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A new fossil Hybosoridae (Coleoptera: Scarabaeoidea) from the Yixian Formation of China

ZHUO YAN[1], MING BAI[2] & DONG REN[1]

[1]*Key Laboratory of Insect Evolution and Environmental Changes, College of Life Sciences, Capital Normal University, Beijing 100048, China. Corresponding author Email: rendong@mail.cnu.edu.cn*

[2]*Key laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China. Email: baim@ioz.ac.cn*

Hybosoridae is a relatively small family of Scarabaeoidea, including five extant and one fossil subfamily (Ocampo & Ballerio 2006, Nikolajev 2007). Until now, 20 fossil species were known from five subfamilies: Anaidinae, Ceratocanthinae, Hybosorinae, Liparochrinae, and Mimaphodiinae (Ocampo & Ballerio 2006, Krell 2007, Nikolajev 2008, Nikolajev *et al*. 2010, Nikolajev 2010a, Nikolajev 2010b, Kirejtshuk *et al.* 2011). In this paper we describe *Pulcherhybosorus tridentatus* Yan, Bai, & Ren **new genus** and **new species**, from a nearly complete and well-preserved fossil. This fossil represents the first record of Hybosoridae from the Early Cretaceous Yixian Formation of Liutiaogou, Inner Mongolia in China. This significant finding tentatively confirms the presence of Hybosoridae during the Mesozoic in what is now China.

The study is based on a part and counterpart (compression and impression) fossil specimen collected near Liutiaogou Village, Ningcheng County, Chifeng City, from Yixian Formation of Inner Mongolia, China and deposited in the Key Lab of Insect Evolution & Environmental Changes, College of Life Sciences, Capital Normal University, Beijing, China. Recent studies have confirmed that the Yixian Formation is the Early Cretaceous in age. The precise age is likely between to 129.7–122.1 million years ago (Barremian to early Aptian) (Yang *et al*. 2007; Chang *et al.* 2009). The strata of Yixian Formation are mainly of lacustrine sediments intercalated with volcaniclastics (Ren *et al*. 1995). This strata has provided abundant insect fossil (Zhang *et al*. 2006, Chang & Ren 2008, Liu *et al*. 2008, Yao *et al.* 2008, Zhang *et al*. 2010, Bai *et al*. 2012). The specimens were examined with a Leica MZ12.5 stereomicroscope and illustrated with the aid of a drawing tube attached to the microscope. Line drawings were made using CorelDRAW X4 Graphics Suite and Adobe Photoshop CS 4 graphic software.

***Pulcherhybosorus* Yan, Bai, & Ren, new genus**
(Figs. 1–4)

Type species: *Pulcherhybosorus tridentatus* new species, here designated.

Diagnosis. Elongate oval. Mandibles and labrum prominent, clearly visible in dorsal view of head, labrum exposed beyond apex of clypeus, mandibles exposed beyond apex of clypeus (fig. 5), anterior margin of clypeus moderately emarginate. Antennae with a 3-antennomere lamellate club, club compact (Fig. 8). Eyes large. Pronotum slightly wider than elytra, nearly trapezoidal, with widest part of pronotum at base. Elytra convex, striae well defined and without tubercles; hind wings well developed, the MP_3 vein present and MP_4 vein absent. Abdomen with five visible sternites. Protibia with three teeth on outer margin, mesotibia and metatibia without a transverse carina, two spurs on the end of mesotibia subequal in length, and two symmetrical claws on the end of mesotarsus.

Remarks. The new genus is tentatively assigned to the family Hybosoridae based on the following characters: (1) antennae with a 3-antennomere lamellate club, club compact; (2) eyes developed; (3) labrum and mandibles produced beyond apex of clypeus; (4) pronotum trapezoidal, convex, base wider than elytral base; (5) elytra convex, striae well defined, Wings well developed, the MP_3 vein present; (6) legs with anterior coxae conical and mesocoxae contiguous; (7) protibia with three teeth; (8) mesotibia and metatibia slightly dilated at the apex, mesotibia with 2 subequal spurs; (9) mesotibia and metatibia without a transverse carina; (10) claws equal in size, simple; (11) abdomen with five visible sternites. *Pulcherhybosorus* is not placed in a subfamily because of the lack of some key visible characters and the unusual combination of characters.

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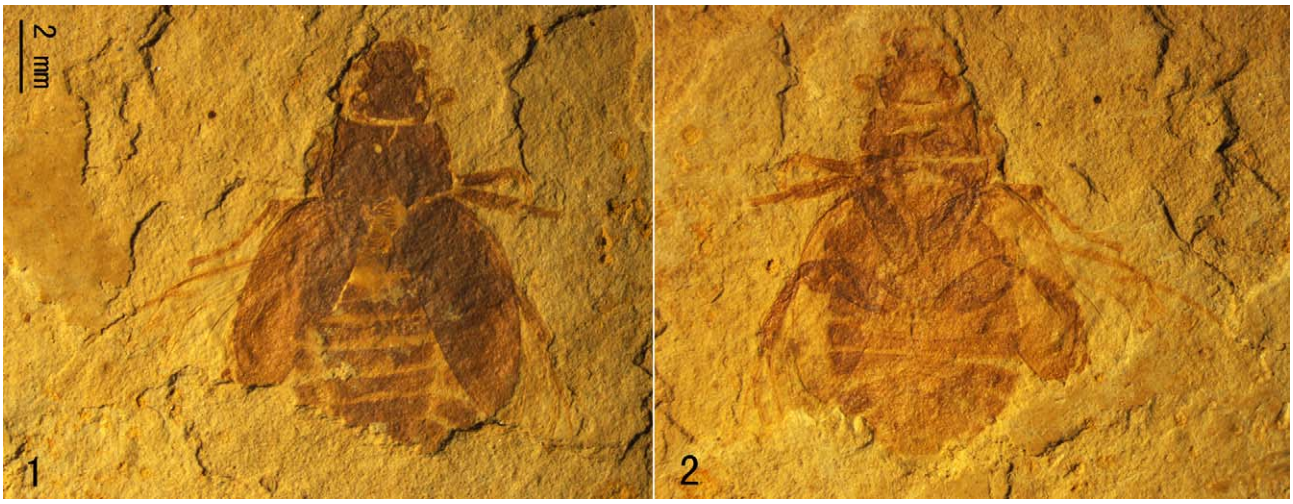
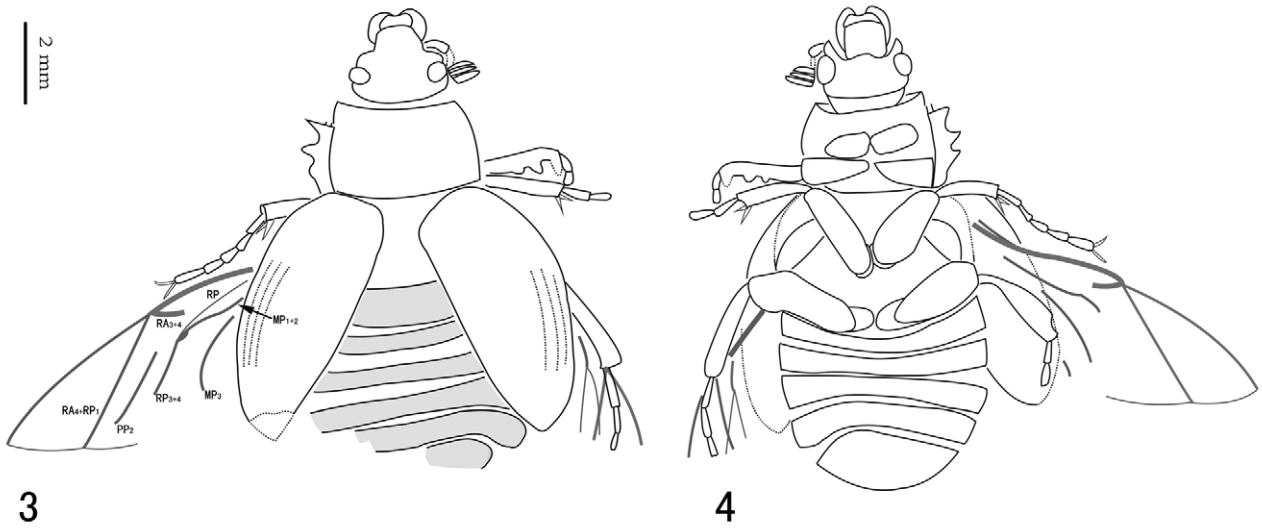


FIGURES 1–2. *Pulcherhybosorus tridentatus* photographs of the holotype. 1—CNU-COL-NN2011002P (dorsal view of body), 2—CNU-COL-NN2011002C (ventral view of body).

Beetle fossils with hind wings not covered by the elytra are extremely rare. *Pulcherhybosorus tridentatus* is the first Hybosoridae fossil species with the hind wing visible and preserved. The hind wings are well preserved and well developed showing the RP, RA_{3+4}, MP_{1+2}, MP_3, RP_{3+4}, RP_2 and RA_4+RP_1 veins. The presence of the MP_3 vein and the absence of the MP_4 vein are different character states from extant Hybosoridae. This fossil provides an important evidence for the early evolution of Hybosoridae.

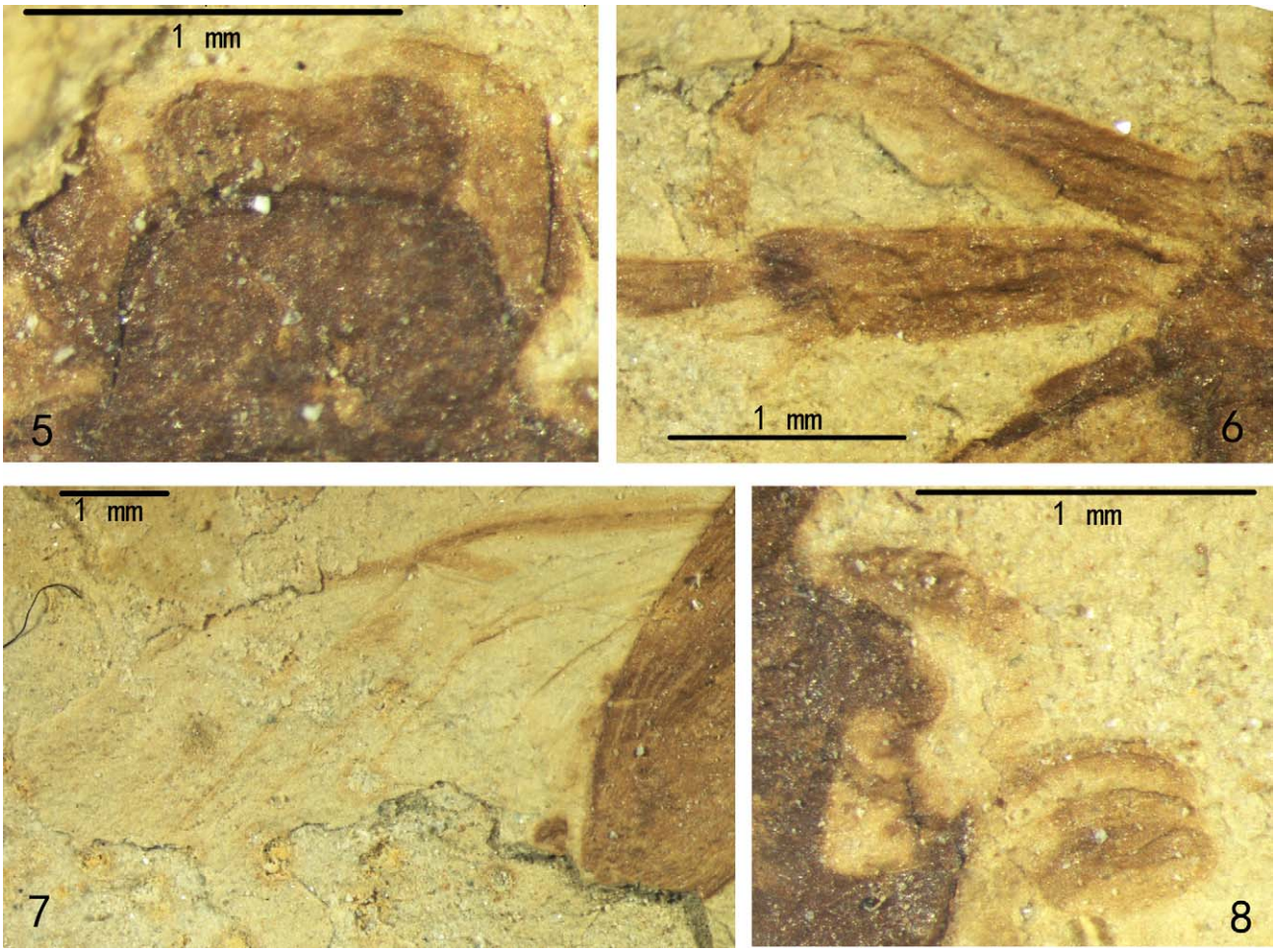


FIGURES 3–4. *Pulcherhybosorus tridentatus* line drawings of the holotype. 3—dorsal view of body; 4—ventral view of body.

Comparison. According to the Hybosoridae fossil record, there are nine genera described from the Mesozoic Era that warrant comparison: *Cretanaides* Nikolajev, 1996; *Cretohybosorus* Nikolajev, 1999; *Jurahybosorus* Nikolajev, 2005; *Leptosorus* Nikolajev, 2006; *Libanochrus* Kirejtshuk, Azar, & Montreuil, 2011; *Mesoceratocanthus* Nikolajev, Wang, Liu, & Zhang, 2010; *Mimaphodius* Nikolajev, 2007; *Protanaides* Nikolajev, 2010; and *Protohybosorus* Nikolajev, 2010. The new genus is readily distinguished from the genera *Cretohybosorus* and *Jurahybosorus* by the large body size, the mandibles visible in dorsal view, and the long and narrow shape of mandibles. *Pulcherhybosorus* is distinguished from the genus *Leptosorus* by the protibia dilated apically and with three teeth on outer margin and by the two spurs on the end of the mesotibia subequal in length. The abdomen with five visible sternites is a reliable diagnostic character that differentiates the new genus from the genus *Protohybosorus* and *Mesoceratocanthus*. The new genus is readily distinguished from the genus *Protanaides* by absence of a transverse carina on the mesotibia and metatibia, and the protibia with three teeth on the outer margin; from *Libanochrus* by the antennae with a 3-antennomere lamellate club and exposed mandibles; from *Mimaphodius* by labrum and mandibles visible in dorsal view. *Pulcherhybosorus* differs from

Cretanaides, known from a single elytron impression, by the body size and the absence of tubercles on the elytra. The new genus is distinguished from the extant genera of Hybosoridae by the large body size, the presence of the MP_3 vein, and the absence of the MP_4 vein.

Etymology. The Latin '*pulcher*-' means 'beautiful' in reference to this beautifully well-preserved fossil.



FIGURES 5–8. *Pulcherhybosorus tridentatus* magnified photographs of some details, 5—labrum and mandibles; 6—two spurs on the end of mesotibia; 7—hind wing; 8—antennae.

Pulcherhybosorus tridentatus Yan, Bai, & Ren, new species

(Figs. 1–4)

Holotype. *S*ex unknown, registration number CNU-COL-NN2011002P/C, part and counterpart. Deposited in the Key Lab of Insect Evolution & Environmental Changes, College of Life Sciences, Capital Normal University, Beijing, China.

Description. Body large, nearly oval; body length: 11.9 mm, width: 5.3 mm. *Head*. Narrower than pronotum, head length: 2.1 mm, width: 2.2 mm; eyes large; anterior margin of clypeus moderately emarginate; labrum and mandibles prominent, produced beyond apex of clypeus (Fig. 5). Antennae with a 3-antennomere lamellate club, club compact (Fig. 8). *Pronotum*. Length: 2.0 mm, width: 3.4 mm; wider than elytra and head; widest at base, width 1.7 times the length. Shape nearly trapezoidal, anterior margin of pronotum concave with lateral margins slightly convex, posterior margin slightly protruding. Scutellum, not preserved. *Elytra and hind wing*. Elytra: long and narrow, about 2.3 times as long as wide; elytra length: 6.0 mm, width: 2.6 mm; widest at middle, slightly constricted at base; convex, constricted at the apical quarter. Striae well defined, elytra without tubercles, lateral margins curved, humeral umbone well developed. Hind wing: the hind wings preserved, well developed; the RP, RA_{3+4}, MP_{1+2}, MP_3, RP_{3+4}, RP_2 and RA_4+RP_1 veins are visible on the fossil (Figs. 1, 2, 3, 7). *Abdomen*. Length: 3.7 mm with five visible sternites; abdominal segment 1 with length 0.4 mm, segments 2 and 3 both with length 0.5 mm, segment 4 with length 0.6 mm, segment 5 with length 1.7 mm. Pygidium, slightly convex; length 0.7 mm, width at base 2.3 mm. *Legs.* Procoxa about 2.3 times wider than long; protibia dilated apically and with three teeth on outer margin; protarsus preserved with only two tarsomeres in this

specimen. Mesofemur and metafemur slender; mesotibia and metatibia slightly dilated at apex, mesotibia with 2 subequal spurs (Fig. 6). Transverse carina on the mesotibia and metatibia absent; mesotarsus with two symmetrical claws and 5 tarsomeres; metatarsus preserved with only 3 segments in this specimen. *Measurements.* Body length 11.9 mm, body width 5.3 mm, head length 2.1 mm, head width 2.2 mm, pronotum length 2.0 mm, pronotum width 3.4 mm, elytra length 6.0 mm, elytra width 2.6 mm.

Etymology. The specific name is derived from Latin for three teeth, referring to dentation of the protibia.

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