

On the Mesozoic Taxa of Scarabaeoid Beetles of the Family Hybosoridae (Coleoptera: Scarabaeoidea)

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Abstract—Three new species of scarabaeoid beetles of the family Hybosoridae are described in the new genus *Protohybosorus*, gen. nov. from the Middle–Upper Jurassic of Kazakhstan (Karatau-Mikhailovka locality). The Lower Cretaceous species *Geotrupoides fortus* Ren, Zhu et Lu, 1995 (Inner Mongolia, China) is transferred to the genus *Leptosorus* Nikolajev, 2006.

Keywords: Hybosoridae, Mesozoic, Asia.

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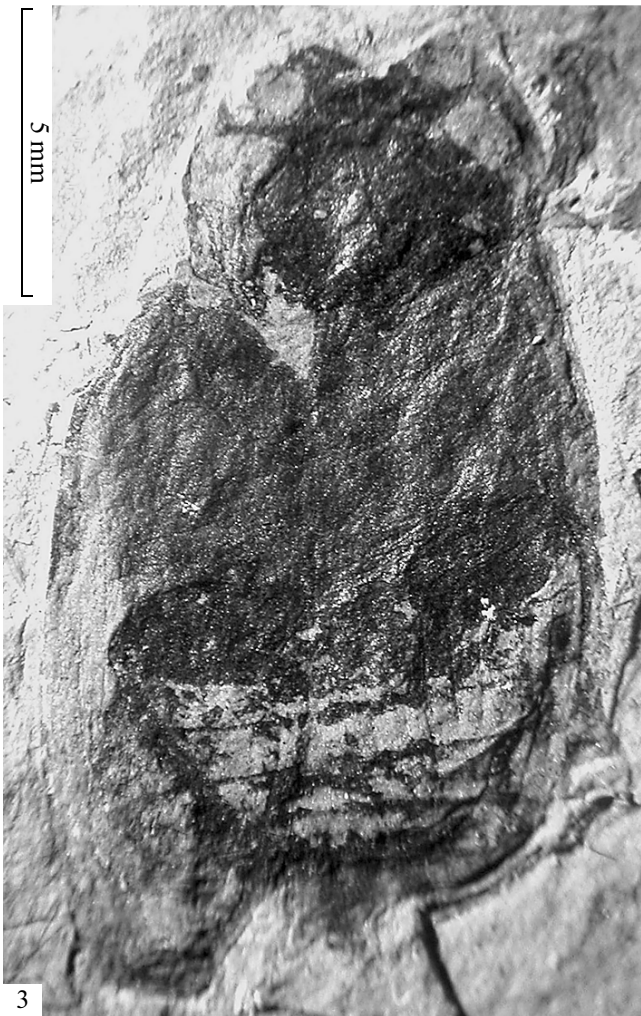
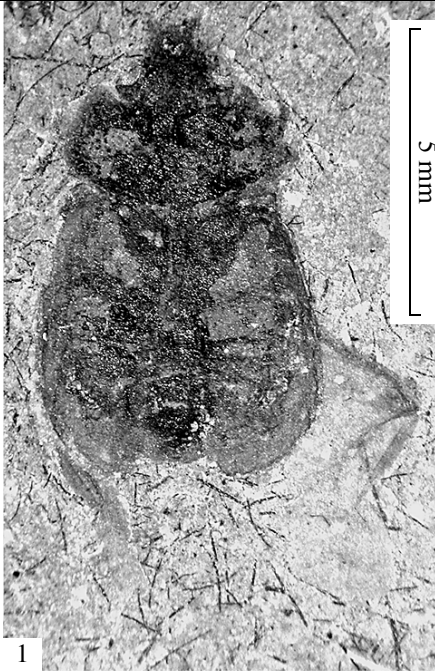
INTRODUCTION

Impressions of members of four species of scarabaeoid beetles were found in the Middle–Upper Jurassic deposits of the Karatau locality (Kazakhstan, South Kazakhstan province, Baidibek District, fossil site near the village Mikhailovka; Middle–Upper Jurassic, Karabastau Formation) (Pl. 6, figs. 1–4). Judging by the preserved characters, these species can be placed only in the family Hybosoridae: the mandibles and labrum are not hidden under the clypeus; the eye is only partially divided by the genal lobe; the abdomen is completely covered by the elytra; the mesocoxae are contiguous; and the meso- and metatibia have one transverse carina on the external surface. The earliest known fossil Hybosoridae were found in the Middle–Upper Jurassic of Mongolia, from where the genus *Jurahybosorus* Nikolajev was described from the impression of a fragment of an adult beetle (Nicolajev, 2005). Judging by the diagnostic characters used for establishing this genus, all specimens from Karatau can be placed in *Jurahybosorus*. However, very strong differences in the size of beetles and in the shape of their mouthparts, not found in species of any recent genus of the family, allow hypothesizing that the same pattern was present in Mesozoic Hybosoridae as well. This requires viewing the species from Karatau as members of at least two genera. The smallest of the impressions (Pl. 6, fig. 1), the size of which is similar to that of the type species of the genus *Jurahybosorus* Nikolajev, is placed in this genus (Nicolajev, 2008). This impression (Pl. 6, fig. 1) was better preserved than the impression of the type species, allowing to specify the diagnosis of *Jurahybosorus*. Three larger impressions are described below as species of the new genus *Protohybosorus*, gen. nov. (Pl. 6, figs. 2–4). Examination of the figure illustrating

the original description of the Lower Cretaceous species *Geotrupoides fortus* Ren, Zhu et Lu, 1995 shows that this species belongs to the genus *Leptosorus* Nikolajev, 2006. Such a considerable addition to the fauna of the Mesozoic Hybosoridae and the complex taxonomic composition of the taxon indicate the important ecological role played by this family in biocenoses of the Mesozoic at the early stages of the evolution of scarabaeoid beetles.

As far as is currently known from reliably identified impressions, members of the family Hybosoridae appear in the fossil record earlier than all other scarabaeoids. The age of the most “ancient” of the impressions is dated to the Middle–Late Jurassic. In the Jurassic, the family is represented by five known species from two genera of the nominotypical subfamily. Characters of most known Jurassic species are plesiomorphic. The plesiomorphic morphological characters clearly visible on impressions include the presence in all species of a transverse carina on the external surface of the meso- and metatibia; the mouthparts protruding from under the anterior margin of the clypeus and clearly visible in dorsal view of the beetle’s head; and the straight or convex anterior margin of the clypeus in most species. Among apomorphies found in the Jurassic Hybosoridae, the strongly elongate mandibles and clypeus in *Jurahybosorus kazakhstanicus* can be mentioned.

In the Early Cretaceous, the taxonomic diversity of the family considerably increases. The group is known from the Early Cretaceous by eight species from six genera of three subfamilies. It should be noted, however, that one of these genera was described from a single elytron, and it is doubtful whether it belongs to this subfamily (Krell, 2007). Among the apomorphies of the Lower Cretaceous Hybosoridae, the following



should be noted: the absence of a transverse carina on the external surface of the metatibia (and probably also mesotibia) and the concave anterior margin of the clypeus in species of the genus *Leptosorus*, placed in the nominotypical subfamily, as well as the mouthparts “hidden” under the clypeus of the monotypic Mesozoic subfamily Mimaphodiinae (Nikolajev, 2007). A remarkable complex of characters is displayed by *Protanoides sibiricus*, placed in the subfamily Anaidinae (Nikolajev, 2010). These include a spine on the external surface of the mesotibia (and probably also metatibia), which can be viewed as a vestige of the transverse carina: a plesiomorphy absent in all recent members of the subfamily. But at the same time *Protanoides* probably had the anterior portion of the head strongly curved downwards, which character can be viewed as an apomorphy. This position of the head makes the mouthparts invisible in dorsal view of the beetle’s head. This character is found in the recent genus *Cryptogenius* Westwood, 1845, represented by three species in South and Central America (Ocampo, 2006).

The Jurassic Hybosoridae generally have larger body size, compared to the Lower Cretaceous species. This difference probably indicates the favorable conditions for the development of the group in this particular period. If this pattern does not result from the fact that impressions of Hybosoridae were found in only two Jurassic localities with similar environmental conditions, then this “homogeneity” of the family’s life forms can be interpreted as evidence that its members inhabited in the Jurassic a relatively small number of biotopes. The diversity of Lower Cretaceous forms (at least four genera of three subfamilies), on the contrary, probably gives evidence of inhabiting a great number of biotopes.

The recent world fauna of Hybosoridae includes less than 600 species (less than 2% of the number of known species in the superfamily) (Nikolajev, 2007). More than 300 of these species belong to the subfamily Ceratocanthinae, the members of which, symbionts of termites and ants, are abundantly represented in the tropics (Ocampo, 2006). The earliest finding of fossil species of this subfamily came from the Dominican amber dated to the Miocene (Krell, 2007). The presence of 12 or 13 species of hybosorids in the Mesozoic (over 10% of the number of scarabaeoid species known from this era) gives evidence of the important ecological role played by members of the family Hybosoridae at the early stages of the evolution of Scarabaeoidea.

The holotypes of the new species are stored in the Borissiak Paleontological Institute of the Russian Academy of Sciences (PIN).

SYSTEMATIC PALEONTOLOGY

Family Hybosoridae Erichson, 1847

Subfamily Hybosorinae Erichson, 1847

Genus *Protohybosorus* Nikolajev, gen. nov.

E t y m o l o g y. From the Greek *protos* (first) and the name of the type genus of the family.

T y p e s p e c i e s. *P. karatavicus*, sp. nov.

D i a g n o s i s. Large oblong oval beetles. Average (and maximum) body size in members of this new genus largest among all known members of Hybosoridae. Mandibles and labrum clearly visible in dorsal view of head, mandibles protruding anteriorly from under apex of labrum. Labrum wide. Clypeus with anterior margin straight or weakly rounded. Eye large, partly divided by genal lobe. Pronotum with narrow coriaceous edging on anterior margin. Scutellum short, with apex weakly rounded. Pygidium completely covered by elytra. Coxae of every pair of legs contiguous; mesocoxae positioned at right angle. Protibia with three or four denticles on external margin. Meso- and metatibia with one transverse carina on external surface. Metatibial spurs contiguous. Each elytron with ten puncture grooves. Abdomen with six visible sternites.

S p e c i e s c o m p o s i t i o n. Three new species from the Middle–Upper Jurassic of Kazakhstan.

C o m p a r i s o n. The new genus is readily distinguished from all Mesozoic members of the subfamily: from the genus *Leptosorus* Nikolajev, by the presence of a transverse carina on the external surface of the meso- and metatibia; from the genera *Jurahybosorus* and *Cretohybosorus* Nikolajev, by the larger size and the shape of mandibles, long and narrow in the former genus and virtually not protruding from under the labrum in the latter. *Protohybosorus* is probably close to the type genus of the family, from which it differs only in the smaller number of elytral grooves (a plesiomorphy).

R e m a r k s. The diagnosis of the new genus includes characters the entire complex of which could not be fully traced in any of the described impressions.

The presence of a transverse carina on the meso- and metatibia distinguishes this new taxon from members of the subfamilies Anaidinae, Ceratocanthinae, and Liparochrinae (Ocampo, 2006). *Protohybosorus* is also distinguished from most species of these three subfamilies by the structure of its simple elytral puncture grooves, the lateral margins of which are not vertical. The abdomen with six visible sternites is a reliable diagnostic character that allows distinguishing the

Explanation of Plate 6

Fig. 1. *Jurahybosorus kazakhstanicus* Nikolajev, 2008.

Fig. 2. *Protohybosorus grandissimus*, sp. nov., holotype PIN, no. 2335/25.

Fig. 3. *Protohybosorus karatavicus*, sp. nov., holotype PIN, no. 2784/1656.

Fig. 4. *Protohybosorus mesasiaticus*, sp. nov., holotype PIN, no. 2384/760.

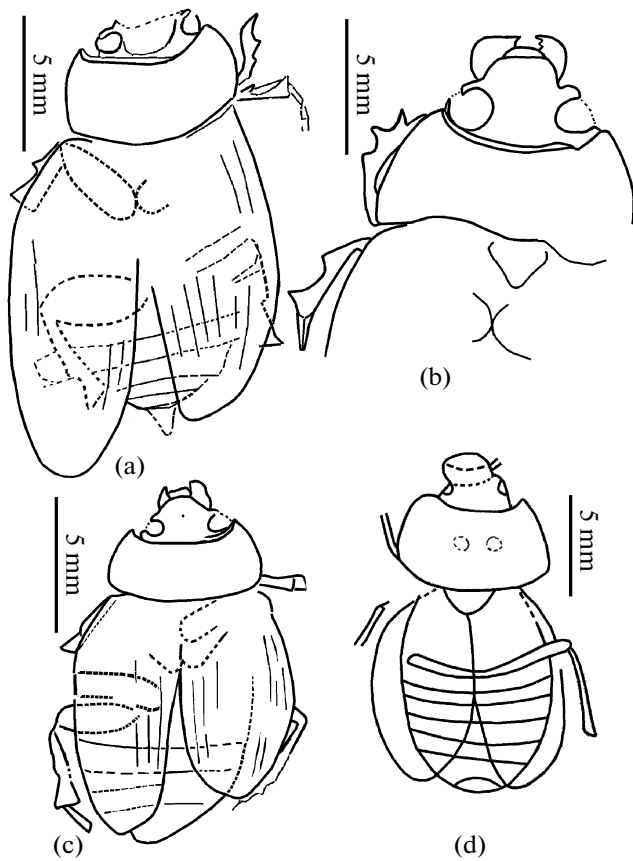


Fig. 1. Mesozoic Hybosoridae: (a) *Protohybosorus karatavicus*, sp. nov., holotype, PIN no. 2784/1656; (b) *Protohybosorus grandissimus*, sp. nov., holotype, PIN no. 2335/25; (c) *Protohybosorus mesasiaticus*, sp. nov., holotype, PIN no. 2384/760; (d) *Leptosorus fortus*, (Ren, Zhu et Lu) comb. nov. (from Ren et al., 1995, Fig. 6).

new genus from members of the subfamily Pachyplectrinae, while the large size and the mandibles visible in dorsal view distinguish it from the fossil subfamily Mimaophodiinae (Nikolajev, 2007). The new genus has not a single character that would prevent including it in the nominotypical subfamily of the family Hybosoridae.

Protohybosorus karatavicus Nikolajev, sp. nov.

Plate 6, fig. 3

E t y m o l o g y. From the Karatau locality.

H o l o t y p e. PIN, no. 2784/1656, almost complete impression of adult beetle without anterior portion of head; Karatau–Mikhailovka locality; Karabastau Formation.

D e s c r i p t i o n (Fig. 1a). The beetle is oblong. The eye is large, partly divided by the genal lobe. The anterior angles of the pronotum are acute, the posterior angles broadly rounded. The lateral margin of pronotum is arcuately convex, indistinctly sinuate in front of the posterior angle. The protibia has at most

four denticles along its external margin; the protibial apex is straight. The posterior margins of abdominal sternites 1–5 have narrow coriaceous edging.

M e a s u r e m e n t s, mm. Length of impression from apex of preserved part of head to apex of left elytron, 18.0; width of impression medially, 9.7; distance between internal margin of eyes, 1.8; length of pronotum medially, about 3.0; maximum width of pronotum, 6.4; length of protibia, about 3.0; maximum width of mesocoxa about 1.1; length of mesofemur, about 3.5; length of mesotibia, about 3.0; width of apical truncation of mesotibia, 0.6; distance between transverse carina on mesotibia and apex of mesotibia, about 1.6; length of metaventrite medially, about 2.5; maximum width of metafemur, about 1.8; length of metafemur, about 1.8; length of metatibia, 4.0; width of apical truncation of mesotibia, 0.6.

M a t e r i a l. Holotype.

Protohybosorus grandissimus Nikolajev, sp. nov.

Plate 6, fig. 2

E t y m o l o g y. From the Latin *grandis* (huge, great).

H o l o t y p e. PIN, no. 2335/25, impression of anterior portion of beetle with partially preserved left pro- and mesotibia; Karatau–Mikhailovka locality; Karabastau Formation.

D e s c r i p t i o n (Fig. 1b). The beetle is large, oblong oval. The mandibles are wide, protruding far to the sides from the lateral margins of the clypeus. The labrum is very short; its anterior margin appears simply rounded. The clypeus has straight anterior margin and broadly rounded anterior angles. A relatively small tubercle was probably developed in the middle of the clypeus. The anterior angles of the pronotum are acute, the posterior angles broadly rounded. The lateral margin of pronotum is arcuately convex. The scutellum is heart-shaped. The protibia has at three denticles along its external margin. The transverse carina on the mesotibia is positioned approximately at the middle of its length.

M e a s u r e m e n t s, mm. Length of head, 4.2; length of labrum, 0.3; distance between internal margin of eyes, about 2.2; length of pronotum medially, about 4.0; maximum width of pronotum, about 9.2; length of protibia, 4.4; length of mesotibia, about 3.5; width of apical truncation of mesotibia, 1.2; distance between transverse carina on mesotibia and apex of mesotibia, 2.0; length of apical mesotibial spur, 1.1.

C o m p a r i s o n. This new species differs from the type species of the genus in the larger size, the broadly rounded posterior angles of pronotum, and the presence of only three denticles along the lateral margin of the protibia.

M a t e r i a l. Holotype.

Protohybosorus mesasiaticus Nikolajev, sp. nov.

Plate 6, fig. 4

E t y m o l o g y. From the Latin *mesasiaticus* (relating to Central Asia).

H o l o t y p e. PIN, no. 2384/760, impression of male adult beetle with visible apex of aedeagus, mesotibiae and left hindleg; Karatau–Mikhailovka locality; Karabastau Formation.

D e s c r i p t i o n (Fig. 1c). The beetle is oblong oval. The mandibles are rather small, relatively narrow, clearly visible in dorsal view of the beetle's head. The labrum has weakly convex anterior margin. The eye is large, partly divided by the genal lobe; the genal lobe is broadly protruding to the side; its anterior margin is weakly convex. A relatively small tubercle was probably developed in the middle of the suture between the clypeus and the frons. The lateral margin of pronotum is arcuately convex. Only small fragments of grooves are very indistinctly traceable on the elytron. The posterior margins of abdominal sternites have narrow coriaceous edging.

M e a s u r e m e n t s, mm. Length of impression from apices of mandibles to apex of aedeagus, 14.9; width at humeral angle, about 7.0; length of labrum, 0.4; length of head, about 2.0; width of head (between external margins of genal lobes), 2.8; distance between internal margin of eyes, 1.9; length of pronotum medially, 2.7; maximum width of pronotum, 6.1; maximum width of elytron, 4.6; maximum width of mesocoxa, about 1.1; distance between transverse carina on mesotibia and apex of mesotibia, 1.3; width of metacoxa, about 1.1; width of metafemur, about 1.3; length of metatibia, 3.4; width of apical truncation of mesotibia, 1.2; distance between transverse carina on metatibia and apex of metatibia, 1.6; length of 1st metatarsomere, 1.6; length of abdominal sternites 3–6 medially, 0.9, 0.6, 0.9, and about 1.4, respectively.

C o m p a r i s o n. The smallest species of the genus. It differs from the type species of the genus in the oval body, more strongly widened posteriorly, and in the shape of the pronotum. The posterior angles of pronotum in *P. mesasiaticus* are broadly rounded; the lateral margin of pronotum is not sinuate in front of them. This new species is distinguished from *P. grandissimus*, in addition to the small size, by the narrower mandibles and the longer labrum.

M a t e r i a l. Holotype.

Genus *Leptosorus* Nikolajev, 2006

Leptosorus fortus (Ren, Zhu et Lu, 1995), comb. nov.

Geotrupoides fortus: Ren et al., 1995, p. 436.

Examination of the figure of the Lower Cretaceous species *Geotrupoides fortus* Ren, Zhu et Lu, 1995

(fig. 1d), described from the Inner Mongolia, China, shows that this species belongs to the genus *Leptosorus*. This is indicated both by the similarity of its habitus with that of the type species of *Leptosorus*, *L. zherikhini* Nikolajev, 2006 and by such diagnostic characters as the concave anterior margin of the clypeus and the absence of transverse carinae on the external surface of the metatibia (Nicolajev, 2006). *L. zherikhini* and *L. fortus* are not conspecific, because they have different body size (9.2 and 14 mm, respectively), as well as width of the metafemur and proportions of the pronotum.

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