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Chunxiangus shii gen. et sp. nov., a new genus and species of Umenocoleidae (Dictyoptera) from mid-Cretaceous Kachin amber

Deqiong Luo, Chuantao Xiao, and Cihang Luo

ABSTRACT

Umenocoleidae is a mysterious and extinct Mesozoic beetle-like roach family. Its systematic position was highly disputed for decades. In this study, a new genus and species of Umenocoleidae, *Chunxiangus shii* gen. et sp. nov., is described based on a well-preserved adult from mid-Cretaceous Kachin amber of northern Myanmar. The new genus mainly differs from the other genera in the ratio of the width of the head and pronotum, anterior margin of pronotum round and posterior margin slightly convex, pronotum and head without distinct cup-shaped punctures, and covered with dense short setae, the forewing veins reduced and without distinct colour pattern. The presence of the cup-shaped punctures on the forewings but the absence of the distinct cup-shaped punctures on the head and pronotum may be the autapomorphy of *Chunxiangus* gen. nov.

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INTRODUCTION

The extinct beetle-like family Umenocoleidae was first described as a kind of unusual beetle by Chen and T'an (1973). Its taxonomic position has been debated for a long time and extensively considered to be close to stem-Coleoptera, Protelytroptera, Blattodea, stem-Mantodea, and Dictyoptera *incertae sedis* (Chen and T'an, 1973; Carpenter, 1992; Vršanský, 1998, 1999a, 1999b, 2003; Grimaldi and Engel, 2005; Bechly, 2007; Lee, 2011, 2016; Nel et al., 2013; Kirejtshuk et al., 2014; Beutel et al., 2020; Koubová and Mlynský, 2020; Luo et al., 2022a, 2022b), primarily due to its beetle-like, heavily sclerotized forewing and unparallel forewing venation (Chen and T'an, 1973). However, recent studies have confirmed that Umenocoleidae is a specialized roach and sister to Alienopteridae (Luo et al., 2022a, 2022b).

Umenocoleidae may already appeared in the Late Jurassic (*Maloval hlavolam* Vršanský, 2024) (Vršanský, 2024) and was distributed globally during the Early Cretaceous but rapidly declined in the Late Cretaceous (see chronogram in Luo et al., 2022b). It has been discovered from Kachin amber, Santana and Crato Formation of Brazil, Jordanian and Lebanese amber, Kzyl-Zhar of Kazakhstan, Jinju Formation of South Korea, the Lower Cretaceous formation in Siberia and Mongolia, Dalazi Formation in Jilin, China, Xiagou Formation and Zhonggou Formation in Gansu, China (Chen and T'an, 1973; Zhang, 1997; Vršanský, 1999, 2003a, 2003b, 2005; Kaddumi, 2005; Bechly, 2007; Nel et al., 2014; Podstrelena and Sendi, 2018; Hörnig et al., 2018; Vrsanský et al., 2018, 2021a, 2019, 2021, 2025; Sendi et al., 2020; Luo et al., 2021a, 2021b, 2022a, 2022b; Oyama et al., 2022; Sendi et al., 2023a, 2023b; Szabó et al., 2023; Lee et al., 2025).

Herein we describe a new genus and species of Umenocoleidae, *Chunxiangus shii* gen. et sp. nov., based on a well-preserved specimen from mid-Cretaceous Kachin amber.

MATERIALS AND METHODS

The origin of the specimens studied is from a former Kachin amber mine located near Tanai Village (26°21′33.41″N, 96°43′11.88″E; palaeolatitude 5.0±4.7°S) in the Hukawng Valley of northern Myanmar (Kania et al., 2015; Thu and Zaw, 2017; Westerweel et al., 2019). The Kachin amber biota has been studied for over a hundred years, and nearly 3000 species were reported (Ross, 2025). The age of Kachin amber is earliest Cenomanian (98.79 ± 0.62 Ma) based on the recent U–Pb dating of zircons (Shi et al., 2012).

The amber piece was collected in 2015, before November 2017 when the Myanmar military closed the Kachin amber mining. The fossil reported in this study was not involved in armed conflict and ethnic strife in Myanmar or linked with such events in any conceivable way. Its collection and acquirement are in full compliance with the laws of Myanmar and China including regulations on the protection of fossils of China. The amber with the holotype of NIGP207227 is permanently deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS), Nanjing, China, in full compliance with the International Code of Zoological Nomenclature (ICZN, 1999), Statement of the International Palaeoentomological Society (Szwedo et al., 2020) and policies proposed by Haug et al. (2020).

Observations were performed using a Zeiss Stemi 508 microscope. The photographs were taken with a Zeiss Stereo Discovery V16 microscope system in the NIGPAS; measurements were taken using Zen software. Photomicrographic composites of 20–140 individual focal planes were digitally stacked using the software Helicon Focus 6.7.1 for a better illustration of 3D structures. Photographs were adjusted using Adobe Lightroom Classic, and line drawings were prepared using CorelDraw2022 graphic software.

SYSTEMATIC PALAEONTOLOGY

Family UMENOCOLEIDAE Chen et T'an, 1973
Genus *CHUNXIANGUS*
Luo, Xiao et Luo, gen. nov.

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Etymology. The generic name is derived from the Chinese words “chun xiang” meaning “fly in the spring”, referring to the roach may be active in the springtime. This name is given by the collector, Mr. Peng Shi. Gender of the genus: masculine.

Type species: *Chunxiangus shii* Luo, Xiao et Luo, sp. nov.

Included species. Type species only.

Diagnosis. Head and pronotum without distinct cup-shaped punctures (“bunky”) but covered with dense short setae, ratio of width of head and pronotum about 1.2. Head with anterior margin convex and posterior margin straight, anterior margin of pronotum round and posterior margin slightly convex, pronotum wider than long, supracoxal furrow present and distinct; forewing strongly sclerotized,

veins reduced, without distinct colour pattern, covered by distinct cup-shaped punctures (“bunky”).

Age and occurrence. Mid-Cretaceous (late Albian-early Cenomanian); amber from Kachin State, northern Myanmar.

Chunxiangus shii Luo, Xiao et Luo, sp. nov.

zoobank.org/07BC4A5C-5BCF-4E63-BDAC-000C5A46070B

Etymology. The specific name is dedicated to the collector, Mr. Peng Shi.

Material. Holotype. Kachin amber with size16×8×3 mm, specimen number NIGP207227.

Locality and horizon. Kachin amber, from deposits near Tanai Village in the Hukawng Valley of northern Myanmar, lower most Cenomanian (mid-Cretaceous).

Diagnosis. As for genus.

Description. Adult: body 10.17 mm long from anterior margin of head to apex of forewing; maximum width in middle body region 3.27 mm (Figure 1A–B).

Head: orthognathous, cylindrical in transverse direction, strongly transverse, distinctly wider than pronotum (1.00 mm long in dorsal view and 2.24 mm wide). Cuticle of head capsule blackish-brown,

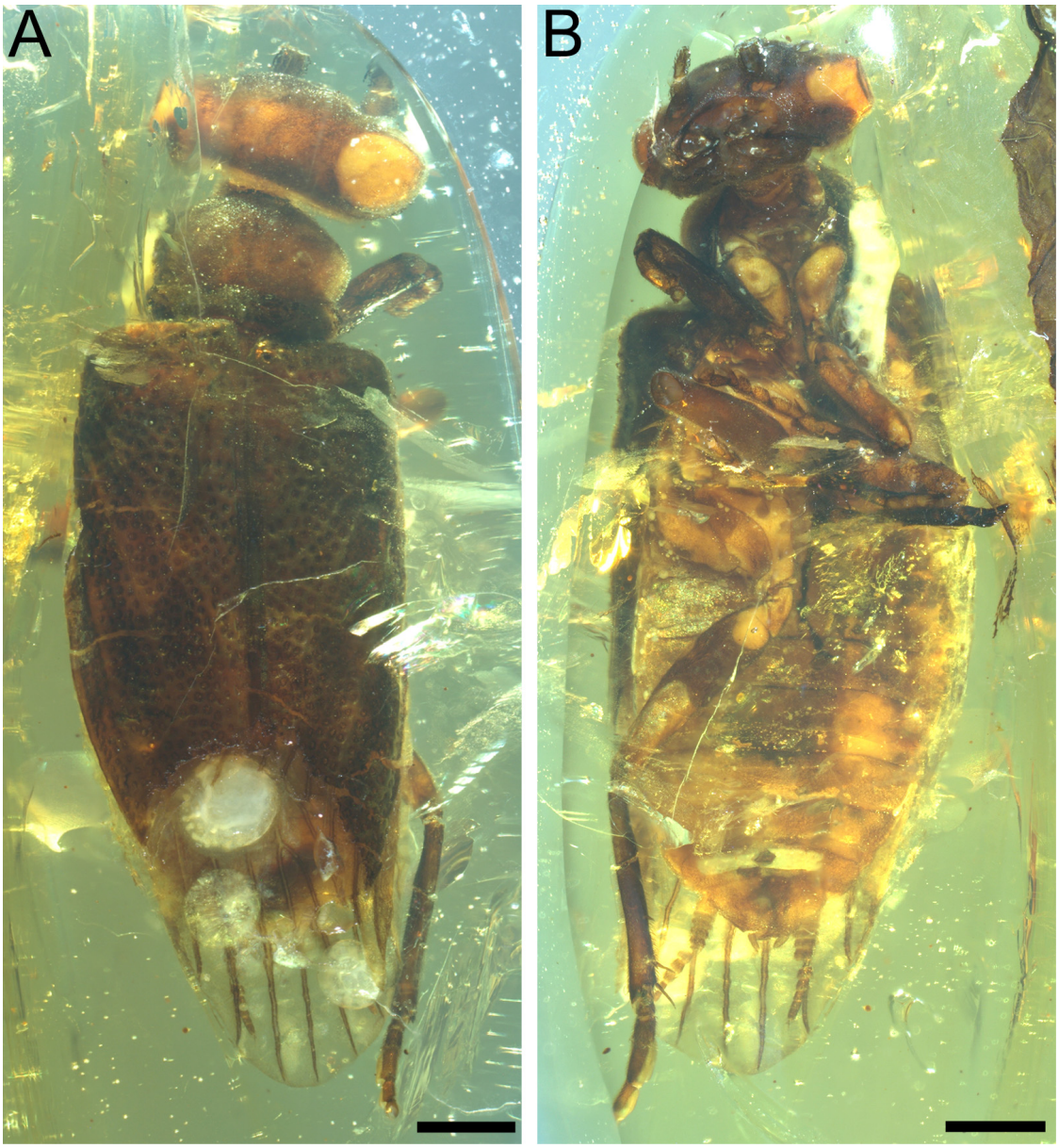

FIGURE 1. Photographs of *Chunxiangus shii* gen. et sp. nov., holotype (NIGP207227). **A,** The dorsal view. **B,** The ventral view. Scale bars equal 1.0 mm (A–B).

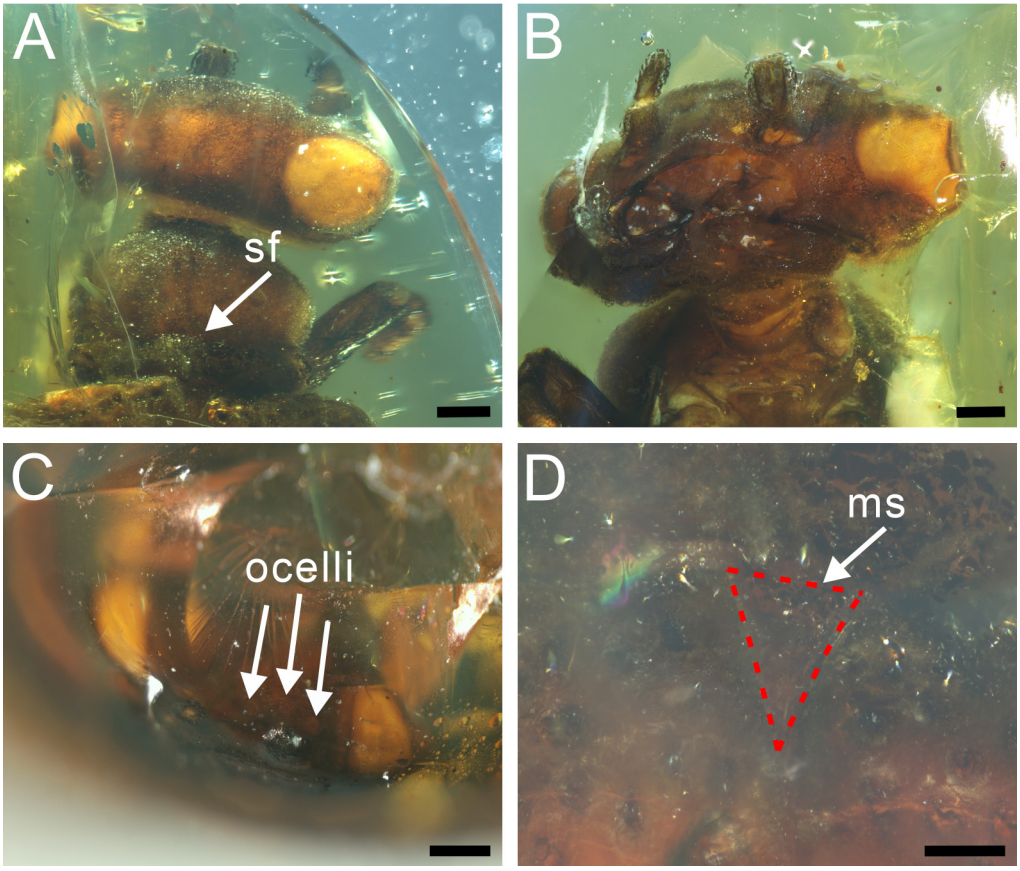

FIGURE 2. Photographs of the head, pronotum and scutellum of *Chunxiangus shii* gen. et sp. nov., holotype (NIGP207227). **A,** Head and pronotum, the dorsal view. **B,** Head, the ventral view. **C,** Head, the frontal view. **D,** Triangular mesoscutellar shield. Abbreviations: sf, supracoxal furrow; ms, mesoscutellar shield. Scale bars equal 0.5 mm (C), 0.2 mm (A–B, D).

covered with short setae. Compound eyes almost white, very large, widely separated and protruding laterally from head outline, almost globular; compound eye 0.60 mm long and 0.50 mm wide (Figure 2A–B). Ocelli diffuse, all three ocelli present, 0.15 mm in diameter (Figure 2C). Antennae only partly preserved, surface covered with short setae (appr. 0.05 mm long); right antenna with scapus 0.22 mm long and 0.20 mm wide, pedicellus 0.31 mm long and 0.10 mm wide, left scapus with scapus 0.29 mm long and 0.19 mm wide. Mandibles are large but only partly preserved. Maxillary palps and Labium palps are invisible.

Pronotum (Figure 2A–B): round, blackish-brown, moderately sclerotized, densely covered with short setae; wider than long (1.46 mm long and 1.81 mm wide); anterior margin strongly convex, posterior margin slightly convex; supracoxal furrow present, close to posterior margin of pronotum, distinct.

Mesoscutellar shield (Figure 2D): small, triangular; located behind pronotum and between proximal parts of forewings; 0.49 mm long and 0.32 mm wide at base.

Forewings (Figure 3A–B): distinctly sclerotized, surface densely covered with cup-shaped punctures (“bunky”) (0.08 mm long in diameter) in nearly constant size, without setae, left forewing about 3.20 mm long and 1.30 mm wide, right forewing about 3.16 mm long and 1.20 mm wide. Dorsal surface of forewings gradually flattening towards apex. Veins indistinct; branch R(?) simple; stem M(?) almost straight, simple; branch CuA(?) simple; stem CuP(?) almost straight, simple; transverse veinlets indistinct. Adsutural line present and anterior margin well-sclerotized.

Hindwings are only visible at apical region, hidden under forewings.

Foreleg (Figure 4A–B): coxa strong and cone-shaped, 0.79 mm long and 0.41 mm wide; trochanter short, distinct; femur strongly developed, carinate, with setae forming row, profemural brush absent, almost keeping same width, 1.31 mm long

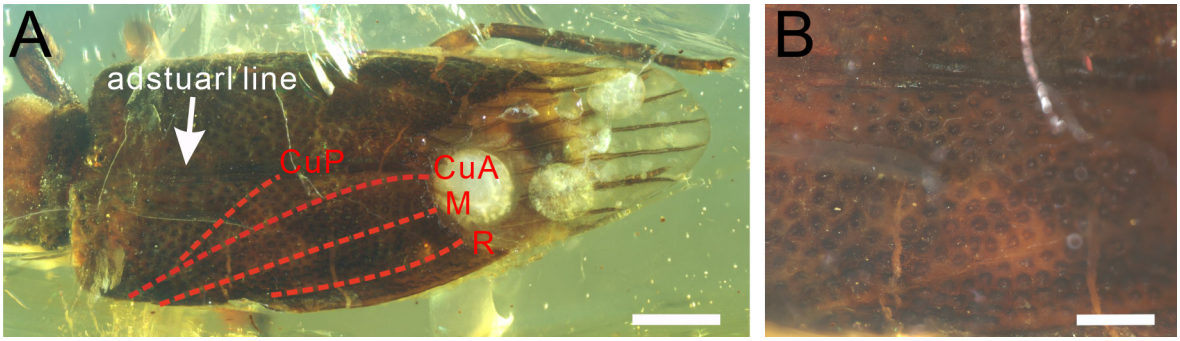

FIGURE 3. Photographs of the structural details and line drawing of the forewing of *Chunxiangus shii* gen. et sp. nov., holotype (NIGP207227). **A,** The right forewing and left forewing in the dorsal view. **B,** Cup-shaped punctures pattern. Scale bars equal 1.0 mm (A); 0.2 mm (B). Abbreviations: CuA, cubitus anterior; CuP, cubitus posterior; M, media; R, radius.

and 0.34 mm wide; tibia much thinner than femur, carinate, with few stiff setae arranged in longitudinal row and two equally sized tibial spurs close to apex, almost keeping same width, 0.93 mm long and 0.19 mm wide; tarsus with 5 segments, covered with very short setae and one tibial spurs close to base, almost keeping same width, tarsomeres I–IV distinctly incised distally on dorsal side; tarsomere I 0.33 mm long and 0.12 mm wide, II 0.20 mm long and 0.13 mm wide, III 0.17 mm long and 0.12 mm wide, IV 0.09 mm long and 0.07 mm wide, V 0.20 mm long and 0.11 mm wide; apical tarsomere bent upwards; euplantulae present on tarsomeres I–IV, enlarged and flanked by sclerotized spine on tarsomere IV; only single large claw visible (second claw much smaller if present); with hook-shaped apical part visible, asymmetrical; arolium 0.19 mm long and 0.07 mm wide, oval shaped, with membranous distal part. Midleg (Figure 4C–D): coxa and trochanter invisible; femur strongly developed, carinate, thinner towards apex, 1.22 mm long and 0.47 mm wide; tibia much thinner than femur, carinate, with few stiff setae arranged in longitudinal row and three equally sized tibial spurs close to apex, 1.45 mm long and 0.16 mm wide; tarsus with five segments, widening towards apex, covered with very short setae, tarsomeres I–IV distinctly incised distally on dorsal side; tarsomere I at least 0.33 mm long and 0.11 mm wide, II at least 0.25 mm long and 0.11 mm wide, III at least 0.20 mm long and 0.14 mm wide, IV at least 0.09 mm long and 0.07 mm wide, V at least 0.14 mm long and 0.08 mm wide; euplantulae present on tarsomeres I–IV; arolium and claw not preserved. Hindleg (Figure 4E–F): coxa strongly developed, broad and flat, 1.13 mm long and 0.66 mm wide, trochanter distinct; femur strongly developed, carinate, thinner distally, 2.57 mm long and 0.65 mm wide; tibia thinner than femur, carinate, slightly widening distally, with stiff setae arranged in longitudinal row and two large tibial spurs close to apex, 2.10 mm long and 0.30 mm wide; tarsus with five segments, with very short setae forming row, tarsomeres I–IV slightly incised distally on dorsal side, tarsomere I 0.15 mm long and 0.11 mm wide, tarsomere II 0.17 mm long and 0.09 mm wide, III 0.22 mm long and 0.08 mm wide, IV 0.14 mm long and 0.07 mm wide, V 0.14 mm long and 0.06 mm wide; euplantulae present on tarsomeres III–V; only single large claw visible (second claw much smaller if present), with hook-shaped apical part visible, asymmetrical; arolium with membranous distal part, 0.13 mm long and 0.12 mm wide.

Abdomen (Figure 5A–B): completely preserved, with 7 visible sternites, maximum width 3.27 mm. Subgenital plate present, semicircular and well sclerotized. Cerci conical, with 10 segments, 0.93 mm long in total, tapering towards apex, densely covered with setae (0.12 mm long). Measurement of cercomeres: segment 1 0.13 mm long and 0.19 mm wide, segment 2 0.06 mm long and 0.18 mm wide, segment 3 0.09 mm long and 0.20 mm wide, segment 4 0.09 mm long and 0.19 mm wide, segment 5 0.09 mm long and 0.15 mm wide, segment 6 0.10 mm long and 0.13 mm wide, segment 7 0.09 mm long and 0.11 mm wide, segment 8 0.08 mm long and 0.10 mm wide, segment 9 0.08 mm long and 0.09 mm wide, segment 10 0.12 mm long and 0.08 mm wide. Long symmetrical styli 0.20 mm long with one visible segmentation.

DISCUSSION

Chunxiangus gen. nov. can be easily categorized within the family Umenocoleidae based on the combination of the following characters: the

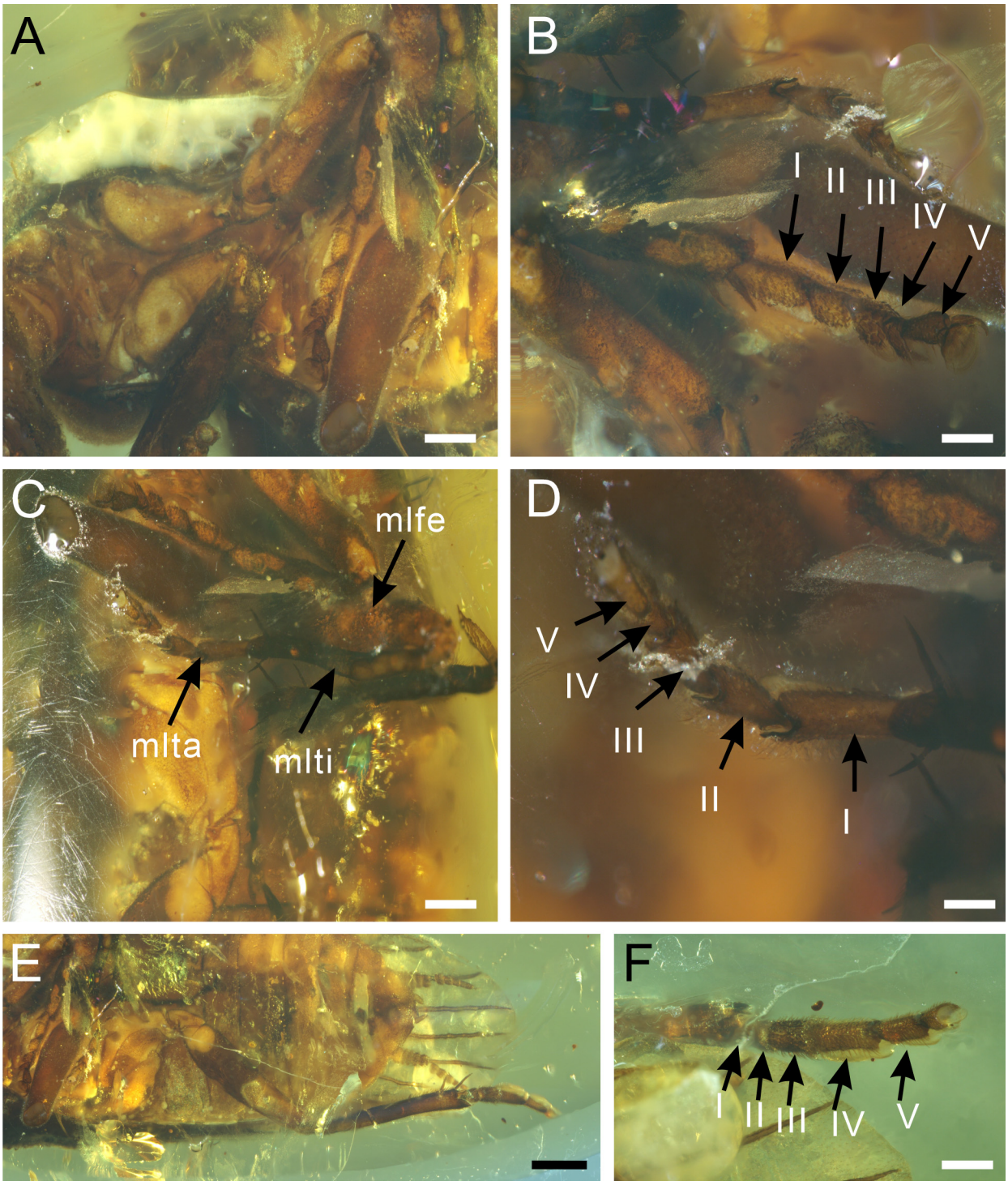

FIGURE 4. Photographs of details of the legs of *Chunxiangus shii* gen. et sp. nov., holotype (NIGP207227). **A,** The left foreleg. **B,** The left foreleg tarsomere. **C,** The left midleg. **D,** The left midleg tarsomere. **E,** The right hindleg in the ventral view. **F,** The right hindleg tarsomere in the dorsal view. Scale bars equal 0.5 mm (E); 0.2 mm (A–D, F). Abbreviations: mlfe, midleg femur; mlti, midleg tibia; mlta, midleg tarsus.

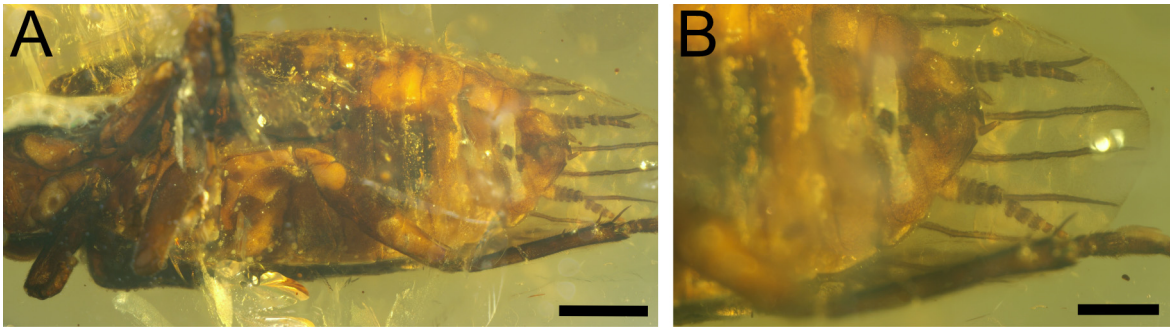

FIGURE 5. Photographs of details of *Chunxiangus shii* gen. et sp. nov., holotype (NIGP207227). **A,** Abdomen, the ventral view. **B,** Subgenital plate, possible elements of ovipositor and cerci. Scale bars equal 1.0 mm (**A**); 0.5 mm (**B**).

transverse head with large protruding compound eyes, pronotum subdivided by a transverse supracoxal furrow (also present in Alienopteridae and Mantodea), sclerotized forewings with cup-shaped punctures ("bunky") and reduced veins (Vršanský, 2003; Nel et al., 2014; Lee, 2016; Luo et al., 2022a, 2022b; Lee et al., 2025).

Chunxiangus gen. nov. differs from all previously described umenocoleids that forewings without clear cup-shaped punctures (e.g., *Alienopterix*) by its forewings bearing distinct cup-shape punctures ("bunky"); meanwhile it also differs from other umenocoleids (those forewings have distinct cup-shape punctures) with a combination of characters: the ratio of the width of the head and pronotum is about 1.2 (head almost as wide as the pronotum in *Blattapterix*, *Petropterix*, and *Umenocoleus*; head much wider than pronotum in *Enervipraeala, Alienopterix, Laticephalana, and Ponopterix*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 1999a, 2003a; Vrsanský et al., 2018, 2021, 2025; Sendi et al., 2020, 2023; Luo et al., 2021a, 2021b); head has a convex anterior margin and a straight posterior margin (globular in *Blattapterix, Umenocoleus,* and *Ponopterix*) (Chen and T'an, 1973; Zhang, 1997; Vršanský, 1999a), without distinct cup-shape punctures ("bunky") (with distinct cup-shape punctures in *Enervipraeala, Umenocoleus,* and *Laticephalana*) (Chen and T'an, 1973; Zhang, 1997; Luo et al., 2021a, 2021b) and with dense short setae (without setae in *Enervipraeala, Laticephalana, Petropterix,* and *Umenocoleus*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 2003a; Sendi et al., 2020, 2023; Luo et al., 2021a, 2021b; Vrsanský et al., 2025); the anterior margin of the pronotum of *Chunxiangus* is round and posterior margin is slightly convex, wider than long (widening posteriorly in *Ponopterix*; elongate in *Laticephalana*; saddle-like in *Alienopterix* and *Enervipraeala*; somewhat saddle-like in *Umenocoleus*; rounded in *Blattapterix*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 1999a; Vrsanský et al., 2018, 2021, 2025; Luo et al., 2021a, 2021b), without distinct cup-shape punctures ("bunky") and with setae (with distinct cup-shape punctures in *Enervipraeala, Umenocoleus, Petropterix,* and *Laticephalana*; without setae in *Enervipraeala, Laticephalana,* and *Petropterix*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 2003a; Sendi et al., 2020, 2023; Luo et al., 2021a, 2021b; Vrsanský et al., 2025), the pronotum of *Chunxiangus* has distinct supracoxal furrow (also distinct in *Ponopterix, Alienopterix, Petropterix,* and *Umenocoleus* and in Alienopteridae; but lost in *Enervipraeala* and indistinct in *Laticephalana*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 1999a, 2003a; Vrsanský et al., 2018, 2021, 2025; Sendi et al., 2020, 2023; Luo et al., 2021a, 2021b); the forewings are strongly sclerotized (less sclerotized in *Pseudoblattapterix* and *Blattapterix*) (Vršanský, 2003a; Lee et al., 2025), without setae (also without setae in *Ponopterix, Alienopterix, Enervipraeala, Laticephalana, Petropterix,* and *Umenocoleus*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 1999a, 2003a; Vrsanský et al., 2018, 2021, 2025; Sendi et al., 2020, 2023; Luo et al., 2021a, 2021b), veins reduced (forking in *Umenocoleus, Ponopterix, Blattapterix, Petropterix, Elytropterix, Pseudoblattapterix,* and *Nigropterix*) (Chen and T'an, 1973; Zhang, 1997; Oyama et al., 2021; Vršanský, 1999a, 2003a; Vrsanský et al., 2018, 2021, 2025; Sendi, 2024; Sendi et al., 2020, 2023; Lee et al., 2025), without distinct colour pattern (present in *Enervipraeala* and *Laticephalana*) (Luo et al., 2021a, 2021b). Therefore, we established a new genus for it.

Among Umenocoleidae, the cup-shaped punctures ("bunky") is an important feature. Most

typical members of Umenocoleidae exhibit distinct cup-shaped punctures on their head, pronotum and forewings, for example, *Enervipraeala*, *Laticephalana*, and *Umenocoleus* (Chen and T'an, 1973; Luo et al., 2021a, 2021b). However, those less typical umenocoleids, for example, *Alienopterix*, lacking distinct cup-shaped punctures on their whole bodies (Vrsanský et al., 2018; Szabó et al., 2023). In *Chunxiangus* gen. nov., its head and pronotum without distinct cup-shaped punctures, but such structures are distinctly present on its forewings, which may be its autapomorphy.

CONCLUSION

Our results tentatively suggest a close relationship among *Chunxiangus, Laticephalana, Alienopterix,* and *Enervipraeala*. The fossil confirms the high diversity and morphological disparity of this enigmatic family during the Cretaceous.

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