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Mesozoic Leaf Beetles of the Tribe Mesolpinini trib. nov. (Coleoptera, Chrysomelidae) from the Lower Cretaceous

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Abstract—This publication is based on recent studies of Lower Cretaceous leaf beetles from the Yixian Formation (Liaoning, China), which are represented by five new species of one new genus *Mesolpinus* gen. nov. (*M. antenattus* sp. nov. [type species], *M. adapertilis* sp. nov., *M. angusticollis* sp. nov., *M. basicollis* sp. nov., and *M. trapezicollis* sp. nov.) assigned to a new tribe, Mesolpinini trib. nov. of the subfamily Chrysomelinae. This tribe, which includes only species from the Jehol biota, is the oldest known group of the family in the fossil record. A key to species of the genus *Mesolpinus* gen. nov. is provided and the position of the new tribe is discussed. A brief overview of the Mesozoic data on the subfamily Chrysomeloidea is given.

Keywords: Coleoptera, Chrysomelidae, Chrysomelinae, new taxa, Lower Cretaceous, China, Lioaning

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INTRODUCTION

Leaf beetles (Chrysomelidae Latreille, 1802) are a rather old group of the order Coleoptera. A related group, longhorn beetles (Cerambycidae Latreille, 1802) is known from the Lower Cretaceous (Wang et al., 2013; Yu et al., 2015). Mesozoic chrysomelids listed by Santiago-Blay (1994) were described in the 19th century and their family affiliation is rather doubtful. The subfamily Protoscelinae proposed by Medvedev (1968) was considered as the only group of Mesozoic leaf beetles of high taxonomic rank recorded before the Cenozoic (Karatau, Upper Jurassic), but it has recently been transferred to the family Anthribidae Billberg, 1820 (Legalov, 2013). However, Wolf-Schwenninger and Schawaller (2007) and Kirejtshuk et al. (2010) demonstrated the occurrence of leaf-beetles in the Lower Cretaceous and Valentin et al. (2014) found a chrysomeline specimen in the Upper Creataceous beds. Finally, Poinar (2005) first described true Mesozoic leaf-beetles of the subfamily Bruchinae Latreille, 1802. All Cretaceous Chrysomelidae were assigned to extant subfamilies and tribes. A more detailed review of the fossil record is given in the catalogue by Kirejtshuk and Ponomarenko (2015).

MATERIAL AND METHODS

All specimens examined come from the same outcrop and are housed in the Capital Normal University (Beijing, China). These specimens were loaned from this collection to the Zoological Institute of the Russian Academy of Sciences for examination, where they were studied using a Leica MZ 16.0 stereomicroscope with a DFC290 camera. Some specimens were also examined with a TESCAN/Vega/XMU scanning electron microscope in the Borissiak Paleontological Institute of the Russian Academy of Sciences, Moscow, which allowed finding some peculiar features that could not be examined using ordinary optics.

The Yixian Formation (Liaoning, China) is a very important and well-known resource of the Lower Cretaceous biota, although different estimates of its age are contradictory (Lo et al., 1999; Swisher III et al., 1999; Wang et al., 2005; Kirejtshuk et al., 2010, 2011; etc.). Nevertheless, the summarized variability of these estimations is restricted to the upper layers of the Jurassic and lower layers of the Cretaceous.

SYSTEMATIC PALEONTOLOGY

Superfamily Chrysomeloidea Latreille, 1802

Remarks. The attribution to this superfamily is supported by the pseudo-four-segmented tarsi with bilobed tarsomere 3 and elongate ultimate tarsomere, more or less transverse head without rostrum, antennae without clear club, and metafemora not widened.

Family Chrysomelidae Latreille, 1802

Subfamily Chrysomelinae Latreille, 1802

Remarks. Some characters of the new taxa observable in available fossil imprints correspond to

those found in members of different groups of the subfamily Chrysomelinae, namely, the hypognathous head is not narrowed at the base; the antennal cavities are located in front of eyes and widely separated; "frontoclypeus" (isolated anterior part of the frons) subquadrangular, are behind the mandibles and separated from the posterior part of the frons by a wide-angle V-shaped "suture"; the pronotum is laterally margined; all coxae moderately separated; the prosternal process apparently lacks lateral structures for receipt the procoxae; procoxae are distinctly transverse; mesoventrite lacks projections for receipt of the mesocoxae; metepisterna is simple and lacks projections; the abdomen has ventrite 1 longest and other ventrites subequal in length, not fused; tarsomere 3 is bilobed. All characters visible in the examined imprints of members of the new tribe make it possible to refer them to the subfamily Chrysomelinae, excluding the head structure (particularly the anterior part of the frons, the "frontoclypeus"). This part of the frons extendind between the mandibles was considered by Reid (1995) as a character important for distinguishing the families Orsodacnidae Thomson, 1859 and Chrysomelidae. On the other hand, this character is quite variable even in modern Chrysomelinae and it is possible to suppose that, in fossil groups, this variability could be even greater. The new fossil species differ from Recent species of Orsodacnidae in the presence of paramedian excavations on the mesoventrite and antennomeres 7–11. The species under description also do not belong to the family Megalopodidae Latreille, 1802 because of the separated and not prominent procoxae and characteristic head, which is not narrowed basally. Within Chrysomelidae, the new species differ from all subfamilies, except Chrysomelinae, in the following features: from Sagrinae Leach, 1815, Criocerinae Latreille, 1804, Donaciinae Kirby, 1837, Synetinae Edwards, 1953, and Bruchinae, in the head not narrowed at the base; from the "Camptosomata" group (subfamilies Cryptocephalinae Gyllenhal, 1813, Chlamisinae Gressitt, 1946, and Lamprosomatinae Lacordaire, 1848), in the abdomen with ventrites not shortened at the middle and without fossa on ventrite 5 in females; from Galerucinae Latreille, 1802, in the widely separated antennal insertions and simple metafemora; from Cassidinae Gyllenhal, 1813, in the not opistognathous head; from Eumolpinae Hope, 1840, in the mesocoxae without excision at the inner edge; and from Spilopyrinae Chapuis, 1874, in the humeri not projecting and the smooth prothoracic sides (without large teeth).

Tribe Mesolpinini Kirejtshuk, Moseyko et Ren, trib. nov.

Type genus. *Mesolpinus* gen. nov.

Diagnosis. Body medium-sized, oval, and strongly convex dorsally. Head suboval, subequal in length and width or slightly transverse and with base rather retracted into prothoracic segment; isolated anterior part of frons ("frontoclypeus") slightly projecting between mandibles. Antennomeres 7–11 somewhat flattened and widened apically. Antennomere 6 smaller than antennomere 5 or 7. Prothoracic sides distinctly carinate, thickened, and heavily sclerotized, appearing as darkened stripe. Prosternum much shorter than pronotum. Procoxae transverse and with exposed protrochantin. Mesoventrite with pair of paramedian depressions, each situated behind procoxa for receipt of latter. Mesocoxae obliquely oval, markedly longer than procoxae. Metaventrite comparatively long, about as long as abdominal ventrite 1 and with very deep and narrow median excision at posterior edge. Metepisterna strongly anteriorly widened; at mesocoxae, 3–4 times wider than at posterior end. Pygidium and ventrite 5 (hypopygidium) simple (without median grooves, lobes, or serrations along posterior edge). Elytra with sides not explanate, not fused along suture, and without clear humeri. Elytral epipleura rather wide and well expressed at least in anterior two-thirds, apparently subhorizontal, and with sharp lateral carina. Tibiae with distinct carina bearing setae on their dorsal surface; their apices without excavations or clear spurs.

Comparison. Within the subfamily Chrysomelinae, the new tribe is easily distinguished from the tribe Timarchini by the long metaventrite and also by the sharply carinate and apparently horizontal epipleura; from Chrysomelini, it can be distinguished by the shape of the frons distinctly projecting between mandibles. Flattened antennomeres 7–11 are not present in timarchins but characteristic of some chrysomelins, especially those known from the Recent Australian fauna. For instance, the antennae with subflattened antennomeres 7–11 and small antennomere 6, which are characteristic of the new tribe, are present in the Recent Australian genus *Ateratocerus* Blackburn, 1890 (after Reid, 2006), although species of the latter have ventrite 5 with crenellate posterior edge. The thickened rollers viewed as stripes along pronotum apparently resembling those found in representatives of the new tribe are also known in some Chrysomelini. Such rollers can be delimited by grooves from above (e.g., some Recent species of the genus *Chrysolina* Motschulsky, 1860) or from below (e.g., members of the Recent genus *Calomela* Hope, 1840). The paramedian excavations in the mesoventrite (behind the procoxae) are also found in many Recent groups of Chrysomelini (*Chrysolina*, *Chrysomela* Linnaeus, 1756, *Gonioctena* Chevrolat in DeJean, 1836, etc.).

Remarks. Elytra of the fossils examined lack clear traces of longitudinal rows of punctures or striae, although the imprint of the holotype of *Mesolpinus trapezicollis* sp. nov. seems to demonstrate some longitudinal arrangement of punctation on the disk of the left elytron. The head of specimens of the newly described species is more or less retracted into the prothoracic segment and the probable level of its transversity visible in the imprints examined can scarcely be

treated as reliable indicator of the head shape in general. The antennae of the specimens examined have some differences which could have been species variability as well as sexual dimorphism, but the nature of these differences is not evident, because no other reliable sexual character has been found in these specimens.

Genus *Mesolpinus* Kirejtshuk, Moseyko et Ren, gen.nov.

Etymology. From *meso* (i.e., Mesozoic) and *lpinus,* as in the generic name *Elpinus* (as well as in *Eoeumolpinus, Micropalpinus,* and *Palpinus*); masculine gender.

Type species. *M. antennatus* sp. nov.

Diagnosis. The same as for the tribe.

Species composition. In addition to the type species, *Mesolpinus adapertilis* sp. nov., *M. angusticollis* sp. nov., *M. basicollis* sp. nov., and *M. trapezicollis* sp. nov.

***Mesolpinus antennatus* Kirejtshuk, Moseyko et Ren, sp. nov.**

Etymology. The epithet of this new species refers to the antennae bearing one of the most characteristic features of the new genus.

Holotype. CNU-Col-LB-2009840, imprint of almost complete beetle with more or less clear outlines of underside sclerites and transparent traces of sutural edges of elytra; tarsi and right antenna not clear or not complete.

Description (Fig. 1). The integument of ventral sclerites has moderately coarse, dense, and diffuse oval punctures; interspaces between them are subequal to puncture diameter; the epipleura have considerably smaller and sparser punctures; the elytra are apparently without traces of longitudinal rows of punctures.

The head is about as wide as long, with moderately large oval eyes, and rather wide and short anterior part of frons (the "frontoclypeus"). The mandibles are moderately raised and gently curved along the outer edge. The mentum is moderately large, subquadrangular, rather transverse (about twice as wide as long). The labial palpi are not visible; the ultimate maxillary palpomere is subconical and about twice as long wide. The antennae are about half as long as the body; the scape is comparatively short, rather vaulted and apparently shorter (or at least not longer) than antennomere 2; antennomeres 2–5 are moderately long and subequal in length, subcylindrical to subconical; antennomeres 7–10 somewhat flattened; antennomere 11 about as long as each of antennomeres 2–5 and subacute at the apex. The prothorax is about twice as wide as long; its anterior and apparently posterior angles have a distinct apex; and its lateral edges are straight, with sclerotized stripes along the sides widening anteriad; the prosternum has a rather deeply arcuately excised anterior edge; in the middle, its precoxal part is about as long as the procoxae or a little shorter; the prosternal process is not visible. The distance between the mesocoxae is almost twice as long and the distance between the metacoxae is more than twice as long as that between the procoxae. The mesoventrite is apparently about as long as the prosternum, with a pair of paramedian excavations behind the procoxae. The metaventrite is slightly longer than the mesoventrite and somewhat shorter than abdominal ventrite 1. The elytra are somewhat wider than the prothorax, subparallel-sided in anterior three-fifths, about 1.4 times as long as wide combined, conjointly subacute at the apices. Abdominal ventrite 1 about as long as ventrites 2–5 combined; the hypopygidium is very short and transverse, about as long as each of ventrites 2–4, subtruncate at the apex; the pygidium is widely rounded at the apex.

The femora are comparatively narrow and moderately long, slightly widened at the middle, 3.0–3.5 times as long as thick. The tibiae are moderately long and thin, thickened gradually apically. The tarsi are apparently not more than three-fourths as long as the corresponding tibiae; tarsomeres 1–3 are widely lobed; the protarsus is somewhat wider than protibia; the meso- and metatarsi are somewhat narrower than meso- and metatibiae; the ultimate tarsomere is somewhat shorter than tarsomeres 1–3 combined.

Measurements, mm. Body length, 4.1; width of elytra, 1.9; length of elytra, at least 2.6; length of prothorax, 0.6.

Comparison. The new species is diagnosed to species in the key provided below. In general, it is more robust than congeners. In addition, it has the widest subapical antennomeres (7–11), although those of the additional specimen of *M. basicollis* sp. nov. are almost comparable. *Mesolpinus antennata* sp. nov. is also characterized by the gently curved outer edge of its mandibles and lateral sclerotized stripes of prothorax widened anteriad.

Material. Holotype.

***Mesolpinus adapertilis* Kirejtshuk, Moseyko et Ren, sp. nov.**

Etymology. From the Latin *adapertilis* (that may/can be opened).

Holotype. CNU-Col-LB-2010253, imprint of almost complete beetle with not quite clear outlines of ventral sclerites and transparent traces of sutural edges of elytra, but traces of considerable parts of tibiae and tarsi obscure or not visible.

Description (Fig. 2). Integument of ventral sclerites lack traces of distinct sculpture.

The head is slightly transverse, with moderately large oval eyes and rather wide and short anterior part of the frons (the "frontoclypeus"). The mandibles are comparatively small and angularly curved along the outer edge. The mentum is moderately large, unclear in outline, strongly transverse (about three times as wide as long). The palpi are not visible. The antennae are somewhat less than half as long as the body; the scape is moderately large, rather inflated, the longest

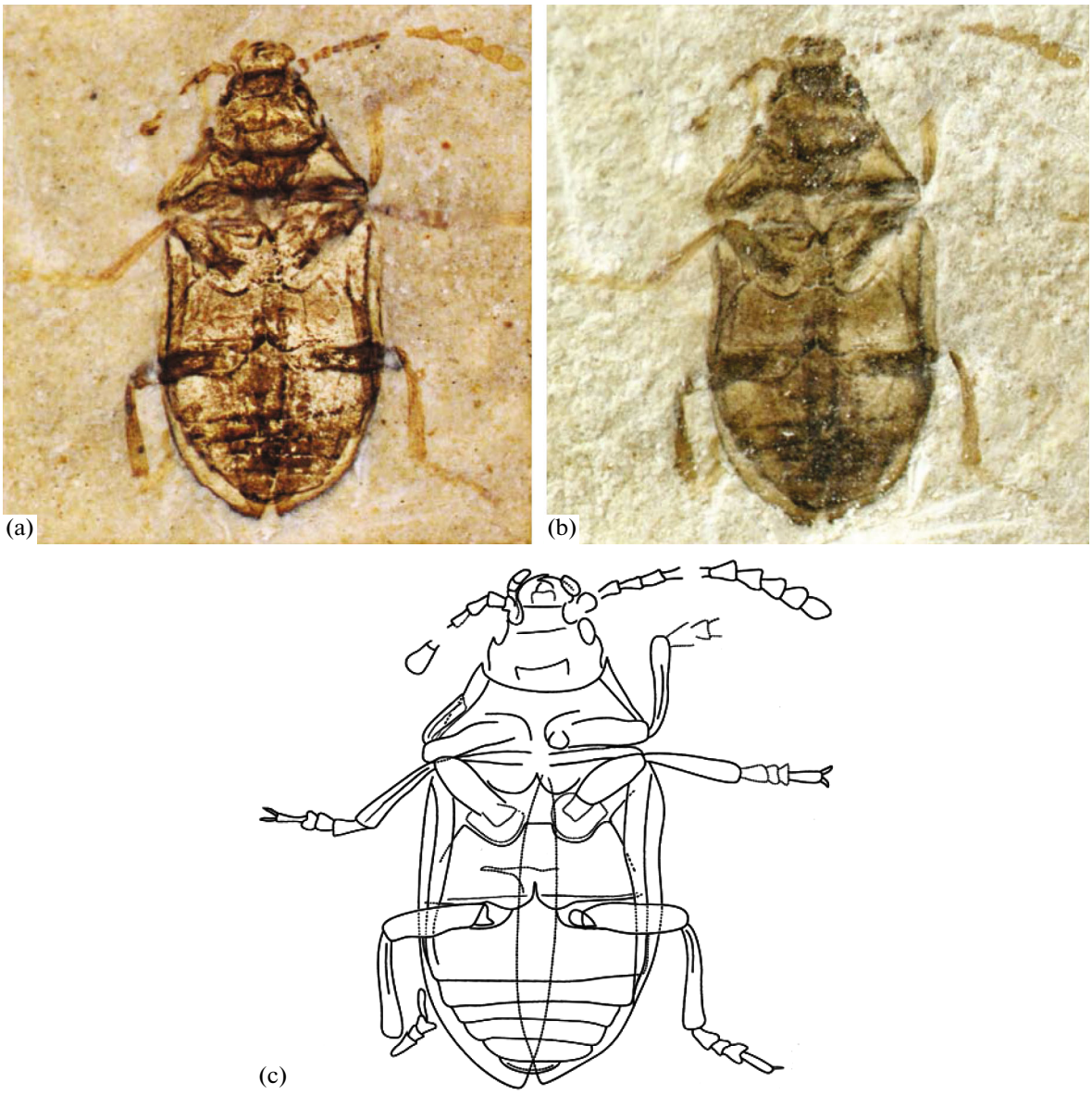

Fig. 1. *Mesolpinus antennatus* gen. et sp. nov., holotype CNU-Col-LB-2009840; Yixian Formation, Lower Cretaceous; Liaoning, China: (a) imprint covered with alcohol; (b) dry imprint; (c) reconstruction of holotype. Length of specimen, 4.1 mm.

and about twice as long as antennomere 2; antennomere 2 is shorter than each of antennomeres 3–5, subcylindrical to subconical; antennomeres 7–10 are slightly flattened; antennomere 11 is somewhat longer than each of antennomeres 7–10 and subacute at the apex. The prothorax is about 1.7 times as wide as long and widest at the base; its anterior and posterior angles are blunt; its lateral edges are straight and distinctly carinate, with sclerotized parallel-sided stripes; the prosternum has a rather deeply arcuately excised anterior edge; its precoxal part is markedly shorter in the middle than the procoxae; the pronotosternal sutures and prosternal process are not visible. The distance between the mesocoxae is almost twice as long and the distance between the metacoxae is more than twice as long as that between the procoxae. The mesoventrite is apparently about as long as the prosternum, with a pair of paramedian excavations behind the procoxae. The metaventrite is about as long as the mesoventrite and considerably shorter than abdominal ventrite 1. The elytra are somewhat wider than the prothorax, broadly rounded in the anterior three-fifths, nearly 1.5 times as long as wide combined; the elytral apices are rather conjointly rounded. The abdominal ventrite 1 is almost as long as ventrites 2–4 combined; the hypopygidium is very short, about as long as each of ventrites 2–4 and widely rounded at the apex; the pygidium is widely rounded at the apex.

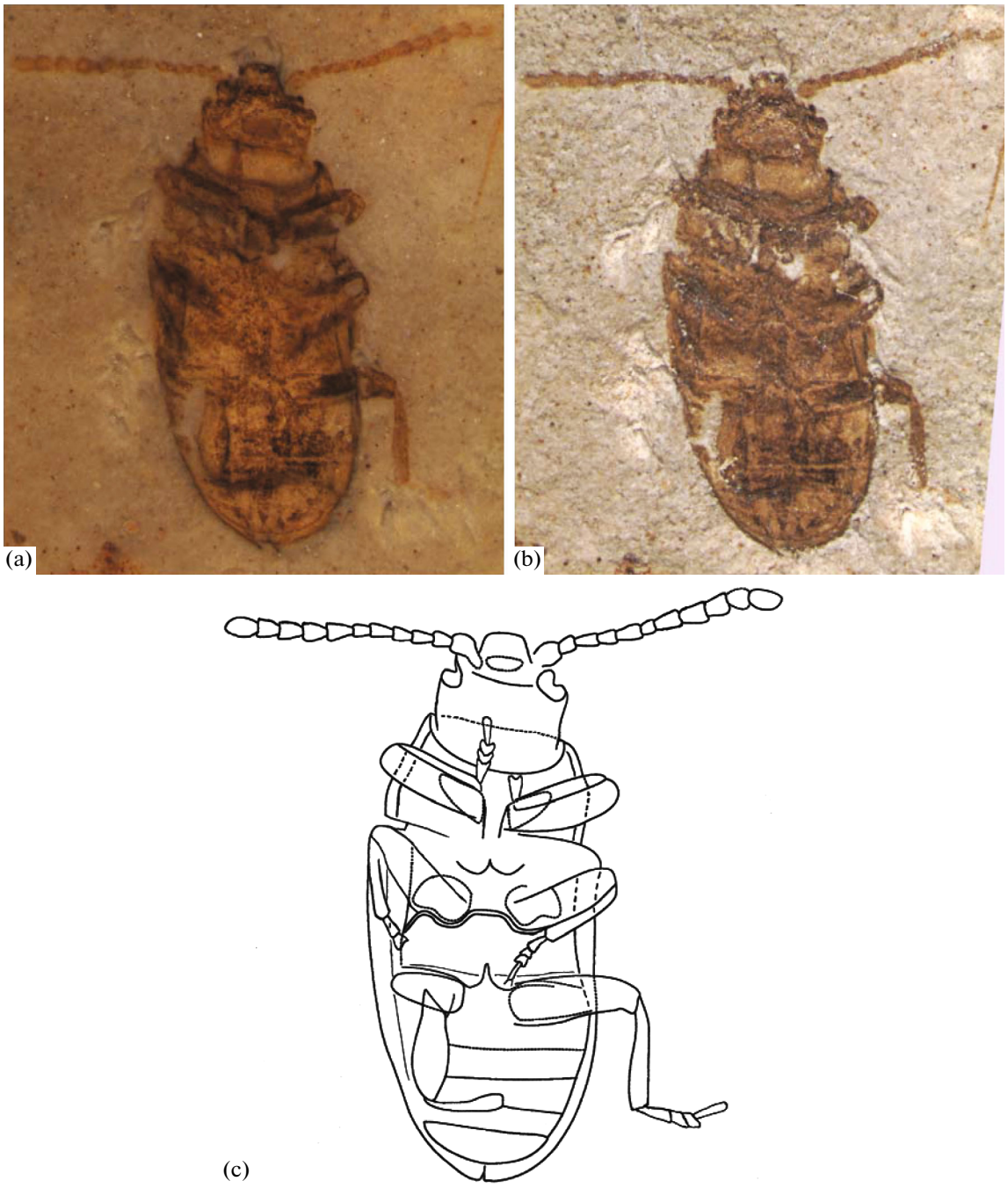

Fig. 2. *Mesolpinus adapertilis* gen. et sp. nov., holotype CNU-Col-LB-2010253; Yixian Formation, Lower Cretaceous; Liaoning, China: (a) imprint covered with alcohol; (b) dry imprint; (c) reconstruction of holotype. Length of specimen, 4.0 mm.

The femora are comparatively narrow and moderately long, slightly widened at the middle, 3.0–3.5 times as long as thick. The tibiae are moderately long and thin, gradually thickened apically. The tarsi are apparently not more than three-fourths as long as the corresponding tibiae; tarsomeres 1–3 are widely lobed; the protarsus is apparently as wide as the protibia; the meso- and metatarsi are slightly narrower than the meso- and metatibiae; the ultimate tarsomere is somewhat shorter than tarsomeres 1–3 combined.

Measurements, mm. Body length, 4.0; width of elytra, 1.7; length of elytra, 2.8; length of prothorax, 0.6.

Comparison. The new species is diagnosed to species in the key provided below. *Mesolpinus adapertilis* sp. nov. is distinguished from congeners by the

shape of its prothorax with parallel-sided sclerotized stripes on the sides.

Material. Holotype.

***Mesolpinus angusticollis* Kirejtshuk, Moseyko et Ren, sp. nov.**

Etymology. From the Latin *angustus* (narrow) and *collum* (neck, stem), referring to the rather narrow prothorax of this species compared to congeners.

Holotype. CNU-Col-LB-2009872, imprint of almost complete beetles with rather clear outlines of underside sclerites and transparent traces of sutural edges of elytra, and traceable dorsal surface of head; however, only a part of sclerites of the left intermediate and posterior femora and tibiae, and also only the distal part of the left profemur are exposed.

Description (Fig. 3). The integument of all visible sclerites has no observable traces of sculpture.

The head is much wider than long, with moderately large oval eyes and rather wide and comparatively long anterior part of frons (the "frontoclypeus"). The mandibles are well raised, angularly curved along the outer edge. The mentum and labial palpi are not visible. The ultimate maxillary palpomere is subconical and about twice as long as wide. The antennae are about two-fifths as long as the body; the scape is comparatively short, rather vaulted and apparently slightly longer than antennomere 2; antennomeres 2–5 are moderately long and subequal in length, subcylindrical to subconical; antennomeres 7–10 are slightly flattened; antennomere 11 is somewhat longer than each of antennomeres 2–5 and suboval. The prothorax slightly narrows anteriad; its anterior angles are widely rounded, and its posterior angles have a distinct apex; the lateral edges are arcuate, with sclerotized stripes widened anteriad; the prosternum has a not deeply arcuately excised anterior edge, its precoxal part is markedly shorter in the middle than the procoxae; the prosternal process is not visible. The distance between the mesocoxae is almost twice as long as and that between the metacoxae is nearly four times as long as that between the procoxae. The mesoventrite is apparently about as long as prosternum, with a pair of paramedian excavations behind procoxae. The metaventrite is significantly longer than the mesoventrite and also longer than abdominal ventrite 1. The elytra are somewhat wider than the prothorax, subparallel-sided to broadly arcuate in anterior three-fifths, about 1.3 times as long as wide combined, separately widely rounded at the apices. Abdomen has ventrite 1 about as long as ventrites 2–4 combined; the hypopygidium is very short and strongly transverse, about as long as each of ventrites 2–4, widely rounded to subtruncate at the apex; the pygidium is widely rounded at the apex.

The femora are comparatively narrow and moderately long, very slightly widened at the middle, 3.0–3.5 times as long as thick. The tibiae are moderately long and thin, gradually thickened apically. The tarsi are not visible.

Measurements, mm. Body length, 4.2; width of elytra, 1.8; length of elytra, at least 2.6; length of prothorax, 0.8.

Comparison. The new species is diagnosed to species in the key provided below. It is clearly distinguished from congeners by its widely rounded elytral apices and it seems to be also different from them in the comparably short antennae.

Material. Holotype.

***Mesolpinus basicollis* Kirejtshuk, Moseyko et Ren, sp. nov.**

Etymology. From the latinized Greek *basis* (base, pedestal) and the Latin *collum* (neck, stem), referring to the pronotal base of this species, peculiar among congeners.

Holotype. CNU-Col-LB-2010210, imprint of almost complete beetle with rather clear outlines of underside sclerites and transparent traces of sutural edges of elytra; however, the tarsi and part of tibiae have obscure outlines or are not visible.

Description (Fig. 4). The integument of all visible sclerites lacks observable traces of sculpture.

The head is much wider than long, with moderately large oval eyes, and rather wide and very short anterior part of the frons (the "frontoclypeus"). The mandibles are well raised, gently curved along the outer edge. The mentum is strongly transverse, about four times as wide as long. The palpi are not visible. The antennae are about nearly half as long as the body; the scape is comparatively short, rather vaulted and much longer than antennomere 2; antennomeres 2–5 are moderately long and subequal in length, subcylindrical to subconical; antennomeres 7–10 are slightly flattened; antennomere 11 is somewhat longer than each of antennomeres 2–5 and suboval. The prothorax narrows strongly anteriad; its anterior angles are widely rounded and its posterior angles have a clear apex; the lateral edges are arcuate and have narrow sclerotized stripes (not widened anteriad); the prosternum has a moderately deeply arcuately excised anterior edge; in the middle, its precoxal part is slightly shorter than the procoxae; the prosternal process is not visible. The distance between the mesocoxae is apparently twice as long and that between metacoxae is nearly thrice as long as that between the procoxae. The mesoventrite is apparently longer than the prosternum, with a pair of paramedian excavations behind the procoxae. The metaventrite is significantly longer than the mesoventrite and also longer than abdominal ventrite 1. The elytra are somewhat wider than the prothorax, broadly arcuate on sides in anterior three-fifths, about 1.3 times as long as wide combined; the elytral apices are rather conjointly subacute. Abdominal ventrite 1 is about as long as ventrites 2–4 combined; the hypopygidium is very short and rather transverse, somewhat

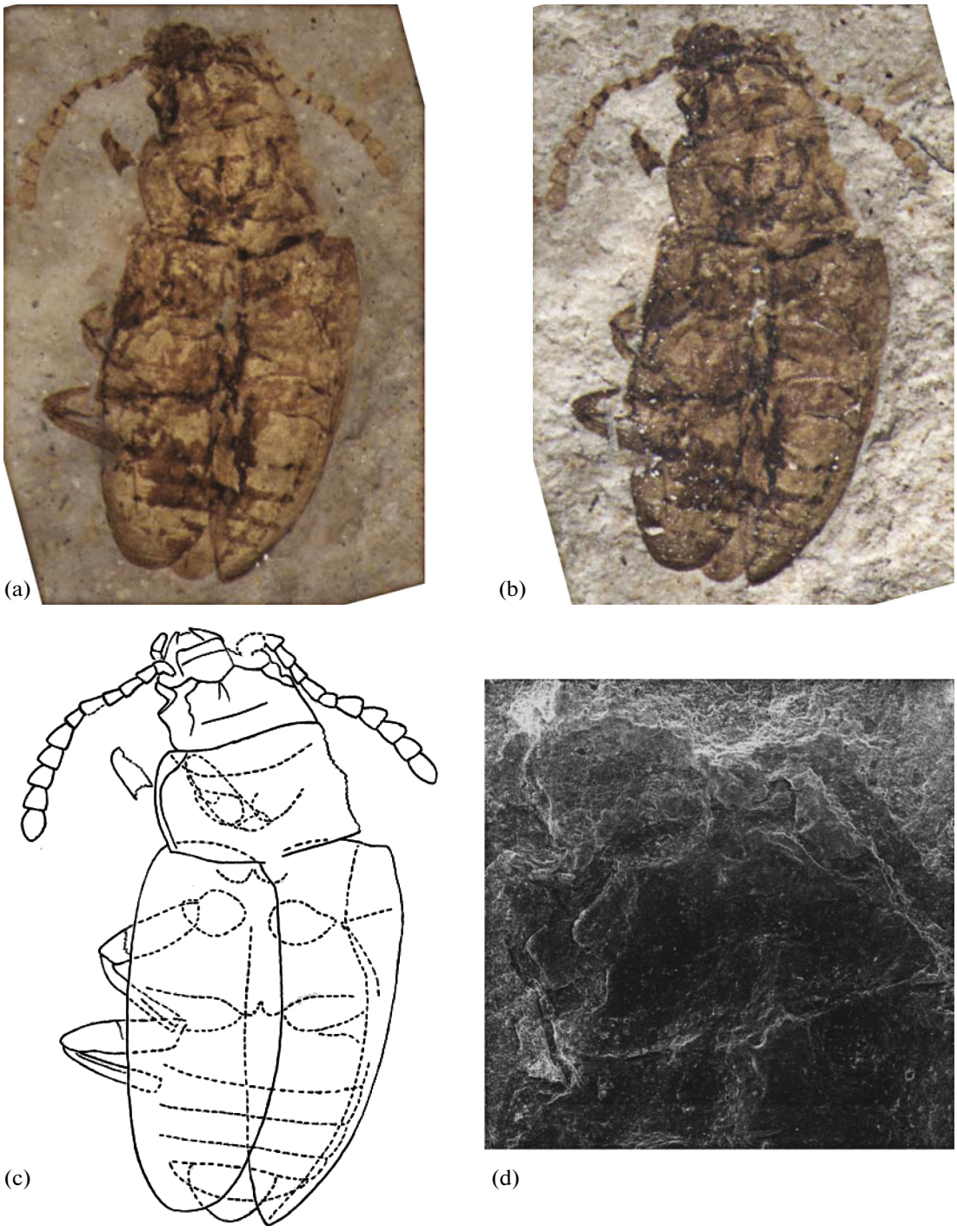

Fig. 3. *Mesolpinus angusticollis* gen. et sp. nov., holotype CNU-Col-LB-2009872; Yixian Formation, Lower Cretaceous; Liaoning, China: (a) imprint covered with alcohol; (b) dry imprint; (c) reconstruction of holotype; (d) head and pronotum of this specimen. Length of specimen, 4.2 mm.

longer than each of ventrites 2–4, widely rounded at the apex; the pygidium is widely rounded at the apex.

The femora are comparatively narrow and moderately long, very slightly widened at the middle, 3.5–4.0 times as long as thick. The tibiae are moderately long and thin, gradually thickened apically, with longitudinal rows with setae. The tarsomeres are mostly not visible.

Measurements, mm. Body length, 4.3; width of elytra, 1.8; length of elytra, 2.6; length of prothorax, 0.8.

Comparison. The new species is diagnosed to species in the key provided below. It is distinguished

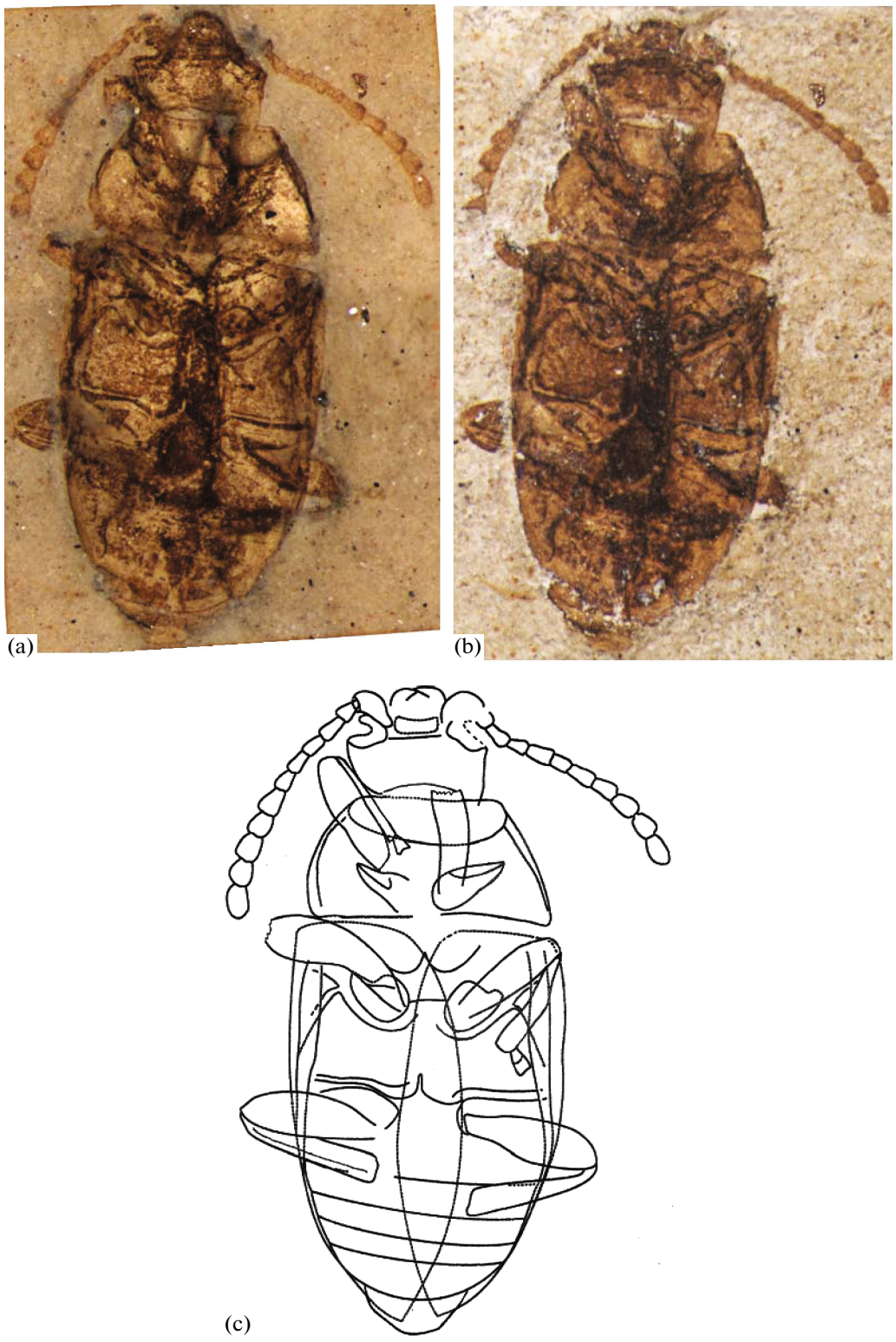

Fig. 4. *Mesolpinus basicollis* gen. et sp. nov., holotype CNU-Col-LB-2010210; Yixian Formation, Lower Cretaceous; Liaoning, China: (a) imprint covered with alcohol; (b) dry imprint; (c) reconstruction of holotype. Length of specimen, 4.3 mm.

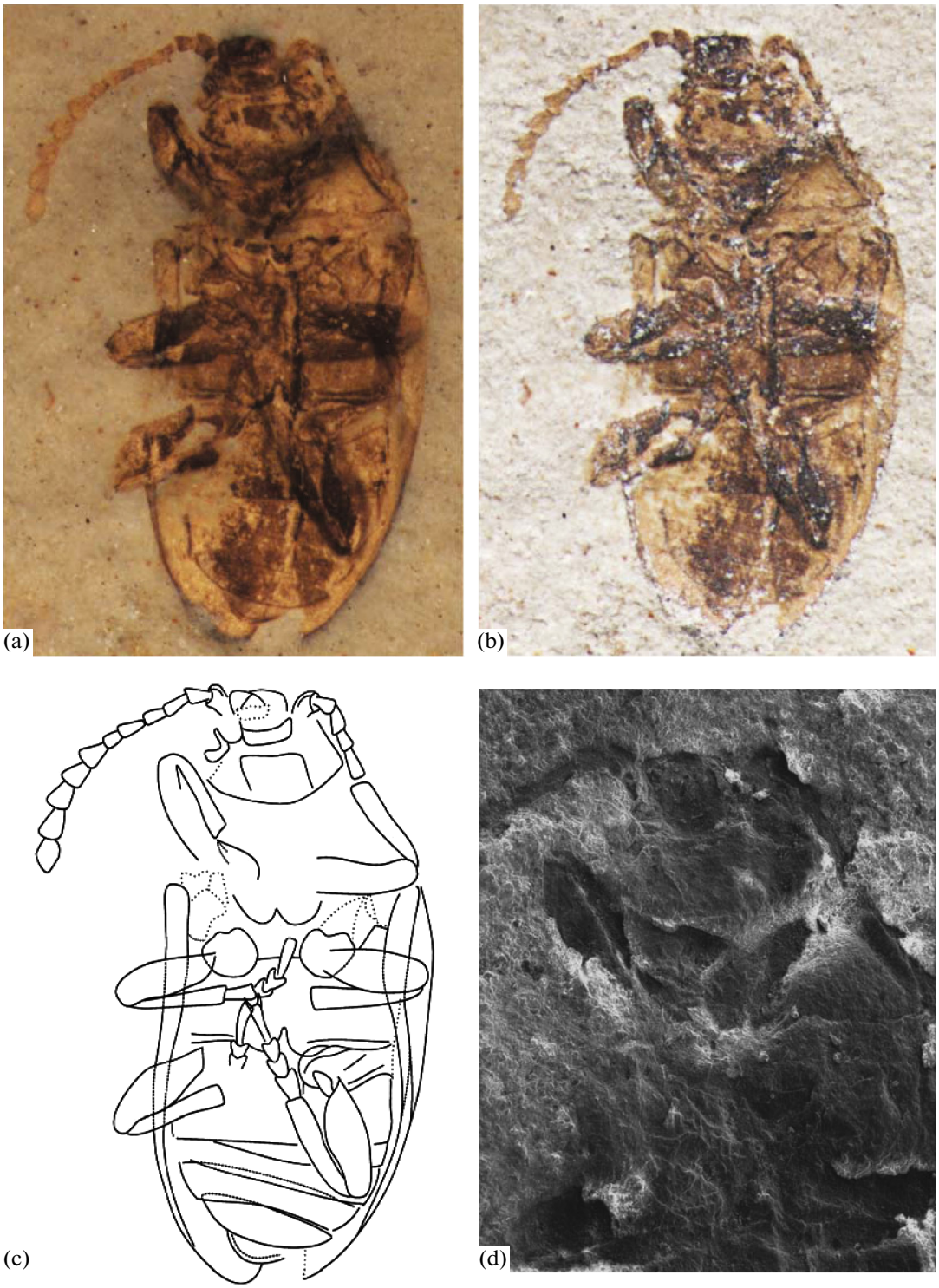

Fig. 5. *Mesolpinus* aff. *basicollis* gen. et sp. nov., specimen CNU-Col-LB-2010211; Yixian Formation, Lower Cretaceous; Liaoning, China: (a) imprint covered with alcohol; (b) dry imprint; (c) reconstruction of specimen; (d) head and prothorax of this specimen. Length of specimen, 4.1 mm.

from congeners by its pronotum and comparatively short head.

M a t e r i a l. Holotype and additional specimen (Fig. 5; CNU-Col-LB-2010211 imprint of almost complete beetle with rather clear outlines of underside sclerites and transparent traces of sutural edges of elytra). The latter differs from the holotype in the slightly shorter antennae (with particularly small scape) and legs. These characters could be sexual. The outline of the prothorax is not visible, but it could be

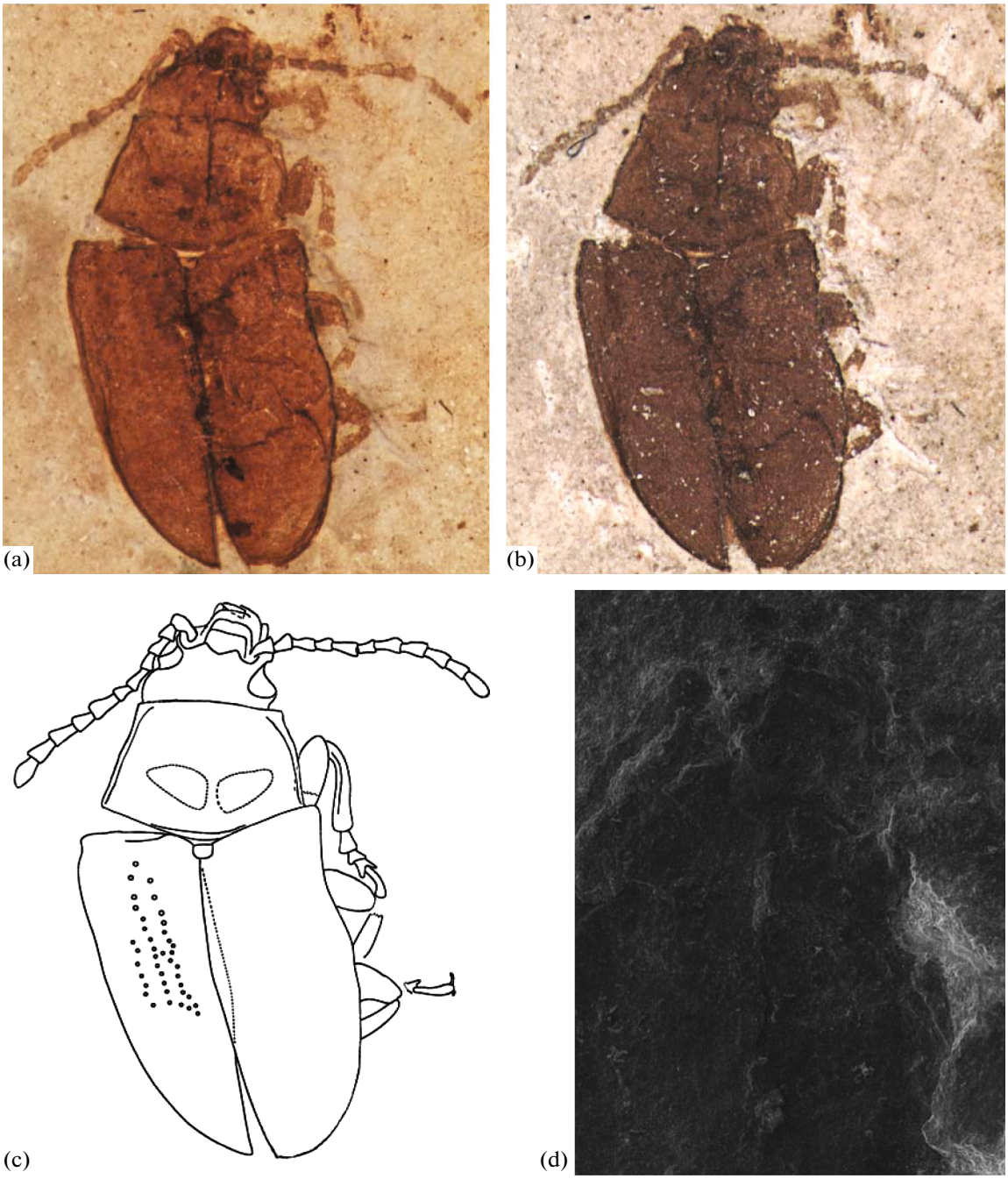

Fig. 6. *Mesolpinus trapezicollis* gen. et sp. nov., holotype CNU-Col-LB-2010255; Yixian Formation, Lower CretaceousLiaoning, China: (a) imprint covered with alcohol; (b) dry imprint; (c) reconstruction of holotype; (d) head and pronotum of this specimen. Length of specimen, 3.9 mm.

very similar to that of the holotype, because other characters are similar to those of the holotype. Body length, 4.1 mm.

***Mesolpinus trapezicollis* Kirejtshuk, Moseyko et Ren, sp. nov.**

Etymology. From the late Latin *trapezium*, originated from the Greek τραπέζιον (trapezion, "irregular quadrilateral", literally "a little table") and the Latin *collum* (neck, stem), referring to the rectilinear pronotal sides of this species.

Holotype. CNU-Col-LB-2010255, imprint of almost complete beetle with rather clear outlines of dorsum and appendages exposed from under it (antennae and right legs).

Description (Fig. 6). The integument of all available sclerites has traces of smoothed sculpture, on

elytra with rather sparse and large punctures appearing arranged in widely separated longitudinal rows.

The head is much wider than long, with rather large oval eyes, and rather wide and very short anterior part of the frons ("frontoclypeus"). The mandibles are well raised, angularly curved along the outer edge. The mentum and labial palpi are not visible. The ultimate maxillary palpomere is about three times as long as wide. The antennae are about half as long as the body; the scape is comparatively short and narrow, slightly vaulted and much longer than antennomere 2; antennomeres 2–5 are moderately long and subequal in length, subcylindrical to subconical; antennomeres 7–10 are subconical (not flattened) and subequal in length to, or somewhat longer than, antennomeres 2–5; antennomere 11 is somewhat longer than each of antennomeres 2–5 and suboval. The prothorax narrows strongly anteriad; its anterior and posterior angles have a clear apex; the lateral edges are rectilinear, with narrow sclerotized stripes widened anteriad. The elytra are markedly wider than the prothorax, subparallel-sided in the anterior three-fifths, about 1.4 times as long as wide combined, conjointly rounded to separately rounded at the apices, forming a shallow blunt sutural angle.

The femora are comparatively wide. The tibiae are moderately long and thin. The tarsomeres are rather wide.

Measurements, mm. Body length, 3.9; width of elytra, 1.6; length of elytra, 2.4; length of prothorax, 0.8.

Comparison. The new species is diagnosed to species in the key provided below. It is distinguished from congeners by its pronotum, narrow subapical antennomeres, narrow and long ultimate maxillary palpomere, and comparatively thick femora.

Material. Holotype.

Key to Species of Mesolpinus gen. nov.

1. Pronotal sides nearly rectilinearly convergent anteriad.....2
—Pronotal sides arcuately convergent anteriad.....3
2. Pronotum about twice as wide as long; elytra about 1.3 times as long as wide combined and subacute at apices; antennomeres 8–10 somewhat flattened and about as long as wide. Body length 4.1 mm. Fig. 1.....*M. antennatus* sp. nov.
—Pronotum about 1.5 times as wide as long; elytra about 1.4 times as long as wide combined and widely rounded at apices (forming shallow sutural angle); antennomeres 8–10 not flattened and longer than wide. Body length 3.9 mm. Fig. 6.....*M. trapezicollis* sp. nov.
3. Posterior edge of pronotum only slightly longer than anterior edge; elytral apices separately and widely rounded at apices (forming wide sutural angle). Body length 4.2 mm. Fig. 3.....*M. angusticollis* sp. nov.
—Posterior edge of pronotum at least 1.3 times as long as anterior edge; elytral apices conjointly subacute or narrowly rounded (forming narrow sutural angle)..... 4
4. Posterior edge of pronotum about 1.3 times as long as anterior edge; antennomeres 8–10 longer than wide; elytral apices conjointly rounded. Body length 4.0 mm. Fig. 2.....*M. adapertilis* sp. nov.
—Posterior edge of pronotum more than 1.5 times as long as anterior edge; antennomeres 8–10 about as long as wide; elytral apices conjointly subacute to separately narrowly rounded. Body length 4.1–4.3 mm. Figs. 4 and 5.....*M. basicollis* sp. nov.

DISCUSSION

The new tribe and genus represent the oldest chrysomelid fossils known to date. The orsodacnid lineage is usually considered as the most primitive group of leaf beetles, i.e., having the greatest number of plesiomorphies (Reid, 1995; Gomez-Zurita et al., 2007; Farrell, 2013). Twelve structural adult characters were proposed to split the branches giving rise to the Recent Orsodacnidae and Chrysomelinae (Reid, 1995). The most important of these characters are present in the structure of the mouthparts (four characters), male genitalia (two characters), metendosternite (one), thoracic glands (one), and cavity on the frons (one). These characters cannot be studied in the examined fossil specimens. The structure of the "frontoclypeus" is accessible to study and resembles those found in Orsodacnidae. In the specimens examined from Liaoning, abdominal ventrite 5 is simple (without lobes). The new tribe is placed within the subfamily Chrysomelinae on the basis of the external structural characters visible in fossil specimens under description and comparable to those found in members of different Recent chrysomeline genera, but absent in the groups of Recent Orsodacnidae, such as the paramedian excavations on the mesoventrite behind the procoxae, somewhat flattened antennomeres 7–11, and comparatively small antennomere 6 (see above). The age of the materials examined makes it possible to suppose that these fossil specimens belong to an ancient group, which could be ancestral to both "Orsodacnidae" sensu Reid, 1995 and "Chrysomelidae" sensu Reid, 1995 and which shares the characters of both these "families." This supposition partly agrees with the dating of divergence of Chrysomeloidea proposed based on molecular data (Farrell, 2013). Another evidence of the Late Mesozoic diversification of the superfamily Chrysomeloidea is the presence of Cerambycidae in materials from the same outcrop, one species of which was assigned to the extant archaic subfamily Prioninae (Wang et al., 2013).

It is important that Mesolpinini trib. nov. is known to us from different Late Mesozoic outcrops, including Kara-Tau (Upper Jurassic, Oxfordian (and/or Kimmeridgian); Kazakhstan, Chimkent Region,

Kara-Tau Range), which will be described in the forthcoming studies.

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REFERENCES

Farrell, B.D., "Inordinate fondness" explained: Why are there so many beetles?, *Science,* 2013, vol. 281, pp. 555–559.

Gómez-Zurita, J., Hunt, T., Kopliku, F., and Vogler, A.P., Recalibrated tree of leaf beetles (Chrysomelidae) indicates independent diversification of Angiosperms and their insect herbivores, *PLoS ONE,* 2007, vol. 2, no. 4, p. e360.

Kirejtshuk, A.G., Nabozhenko, M.V., and Nel, A., First Mesozoic representative of the subfamily Tenebrioninae (Coleoptera, Tenebrionidae) from the Lower Cretaceous of Yixian (China, Liaoning)), *Entomol. Obozr.,* 2011, vol. 90, no. 3, pp. 548–552.

Kirejtshuk, A.G. and Ponomarenko, A.G., Catalogue of fossil Coleoptera, 2015, http:// www.zin.ru/Animalia/Coleoptera/eng/paleosys.htm and http://www.zin.ru/Animalia/Coleoptera/ rus/paleosys.htm

Kirejtshuk, A.G., Ponomarenko, A.G., Prokin, A.A., Chang, H., Nikolajev, G.V., and Ren, D., Current knowledge on Mesozoic Coleoptera from Daohugou and Liaoning (North East China), *Acta Geol. Sin.,* 2010, vol. 84, no. 4, pp. 783–792.

Legalov, A.A., Review of the family Anthribidae (Coleoptera) from the Jurassic of Karatau: Subfamily Protoscelinae, genus *Protoscelis* Medvedev), *Paleontol. Zh.,* 2013, no. 3, pp. 57–65.

Lo, C.H., Chen, P.J., Tsou, T.Y., Sun, S.S., and Lee, C.Y., Age of *Sinosauropteryx* and *Confuciusornis*—$^{40}Ar/^{39}Ar$ laser single-grain and K–Ar dating of the Yixian Formation, N.E. China, *Geochemica,* 1999, vol. 28, no. 4, pp. 1–405.

Medvedev, L.N., Leaf beetles from the Jurassic of Karatau((Coleoptera, Chrysomellidae)), in *Yurskie nasekomye Karatau* (Jurassic Insects of Karatau), Rohdendorf, B.B., Ed., Moscow, Nauka, 1968, pp. 155–165.

Poinar, Jr., A Cretaceous palm bruchid, *Mesopachymerus antiqus,* n. gen., n. sp. (Coleoptera: Bruchidae: Pachymerini) and biogeographical implications, *Proc. Entomol. Soc., Washington,* 2005, vol. 107, pp. 392–397.

Reid, C.A.M., A cladistic analysis of subfamilial relationships in the Chrysomelidae sensu lato (Chrysomeloidea), in *Biology, Phylogeny, and Classification of Coleoptera: Papers Celebrating the 80th Birthday of Roy A. Crowson,* Pakaluk, J. and Slipinski, S.A. Eds., Warszawa: Muz. Inst. Zool. Pol. Akad. Nauk, 1995, pp. 559–632.

Reid, C.A.M., A taxonomic revision of the Australian Chrysomelinae, with a key to the genera (Coleoptera: Chrysomelidae), *Zootaxa,* 2006, vol. 1292, pp. 1–119.

Santiago-Blay, J.A., Paleontology of leaf beetles, in *Novel Aspects of the Biology of Chrysomelidae,* Jolivet, P.H., Cox, M.L., and Petit-Pierre, G., Eds., Dordrecht–Boston–London: Kluver Acad. Publ., 1994, pp. 1–68.

Swisher, C.C., III, Wang, Y.Q., Wang, X.L., Xu, X., and Wang, Y., Cretaceous age for the feathered dinosaurs of Liaoning, China, *Nature,* 1999, vol. 400, pp. 58–61.

Valentin, X., Gomez, B., Daviero-Gomez, V., Charbonnier, S., Ferchaud, F., Kirejtshuk, A.G., Licht, A., Neraudeau, D., Vullo, R., and Garcia, G., Plant-dominated assemblage and invertebrates from the Lower Cenomanian of Jaunay-Clan, western France, *C. R. Palevol.,* 2014, vol. 13, pp. 443–454.

Wang, B., Ma, J., McKenna, D.D., Yan, E.V., Zhang, H., and Jarzembowski, E.A., The earliest known longhorn beetle (Cerambycidae: Prioninae) and implications for the early evolution of Chrysomeloidea, *J. Syst. Palaeontol.,* 2013, vol. 12, no. 5, pp. 565–574.

Wang, W., Zhang, L., Zheng, S., Ren, D., Zheng, Y., Ding, Q., Zhang, H., Li, Z., and Yang, F., The age of the Yixian stage at the boundary of Jurassic–Cretaceous—the establishment and study of stratotypes of the Yixian stage, *Geol. Rev.,* 2005, vol. 51, no. 3, pp. 234–242.

Wolf-Schwenninger, K. and Schawaller, W., Coleoptera: beetles, in *The Crato fossil Beds of Brazil: Window into an Ancient World,* Martill, D.M., Bechly, G., and Loveridge, R.F., Eds., Cambridge: Cambridge Univ. Press, 2007, pp. 338–350.

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