiae slender; tarsi with five tarsomeres, tarsomeres 1–4 subequal, tarsomere 5 slender, long; pretarsal claws simple.

Abdomen with seven free subequal ventrites.

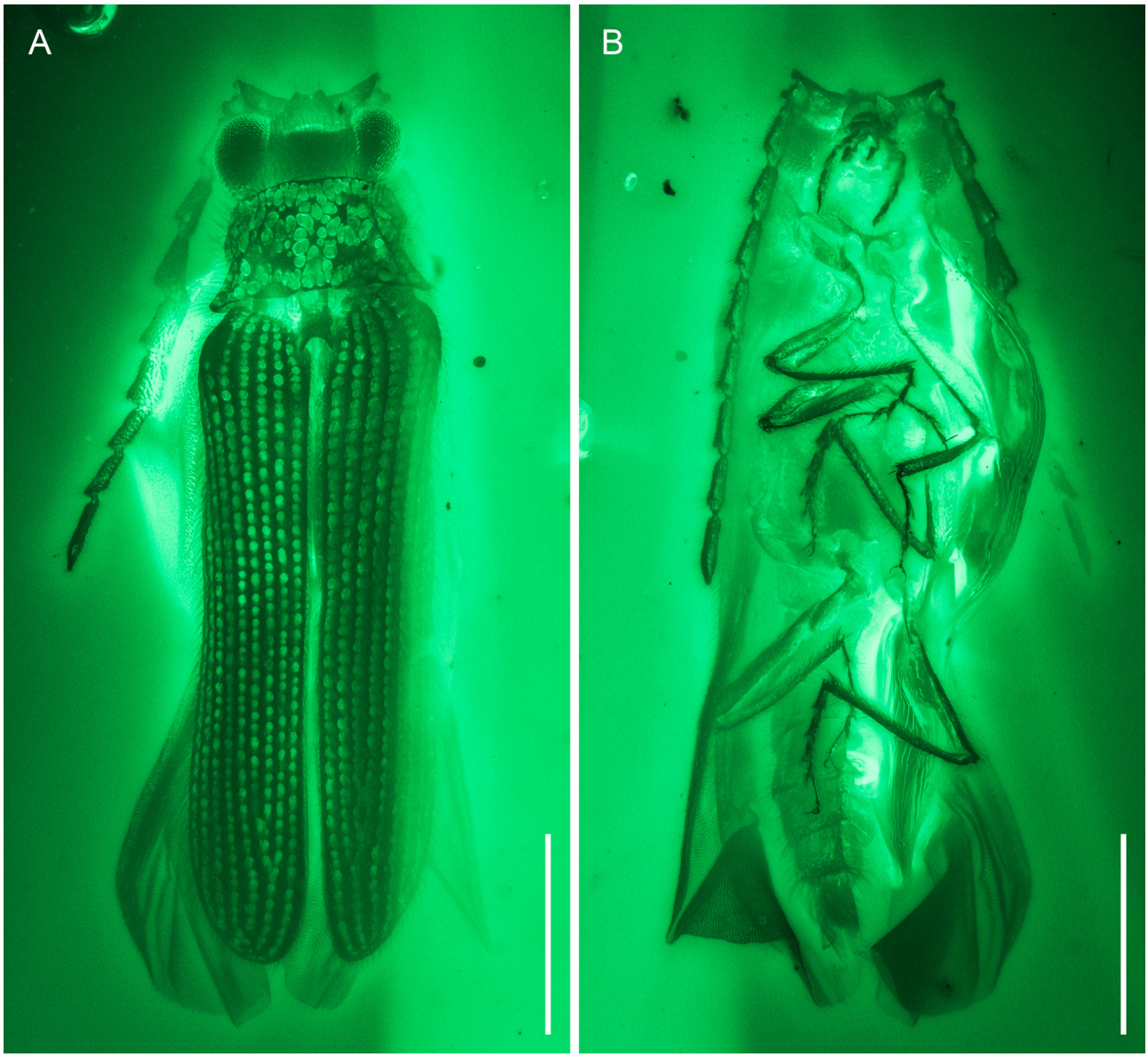

FIGURE 2. General habitus of *Murcybolus longiantennus* **gen. et sp. nov.**, female, holotype, NIGP173914, under widefield fluorescence. **A**, Dorsal view. **B**, Ventral view. Scale bars: 500 μm.

Discussion

Murcybolus has a similar habitus to some Dexorinae and Erotinae, both of which are deeply-rooted lineages in Lycidae (Kusy *et al*. 2019). Dexorinae has been recovered as the basalmost lineage of Lycidae in a recent phylogenomic study (Kusy *et al*. 2019), and differs from all other lycids in the oblique attachment of femora to trochanters (Kazantsev 2005). *Murcybolus* possesses femora obliquely attached to trochanters (Fig. 3I), which is in accordance with a placement in Dexorinae. *Murcybolus* differs from Erotinae additionally in the structure of the pronotum. The pronotum of Erotinae is characterised by several relatively large areolae separated by carinae (Kazantsev 2012; Kusy *et al*. 2019), while the pronotum of *Murcybolus* has only irregular rounded punctures and no carinae (Fig. 3A,G). Thus, we prefer to place *Murcybolus* into the subfamily Dexorinae till more data is available and Mesozoic net-winged beetles are better known.

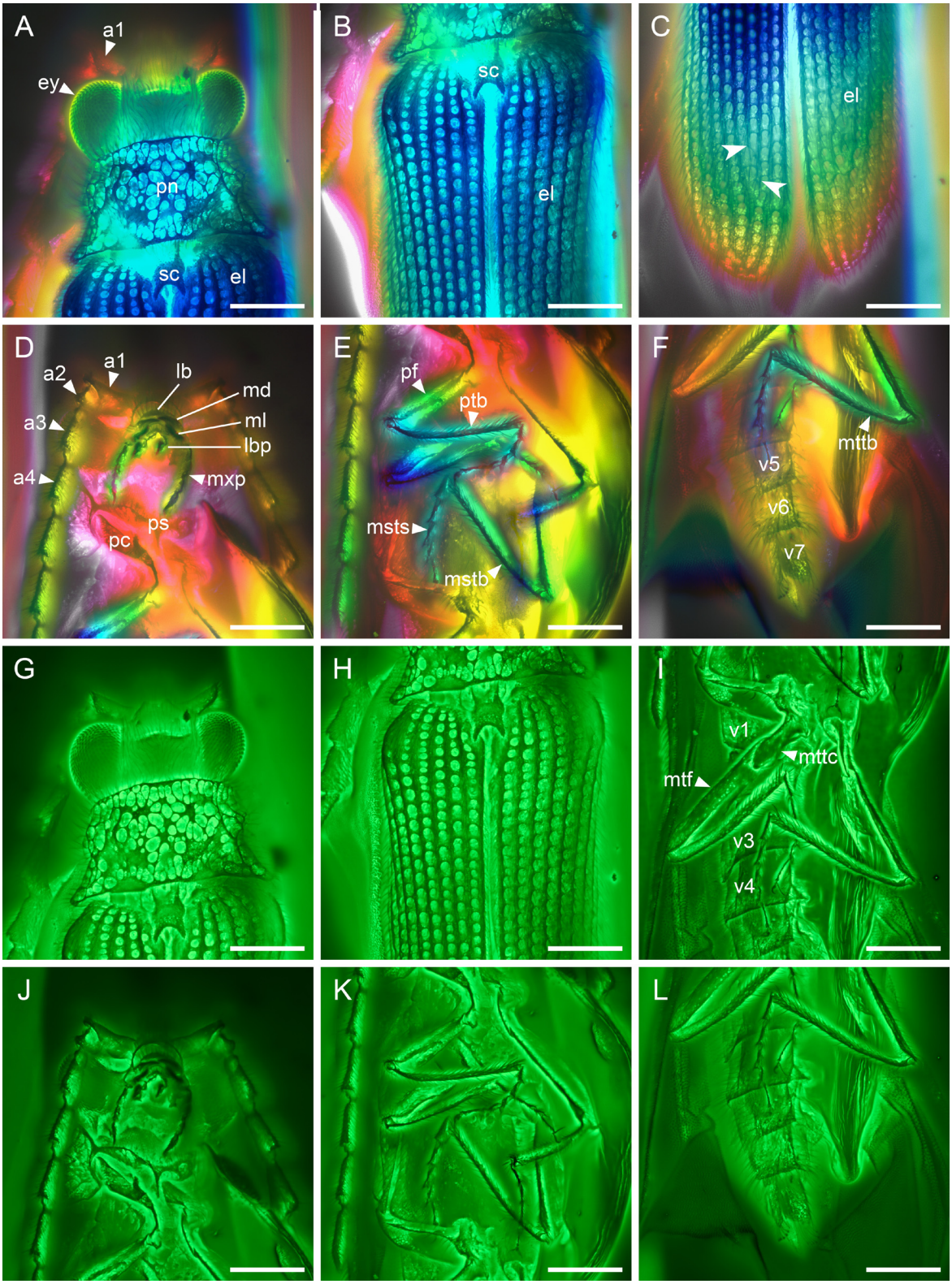

FIGURE 3. Details of *Murcybolus longiantennus* **gen. et sp. nov.**, female, holotype, NIGP173914, under confocal microscopy, with depth colour-coding in **A–F**. **A**, Head and prothorax, dorsal view. **B**, Elytral base. **C**, elytral apex, showing the interrupted costae 2 and 3 (arrowheads). **D**, Head and prothorax, ventral view. **E**, Legs, ventral view. **F**, Abdominal apex, ventral view. **G–H**, Same as **A–B**. **I**, Anterior portion of abdomen, ventral view. **J–L**, Same as **D–F**. Abbreviations: a1–4, antennomeres 1–4; el, elytron; ey, compound eye; lb, labrum; lbp, labial palp; ml, mala; md, mandible; mstb, mesotibia; msts, mesotarsus; mtf, metafemur; mttb, metatibia; mttc, metatrochanter; mxp, maxillary palp; pc, procoxa; pf, profemur; pn, pronotum; ps, prosternum; ptb, protibia; sc, scutellum; v1–7; ventrites 1–7. Scale bars: 200 μm.

Bocak *et al*. (2019) described the first Mesozoic lycid, *Burmolycus compactus*, and placed it into a newly established tribe inside Dexorinae, Burmolycini. The most important diagnostic character of Burmolycini is the fully metamorphosed adult female, which is different from all extant Dexorinae (Bocak *et al*. 2019). Our newly discovered specimen of *M. longiantennus* has only seven abdominal ventrites (Fig. 3F,I), thus it is probably also a fully metamorphosed female. Furthermore, *Murcybolus* is attributed into Burmolycini based on its 10-segmented antennae and the pronotal disc with deep rounded punctures but without carinae.

All three Mesozoic lycids known to date have been assigned to the subfamily Dexorinae (Bocak *et al*. 2019; Tihelka *et al*. 2019; this study). Dexorinae is a small subfamily of Lycidae, with less than 20 species described to date (Bocakova 2014; Kazantsev 2018). However, all three known Mesozoic lycids belong to Dexorinae, suggesting that this subfamily had a higher diversity in the Mesozoic, and was a major contributor to the early phase of Lycidae radiation.

Data availability

The original series of confocal slices are available on Zenodo repository (doi:10.5281/zenodo.4549807).

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