

## SHORT COMMUNICATIONS

## A new fossil weevil ( Coleoptera , Curculionoidea , Belidae ) from the Yixian Formation of western Liaoning , China \*

LIU Ming , REN Dong\*\* and SHIH Chungkun

( College of Life Science , Capital Normal University , Beijing 100037 , China )

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**Abstract** This paper reports a new genus and a new species *Microprobelus liuae* gen. et sp. nov. referred to the family Belidae. This fossil was collected from the Late Jurassic Yixian Formation of western Liaoning , China. Detailed description and illustration of the specimen along with a brief review of fossil belids are given. And the age of the Yixian Formation and the early diversification of the weevils are discussed.

**Keywords :** fossil , weevil , Belidae , new taxa , Jurassic , Yixian Formation , Liaoning.

The family Belidae is now a relict group and its extant species are confined to Australia , New Guinea and some associated islands , New Zealand and South America<sup>[1]</sup>. The fossils of this family are represented by 17 species within 8 fossil genera ranging in age from the Late Jurassic to the Early Cretaceous. Abundant Late Jurassic belids were discovered from Karatau Range in Kazakhstan and 12 species within 5 fossil genera have been described<sup>[2,3]</sup>. Hong reported a new species *Probelus sinicus* from the Late Jurassic Yixian Formation of Hebei Province , China<sup>[4]</sup>. The belids were widespread in Early Cretaceous deposits : Okhotsk region in Russia<sup>[5]</sup>, Sierra del Montsec in Spain<sup>[6]</sup>, Jilin Province in China<sup>[7]</sup>, Santana Formation in Brazil<sup>[8]</sup>. In total , three genera with four species have been recorded from these Early Cretaceous sites. Hitherto , there are no record of the Late Cretaceous and Cenozoic belids<sup>[9]</sup>.

In 1977 , Arnoldi described a series of complete fossil weevils from Karatau Range and established an extinct family Eobelidae to embrace all of them<sup>[3]</sup>. Subsequently , many authors discussed the systematic position of Eobelidae<sup>[1,6,10,11]</sup>. Herein , we follow the systematic arrangement proposed by Zherikhin and Gratshev<sup>[6,11]</sup>, who elevated the fossil tribe Eobelini to subfamily Eobelinae and assigned it to the family Belidae.

### 1 Material and methods

The fossil material was newly discovered from the Upper Jurassic Yixian Formation in Lingyuan City , western Liaoning , China.

The specimen was examined with a Leica MZ12.5 dissecting microscope and illustrated with the aid of a drawing tube attached to the microscope. The specimen studied in this paper is housed at the College of Life Science , Capital Normal University , Beijing , China.

### 2 Systematic paleontology

**Superfamily Curculionoidea Latreille , 1802**

**Family Belidae Schoenherr , 1826**

**Subfamily Eobelinae Arnoldi , 1977**

**Genus *Microprobelus* gen. nov.**

**Type species :** *Microprobelus liuae* gen. et sp. nov.

**Etymology :** A combination of the Greek prefix *micro* ( meaning “ small ” ) and genus *Probelus* Arnoldi 1977 , referring to the small body size ; gender masculine.

**Diagnosis :** Body small , less than 6 mm , elon-

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\*\* To whom correspondence should be addressed. E-mail : rendong@mail.cnu.edu.cn

gated, flat in lateral view. Rostrum thick, longer than head and pronotum together, curved, with small mandibles. Antennae inserted ventrally near middle of rostrum; scape thin and short; funicular segments thick except for the first one, longer than broad; club indistinct, segments nearly rounded. Head large; frons convex; eyes rounded and big, laterally positioned. Pronotum transverse, its base wider than its apex. Fore coxae intermediate in size, close to base of prothorax; fore femora thick; fore tibiae slender, slightly longer than its femora, base sunken; middle and hind femora both inflated, nearly as long as fore femora; middle and hind tibiae in same length with their femora, with two small apical spurs; tarsi long, fourth segment distinctly longer than other segments; claws free, paired and long, without tooth. Abdomen flat. Elytra parallel-sided, dorsally flat, as long as abdomen, with sharp and raised bottom.

**Remarks :** The combined characteristics of this genus allow an allocation to the subfamily Eobelinae: body is elongated; rostrum is longer than head and pronotum together; the antennae are inserted near the middle rostrum; frons is convex; middle and hind tibiae have apical spurs; both of elytra and abdomen are flat.

Till now, 8 extinct genera within Eobelinae have been documented: *Archaeorrhynchus* Martynov, 1926; *Eobelus* Arnoldi, 1977; *Probelopsis* Arnoldi, 1977 (all from the Late Jurassic of Kazakhstan<sup>[2, 3]</sup>); *Probelus* Arnoldi, 1977 (from the Late Jurassic of Kazakhstan and China<sup>[3, 4]</sup>); *Belonotaris* Arnoldi, 1977 (from the Late Jurassic of Kazakhstan and the Early Cretaceous of Russia<sup>[3, 5]</sup>); *Montsecobelus* Zherikhin and Gratshev, 1997 (from the Early Cretaceous of Spain<sup>[6]</sup>); *Longidorsum* Zhang, 1997 (from the Early Cretaceous of China<sup>[7]</sup>); *Davidibelus* Zherikhin and Gratshev, 2004 (from the Early Cretaceous of Brazil<sup>[8]</sup>). This new genus is different from all the known genera in possessing a comparatively curved and thick rostrum, sunken base of fore tibiae, long tarsi, free and large claws together with a small body. Except for these unique characteristics, this new one is somewhat similar to *Probelus* in the length of rostrum, the inflated hind femora and the length proportion of the femora to the tibiae.

***Microprobelus liuae* gen. et sp. nov.** (Fig. 1)

**Etymology :** This species is named after Madam Liu Xiuli for her assistance and contribution in collecting Liaoning fossils, including this specimen.

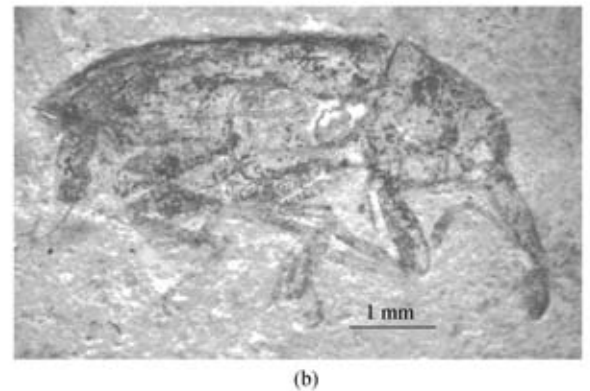
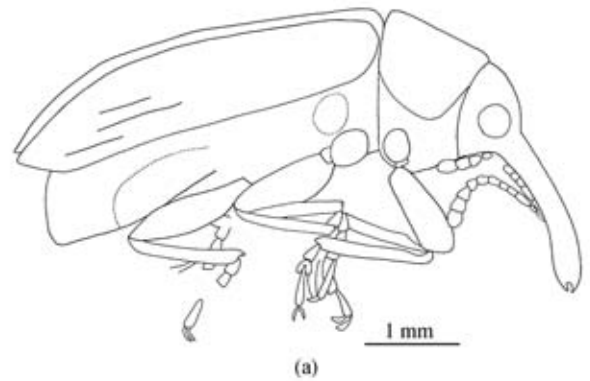


Fig. 1. *Microprobelus liuae* gen. et sp. nov. holotype, No. CNU-C-LB2005106. (a) Line drawing, (b) photograph.

**Holotype :** No. CNU-C-LB2005106, an impression of complete weevil in ventrolateral position; 24-06-2004, collector Dr. Shih Chungkun.

**Locality and horizon :** Yixian Formation, Upper Jurassic, Dawangzhangzi Village, Lingyuan City, Liaoning Province, China.

**Description :** Length (excluding rostrum) 5.5 mm, rostrum length 1.8 mm. Body pale, elongated, flat in lateral view. Rostrum thick and slightly longer than head and pronotum together, nearly parallel-sided, curved, gradually becoming slightly thicker towards apex, 7 times longer than broad; mandibles small, shorter than apical width of rostrum. Antennae inserted ventrally, slightly before middle of rostrum, reaching middle pronotum, with 11 segments, antennal segments gradually becoming bigger towards apex; scape thin and short; funicular with 7 segments, segments longer than wide, thick except first one, second segment distinctly longer than others; club indistinct, with 3 segments, its segments nearly rounded, third segment acuminate at its apex. Head large; frons broad and convex, forming an obtuse an-

gle of 130° with base of rostrum; eyes rounded and big, mid-laterally positioned, as long as the width of rostrum at its base; temple long, but shorter than eye. Pronotum transverse, 1.4 times wider than long, widest at base, 1.3 times longer than head. Fore coxae intermediate in size, close to base of prothorax; fore femora thick; fore tibiae slender, one third width of femora, slightly longer than its femora, its base sunken; middle and hind femora both inflated, nearly as long as fore femora; middle and hind tibiae short, in same length with femora, as wide as fore tibiae, with two small apical spurs; tarsi long, with four segments, first and second segments nearly rectangle, third segment bilobate, fourth segment distinctly longer than others; claw free, paired and long, without tooth. Abdomen flat, a little longer than mesothorax and metathorax together. Elytra parallel-sided, dorsally flat, 4 times longer than pronotum, nearly as long as abdomen, bottom sharp and raised, with three visible longitudinal striae, points in striae indistinct.

### 3 Discussion

The age of Yixian Formation is still being debated and two opinions presented: Late Jurassic and Early Cretaceous<sup>[12–19]</sup>. The fossil belids provide some new information on the age of the Yixian Formation. To this day, *Probelus sinicus* is the only weevil reported from Yixian Formation<sup>[4]</sup>. The other three species within the same genus are all documented from the Late Jurassic Karatau Range<sup>[3]</sup>. While, the nemonychids and belids are the co-dominating groups among weevils in Karatau Range<sup>[9]</sup> and the genus *Probelus* is the important component within Belidae. Furthermore, the new genus *Microprobelus* has great resemblance with *Probelus*. So, the investigation of the Yixian belids fauna indicates that it is similar to the Karatau insect fauna and the age of Yixian Formation is Late Jurassic. However, this inference should be considered as preliminary, because only two weevils have been known from the Yixian Formation.

Until now only three localities have yielded the Jurassic weevils: Karatau<sup>[2, 3, 20–22]</sup>, Shar-Teg in Mongolia<sup>[23]</sup> and Hebei Province, China<sup>[4]</sup>. Four families within Curculionoidea were recognized from these sites, among them Obrieniidae is an extinct family; Nemonychidae now distribute worldwide but Ethiopian and Oriental Regions<sup>[10]</sup>; Belidae and Eucoparthridae are confined to southern hemisphere today<sup>[11]</sup>. As all Jurassic weevils are exclusively central

and eastern Asia in distribution, the most parsimonious hypothesis is that the basal weevils initially radiated in central and eastern Asia, and spread worldwide no later than Early Cretaceous. The main factor contributing to the decline of nemonychids, belids and eucoparthrids from the fossil record after Early Cretaceous is mostly the competitive pressure from new weevils. During the Cretaceous, weevil diversity at family level increased<sup>[5, 8, 9]</sup>. The families that appeared for the first time might have been more competitive than those primitive ones and constitute the majority of modern weevil fauna.

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