



Notes on the extinct family Protapioceridae, with description of a new species from China (Insecta: Diptera: Asiloidea)

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Abstract

Protapioceridae, which belongs to the superfamily Asiloidea, is an extinct endemic family in China. Until now, only one genus and two species were known from Liaoning Province of Palaeartic China. In the present paper a third species of the small family is reported. A key to the species is presented.

Key words: Protapioceridae, *Protapiocera*, new species, Liaoning, China

Introduction

Protapioceridae was established by Dong Ren in 1998. It is a very small family. Only one genus and two species, *Protapiocera megista* Ren and *Protapiocera ischyra* Ren were known from the Upper Jurassic of China, Beipiao City, Liaoning Province (Ren 1998). The holotypes of these two known species are almost complete adults except for missing antennae, claws and empodia. Here a new species, *Protapiocera convergens* sp. nov., which has the antennae present, is described from Liaoning, China (Fig. 1). All of the specimens are from the same geologic stratum.

All species of the family are part of the famous Jehol biota, which includes the late Mesozoic biota of the western Liaoning, northern Hebei and southeastern Inner Mongolia. The Jehol biota of Northeastern China is well-known by recent discoveries of the earliest known angiosperms, “feathered” dinosaurs, primitive birds, reptiles and insect fossils (Gao & Fox 2005, Ren *et al.* 1995, Sun *et al.* 1998, Swisher *et al.* 1999 and so on). The Yixian Formation, which belongs to the Beipiao City, Liaoning Province, plays a vital part in this biota. Thousands of insect fossil specimens have been found there (Liu & Ren 2006, Ren 1998, Ren & Tan 2006, Tan & Ren 2006a, b, Tan *et al.* 2006, Zhang *et al.* 2006). However, its stratum has been controversial mainly due to various viewpoints held by paleontologists and geologists as to its geological age (Wang *et al.* 2005, Zhou *et al.* 2003). Based on our current data from the Yixian Formation, we cannot draw a conclusion about its definite age.

Materials and methods

Materials: This study is based on two specimens housed in the fossil insect collection of the Key Lab of Insect Evolution & Environmental Changes, Capital Normal University, Beijing, China.

Illustrations: Line drawing was prepared with the aid of a camera lucida attached to a LEICA MZ12.5 stereomicroscope.

Basic terminology follows McAlpine (1981) and Peterson (1981).



FIGURE 1. Geographic position of the type locality of *Protapiocera convergens* sp. nov.

Taxonomy

Family Protapioceridae Ren, 1998

Genus *Protapiocera* Ren, 1998

Type species. *Protapiocera megista* Ren, 1998

Diagnosis. Body robust with dense setulae. Eyes large, holoptic in male. Wing slender, with distinct venation on basal part, but absent or obscure on apical part of wing in natural state (not caused by preservation). Veins R_{2+3} and R_4 contiguous, both ending on vein R_1 apically. Vein M_3 present, vein CuA_1 arising from cell bm . Vein CuP present; cell cup closed, apical part truncate.

Key to species of *Protapiocera*

- 1 Veins R_{2+3} and R_4 converged apically; cell m_2 acute basally *Protapiocera convergens* sp. nov.
- Veins R_{2+3} and R_4 distinctly separated apically; cell m_2 subquadrate basally 2
- 2 Cell d long; crossvein $r-m$ located at basal 1/4 of cell d ; vein A_2 long *Protapiocera ischyra* Ren
- Cell d short; crossvein $r-m$ nearly located at middle of cell d ; vein A_2 short *Protapiocera megista* Ren

***Protapiocera convergens* sp. nov.**

(Figs. 2–4)

Diagnosis. Veins R_{2+3} nearly converged with R_4 ; base of cell m_2 acute; apex of vein A_2 obscure.

Description. Body length 19.5 mm; wing length 12 mm, width 3.5 mm. Body large, stout, elongated. Head large and round, as long as high. Eyes thinly pilose, with clear facets. Antenna short, missing basally; first flagellomere somewhat thick basally, its apical portion [= arista] long and thin. Thorax robust with hairs, about 1.3 times as high as head. Most parts of legs missed. Hind femur swollen, with dense short hairs; tibia narrow and slightly curved.

Wing long, nearly as long as abdomen; venation on basal and middle part distinct, but absent or obscure on apical part of wing in natural state (not caused by preservation). Vein C ending nearly at wing tip. Vein Sc long, reaching vein C, far beyond middle of wing. Vein R_1 ending nearly at apical 1/6 of wing. Vein Rs very short, originating from vein R_1 at middle of wing; veins R_{2+3} and R_4 short, curved forward and ending on vein R_1 apically; veins R_{2+3} converged with R_4 ; apex of vein R_5 obsolete. Crossvein r-m situated at basal 2/5 of cell d. Vein M with 3 branches, all indistinct apically, thus all posterior cells open. Vein CuA_1 arising from cell bm. Vein CuP present. Vein CuA_2 short and strongly curved backward. Apex of vein A_2 obscure. Base of cell m_2 obviously acute. Cell cup closed, nearly as wide as cell bm, apically truncate.

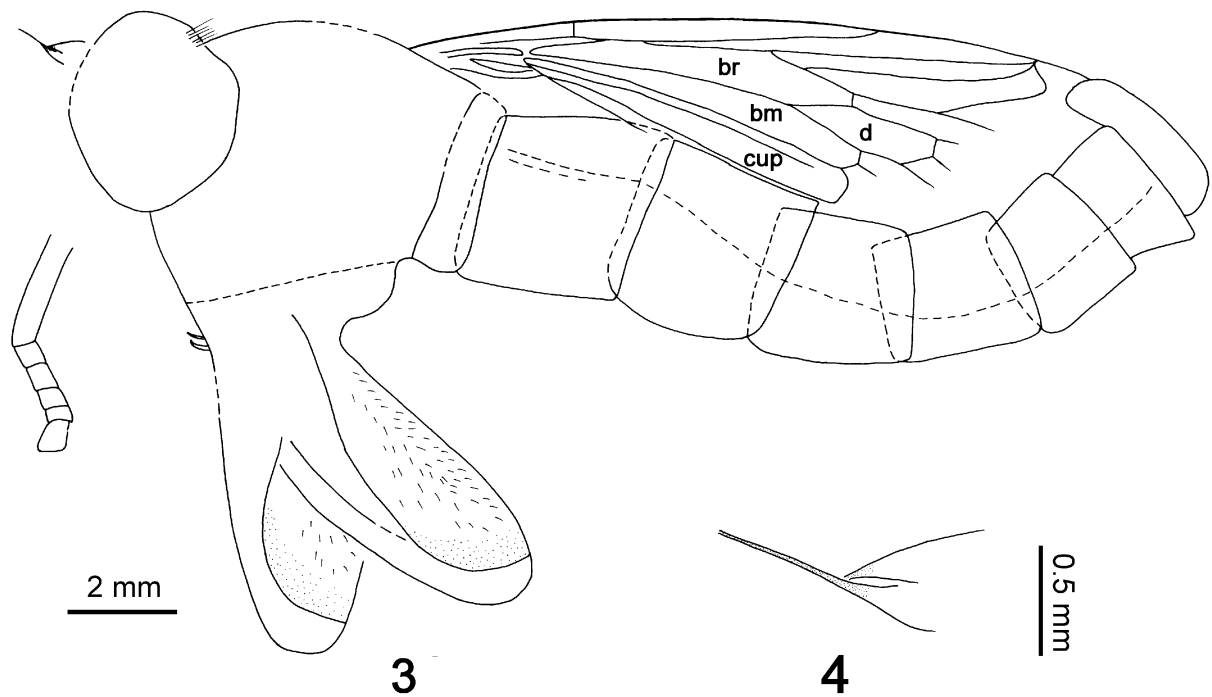
Abdomen long and subcylindrical, with 8 visible segments. Segment I shortest; segments II and III thickest, almost 3.3 times as wide as segment I.

Holotype. Body with wing in lateral view, part and counterpart. No. CNU-DB-LB2006001, 2006002, housed in Key Lab of Insect Evolution & Environmental Changes, Capital Normal University, Beijing, China.

Locality and horizon. Collected from near Chaomidian Village, Beipiao City, Liaoning Province, China. Upper Jurassic or Early Cretaceous Yixian Formation outcrop.



FIGURE 2. *Protapiocera convergens* sp. nov. Body, photograph.



FIGURES 3–4. *Protapiocera convergens* sp. nov. 3. Body, camera lucida drawing. 4. Antennae.

Etymology. The species name refers to the convergence of veins R_{2+3} and R_4 .

Remarks. The new species is similar to the two known species: *Protapiocera megista* and *Protapiocera ischyra*, but can be easily separated from *P. megista* by having the smaller body (body length 19.5 mm), vein R_{2+3} converged with vein R_4 , and the base of cell m_2 obviously acute. In *P. megista*, the body is large (body length 31 mm), veins R_{2+3} and R_4 are distinctly separated apically, and cell m_2 is subquadrate basally (Ren 1998). Also, *P. convergens* sp. nov. can be separated from *P. ischyra* by having vein R_{2+3} converged with vein R_4 , crossvein r-m located at basal 2/5 of cell d, cell br and cell bm subequal in width, vein A_2 very short, not exceeding 1/2 length of cell bm. In *P. ischyra*, veins R_{2+3} and R_4 are distinctly separated apically, crossvein r-m is located at basal 1/4 of cell d, cell br is wider than cell bm, and vein A_2 is long, exceeding 2/3 length of cell bm (Ren 1998).

Discussion

Family Apioceridae includes only the genus *Apiocera*, which contains 137 described species in four subgenera. These four subgenera are found in western North America, southwestern South America, South Africa and Australia, respectively. Most species occur in arid or semiarid regions, or in sandy areas on or near ocean beaches. Adults are usually from on or near the vegetation of these areas (Peterson 1981, Cannings 2006). Mydidae and Apioceridae are sister groups with similar morphological and behavioral characters. Although Mydidae has a worldwide distribution, only two species have been found in China. The relationships of the two families are discussed by Yeates & Irwin (1996).

The extinct Mesozoic family Protapioceridae is similar to the extant family Apioceridae in having the stout body, large eyes, elongate abdomen, dense hairs, and so on. However, the significant differences between them are found in the antennae, wing venation and hind femur. In Protapioceridae, the arista is long and thin, vein R_s is arising from vein R_1 at midwing, the mouth of cell R_4 is markedly longer than that of cell R_5 , cell m_3 is wide open, cell cup is truncated apically, veins of wing are obscure apically, the hind femur is

strongly swollen. In Apioiceridae, the terminal stylus of the antenna is small or absent, vein R_s is arising from vein R_1 at wing base, the mouth of cell R_4 is equal to that of cell R_5 in length, cell m_3 is closed, cell cup is not truncate at apex, veins are distinctly present apically, the hind femur is slightly swollen (Cazier 1941, Cazier 1985, Irwin & Stuckenberg 1972, Peterson 1981, Ren 1998).

We also found that Protapioceridae has a close relationship with Mydidae. So, it seems that Protapioceridae is a Mesozoic ancestor of the sister group Apioiceridae and Mydidae. It originated from China, then spread to all over the world. Over 100 million years has passed, today, Protapioceridae has evolved into Apioiceridae and Mydidae. Meanwhile, Protapioceridae has been extinct in China, only fossils are preserved. Meanwhile, Peterson (1981) also indicated that the Apioiceridae is generally considered to be an archaic family and one that is in its declining stages of evolution. Despite the suggested antiquity of this relict family, there are no known fossil records. Thus, Protapioceridae may be a representative of the stem group of Apioiceridae + Mydidae. Protapioceridae may provide an evidence for the standpoint that “the ancestral Apioiceridae and Mydidae spread from Laurasia to Gondwanaland prior to the fragmentation of Pangea in the Jurassic (Yeates & Irwin 1996)”. However, the clear systematic relationships of the three families need more evidences and research. At this time it is difficult to give a more appropriate answer.

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