



## A new genus and species of fossil Eodromeinae from the Yixian Formation of Western Liaoning, China (Coleoptera: Adephaga: Trachypachidae)

TING JIA<sup>1</sup>, HONGBING LIANG<sup>2</sup>, HUALI CHANG<sup>1</sup> & DONG REN<sup>1,3</sup>

<sup>1</sup>College of Life Science, Capital Normal University, Beijing 100048, China

<sup>2</sup>Institute of Zoology Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China

<sup>3</sup>Corresponding author. E-mail: rendong@mail.cnu.edu.cn

### Abstract

A new genus and species of fossil trachypachid *Fortiseode pervalimand* Jia & Ren **gen. et sp. nov.**, is described and illustrated. The new fossil with large and strong mandibles, short and robust legs, and pronotum widest near apical angle differs from other members of Eodromeinae. It is the first record of fossil trachypachid from the Mesozoic Yixian Formation of Huangbanjigou, Liaoning, China.

**Key words:** Trachypachidae, fossil, new genus, new species, Yixian Formation, Late Jurassic-Early Cretaceous, China

### Introduction

Thirty-nine fossil species of trachypachids classified in 18 genera have been reported from Mesozoic rocks (Table 1). According to the fossil record trachypachids probably originated no later than the Late Triassic.

A fossil trachypachid specimen was recently collected from the Huangbanjigou bed, Yixian Formation, Liaoning in China. The new finding of trachypachid is the first record of fossil trachypachid from the Late Jurassic-Early Cretaceous Yixian Formation. The strata of the Yixian Formation are mainly of lacustrine sediments intercalated with volcanoclastics (Ren *et al.* 1995). Paleobotanical data from fossil spores, pollen and plants indicates a climate that was warm and humid at that time (Ding *et al.* 2001).

### Material and methods

The specimen were examined using a Leica MZ12.5 dissecting microscope, illustrated with the aid of a drawing tube attachment, and photographs acquired by a Nikon Digital Camera DXM1200C. The morphological terminology used here follows Newton (2001), and the Trachypachidae taxonomic system is adopted from Lorenz (2005).

Body length was measured along the midline from the anterior margin of frons to apex of elytra, and width was measured across the broadest part of elytra. The length of pronotum was measured along the midline; the width was measured across the broadest part of pronotum.

### Systematic palaeontology

**Class Insecta Linnaeus, 1758**

**Order Coleoptera Linnaeus, 1758**

**Family Trachypachidae C.G. Thomson, 1857**

**Subfamily Eodromeinae Ponomarenko, 1977****Genus *Fortiseode* Jia & Ren gen. nov.**

**Etymology.** The Latin word of “*fortis-*”, which means strong, refers to its strong mandibles and legs.

**Type species.** *Fortiseode pervalimand* Jia & Ren sp. nov.

**Diagnosis.** Head transverse, length of head capsule more than half its width; Mandibles with the same length as the head; Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave; base of pronotum with similar width as base of elytra; length of head including mandibles nearly equal to width of head capsule; hind coxae strong, transverse; legs with strong femora and tibiae, metatarsus shorter than 1/2 of elytra, metatarsus short, with length nearly 1/2 metatarsus length; trochanters large, longer than 1/3 metafemur length.

**Remarks.** The new genus is assigned to the family Trachypachidae based on the following characters: (1) Antennae smooth and non-pubescent; (2) Hind coxae large, and extend to the lateral margins of body. The attribution of the new genus to the subfamily Eodromeinae Ponomarenko, 1977 is based on the following characters: (1) Clypeus not extending to point of antennal attachment; (2) Forecoxal cavities open; (3) Lateral wall of midcoxal cavities formed by mesosternum, mesepimeron and metasternum; (4) Mesepisternum not extending to midcoxal cavities, minimum separation equal to mesepisternal mesal margin; (5) Hind coxae separating metasternum and abdomen, with large femoral plates.

**Comparisons.** According to the fossil record in the subfamily Eodromeinae, there are seven genera described from Mesozoic Era: *Sogdodromeus* Ponomarenko, 1977; *Platycoxa* Ponomarenko, 1977; *Unda* Ponomarenko, 1977; *Pscodromeus* Ponomarenko, 1977; *Karatoma* Ponomarenko, 1977; *Karadromeus* Ponomarenko, 1977; *Eodromeus* Ponomarenko, 1977.

The new genus, as compared with the genus *Sogdodromeus* Ponomarenko, 1977 from Triassic of Soviet Central Asia, has the following unique characters: (1) Head transverse, length of head capsule more than half its width; (2) Width of the last sternite nearly equal to that of the base of abdomen; (3) Midcoxal cavities large, oval, and separated from one another.

The new genus differs from the genus *Platycoxa* Ponomarenko, 1977 from Late-Jurassic of Soviet Central Asia by the following features: (1) Head transverse, length of head capsule more than half its width; (2) Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave; (3) Width of the last sternite nearly equal to that of the base of abdomen.

The new genus differs from the genus *Unda* Ponomarenko, 1977 from Early-Cretaceous of Transbaikal by the following features: (1) Antennae shorter and thicker; (2) Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave; (3) Last sternite anterior margin nearly equal to base of abdomen.

Compared with the genus *Pscodromeus* Ponomarenko, 1977 from Late-Jurassic of South Kazakhstan, the new genus has a distinct teardrop-shaped body and much shorter antennae.

Compared with the genus *Karatoma* Ponomarenko, 1977 from Late-Jurassic of South Kazakhstan, the new species has the following unique characters: (1) Elytra smooth, without large irregularly distributed punctures; (2) Antennae shorter and thicker; (3) Metasternum, distance between middle and hind coxae longer than middle coxae; (4) Length of head including mandibles nearly equal to width of head capsule.

The new genus differs from the genus *Karadromeus* Ponomarenko, 1977 from Late-Jurassic of South Kazakhstan by the following features: (1) Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave; (2) Hind coxae strong, transverse.

Compared with the genus *Eodromeus* Ponomarenko, 1977 from Early Cretaceous of Trans-Baikal, the new species has these unique characters: Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave; base of pronotum with similar width as base of elytra.

According to the fossil record in the family Trachypachidae, there are two genera: *Beipiaocarabus* Hong, 1983 and *Xinbinia* Hong, 1983, described from Liaoning Province.

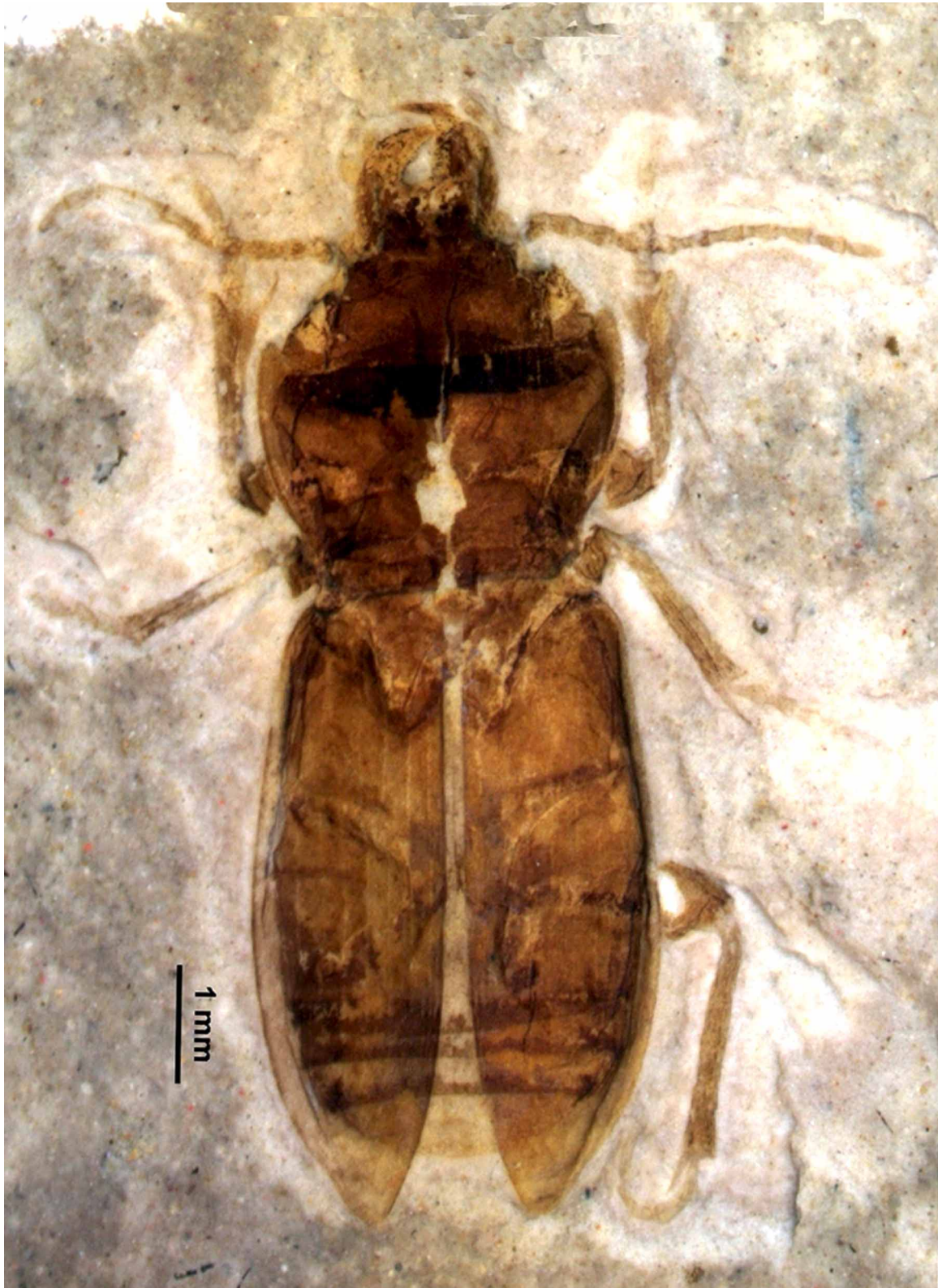
The new genus differs from the genus *Beipiaocarabus* Hong, 1983 from Middle-Jurassic of Haifanggou Formation by the following features: (1) Body larger, length 10 mm, width 3.5 mm; (2) Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave, with width 3.1 mm, posterior edge straight, width 2.1 mm, base of pronotum with similar width as base of elytra.

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Compared with the genus *Xinbinia* Hong, 1983 from Middle-Jurassic of Houjiatun Formation has these unique characters: Pronotum cordiform, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave, with width 3.1 mm, posterior edge straight, width 2.1 mm, base of pronotum with similar width as base of elytra.



**FIGURE 1.** *Fortiseode pervalimand* Jia & Ren **gen. et sp. nov.**, holotype. CNU-COL-LB-2010495.

*Fortiseode pervalimand* Jia & Ren sp. nov.

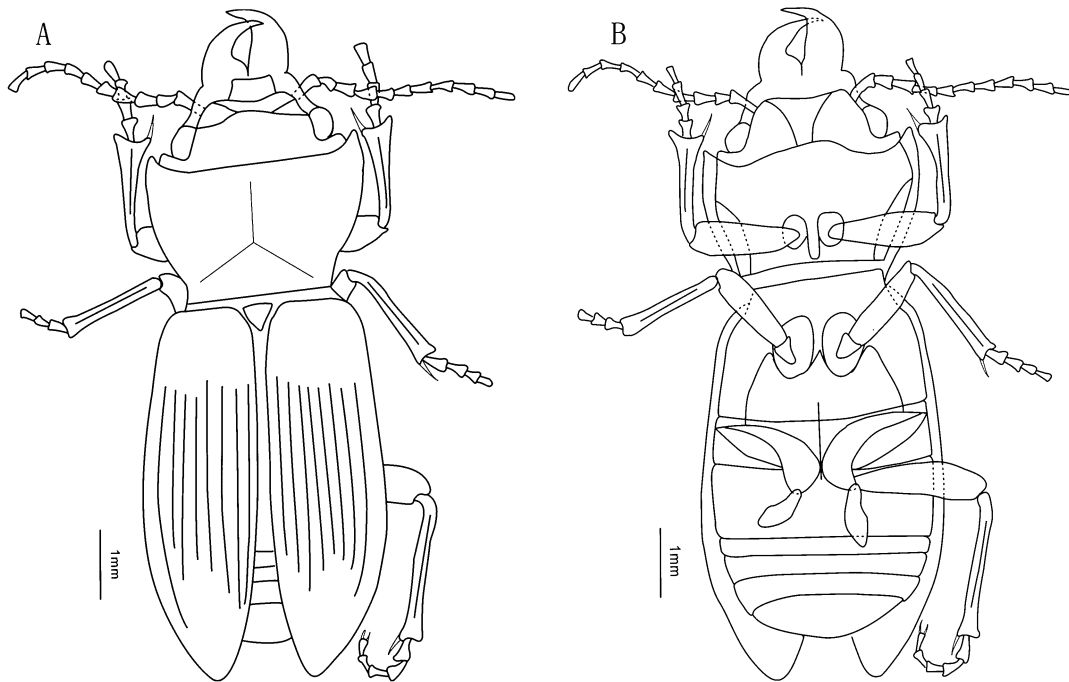
(Figs 1, 2 A–B)

**Etymology.** The specific name of *pervalida* is derived from the Greek word of “*pervalid-*” (meaning strong), referring to the robust mandibles.

**Material.** CNU-COL-LB-2010495, deposited in the Key Lab of Insect Evolution & Environmental Changes, Capital Normal University, Beijing, China.

**Locality and horizon.** Collected from 2<sup>nd</sup> bed of Yixian Formation in Huangbanjigou, near Chaomidian Village, Shangyuan County, Beipiao City, Liaoning Province, China; Late Jurassic-Early Cretaceous.

**Diagnosis.** Same as the genus.



**FIGURE 2.** *Fortiseode pervalimand* Jia & Ren gen. et sp. nov, line drawings of holotype. A. Dorsal view of body; B. Ventral view of body.

**Description.** Body small sized, length 10 mm, width 3.5 mm; elytron 5 mm long, with 8 longitudinal striae. The holotype is a dorso-ventral compression of a carabid. Antennae unisetose, scape long and robust, not completely visible from dorsal side; elytra without large pores.

**Head.** Head sub-triangular, convex; narrower than prothorax; eyes moderately prominent; antennae inserted between eyes and base of mandibles under a frontal ridge, filiform, with eleven antennomere; antennomere 1 (scape) long and robust, antennomere 2 shorter than scape, antennomeres 6 to 10 subequal in length, apical antennomere narrower and longer; mandible falciform, robust, prominent, apices rather blunt, laterally with setae, occlusal margins toothed, length equal to that of head, molar plate visible, outer sides of mandibles not expanded; base of head retracted into pronotum.

**Thorax.** Prothorax width nearly equal to that of paired elytra together, with lateral margins inflexed and a distinct submarginal suture between proepipleuron and propleuron; pronotum cordiform, length 2mm, width 3.4mm, widest at about anterior one-fifth of the pronotum, anterior edge of pronotum strongly concave, with width 3.1mm, posterior edge straight, width 2.1mm. base of pronotum with similar width as base of elytra; pronotum with lateral margins narrowly reflexed; forecoxal cavities open, confluent, bridged; midcoxal cavities disjunct, confluent; hind coxal cavities incomplete, confluent.

**Pterothorax.** Scutellum triangular, visible; elytra margined laterally and basally, humeri broadly rectangular; posteriorly not sinuate, apical margin narrowly rounded, elytra broadest in the middle, with basal border, width 2.5 mm, wider than that of posterior edge of pronotum, length 6 mm, twice as long as wide, dorsal surface striate, with 8 longitudinal striae, each stria linear, striae absent laterally, surface smooth, without large pores; second elytral interval with similar width as other intervals, elytra margin with internal plica toward apex.

**Abdomen.** Elytra completely cover the last ventrite of abdomen, abdomen with six sterna (2–7), sternum 2 (first visible sternum) interrupted by hind coxae, remnants visible only at sides; the last four ventrites of abdomen are much shorter compared with the first two ventrites; the first abdominal segment with length 0.7 mm, the second segment longest, with length 0.9 mm, segments 3 to 5 equal in length 0.3 mm, and the last segment length 0.6 mm.

**TABLE 1.** Mesozoic fossil Trachypachidae of the World.

Species	Age	Locality
<i>Platycoxa jurassica</i> Ponomarenko, A.G., 1977	Late Triassic	Kazakhstan
<i>Sogdodromus altus</i> Ponomarenko, A.G., 1977	Triassic	Kirghizia
<i>Beipiaocarabus oblonga</i> Hong, Y., 1983	Middle Jurassic	China
<i>Xinbinia foveolata</i> Hong, Y., 1983	Middle Jurassic	China
<i>Dundorabus glabrus</i> Ponomarenko, A.G., 1989	Late Jurassic	Mongolia
<i>Eodromeus antiquus</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Karadromeus latus</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Karadromeus rostratus</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Karatoma agilis</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Psacodromeus crassus</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Psacodromeus gutta</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Psacodromeus ovalis</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Psacodromeus rugosus</i> Ponomarenko, A.G., 1977	Late Jurassic	Kazakhstan
<i>Platycoxa armata</i> Ponomarenko, A.G., 1977	Early Jurassic	Kirghizia
<i>Prosynactus gracilis</i> Ponomarenko, A.G., 1992	Early Jurassic	Germany
<i>Prosynactus procerus</i> Ponomarenko, A.G., 1992	Early Jurassic	Germany
<i>Karadromeus verrucosus</i> Ponomarenko, A.G., 1989	Jurassic - Cretaceous	Transbaikalia
<i>Unda pachycephala</i> Ponomarenko, A.G., 1989	Jurassic - Cretaceous	Transbaikalia
<i>Dolichorabus longipes</i> Ponomarenko, A.G., 1985	Jurassic	-
<i>Conjunctia longa</i> Zhang, H., 1997	Early Cretaceous	China
<i>Eodromeus dissectus</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Eodromeus major</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Eodromeus mongolicus</i> Ponomarenko, A.G., 1989	Early Cretaceous	Mongolia
<i>Eodromeus sternalis</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Eodromeus sulcatus</i> Ponomarenko, A.G., 1989	Early Cretaceous	Mongolia
<i>Eodromeus viriosus</i> Zhang, H., 1997	Early Cretaceous	China
<i>Evertus cornatus</i> Ponomarenko, A.G., 1986	Early Cretaceous	Mongolia
<i>Karadromeus capitatus</i> Ponomarenko, A.G., 1986	Early Cretaceous	Mongolia
<i>Karadromeus elongatus</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Karadromeus erensis</i> Ponomarenko, A.G., 1986	Early Cretaceous	Mongolia
<i>Karadromeus gobiensis</i> Ponomarenko, A.G., 1980	Early Cretaceous	Mongolia
<i>Karadromeus mongolicus</i> Ponomarenko, A.G., 1977	Early Cretaceous	Mongolia
<i>Karatoma raptor</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Protorabus minisculus</i> Zhang, H., 1997	Early Cretaceous	China
<i>Unda angulata</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Unda cursoria</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Unda microplata</i> Ponomarenko, A.G., 1977	Early Cretaceous	Transbaikalia
<i>Undo pandurata</i> Ren, D., Lu, L., & Guo, Z., 1995	Early Cretaceous	China
<i>Conexicoxa homora</i> Lin, Q., 1986	-	China

Note“-” indicate that it is not sure about the age.

**Legs.** Gressorial, fairly short and thick; legs with strong femora and tibiae, metatarsus shorter than 1/2 of elytra, metatarsus short, with length nearly 1/2 of metatarsus; trochanters large, longer than 1/3 metafemur length, tarsi with 5 segments; tarsomere 5 terminated by pair of claws; claws with inner margins smooth; metatarsi length 2.3 mm, shorter than half of elytra, length 2.3 mm, shorter than half of elytra, nearly equal to half of metatibia; front and middle coxae globular, hind coxae dilated internally, and extended each side to lateral margins of body; metacoxae larger and transverse; metafemur much wider than metatibia; front tibia with large apical spurs, inner margin simple; hind trochanters large, longer than one-third of metafemur.

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