

## The first snipe fly (Diptera: Rhagionidae) from the Middle Jurassic of Inner Mongolia, China

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### Abstract

The description of the oldest Rhagionidae in China, *Sinorhagio daohugouensis* gen. et sp. nov., is given as new to science. It comes from the Middle Jurassic Daohugou Formation of Inner Mongolia. The relationships of *Sinorhagio* and other relevant genera of Rhagionidae are discussed.

**Key words:** Diptera, Rhagionidae, *Sinorhagio*, new genus, Daohugou, China

### Introduction

Rhagionidae is a small family in lower Brachycera. It consists of 2 subfamilies: Spaniinae (4 genera) and Rhagioninae (14 genera). Up to now, 18 extant genera and above 500 extant species have been described throughout the world (Nagatomi 1982). Fossil Rhagionidae have 26 genera (18 extinct genera) and above 50 species (Kovalev 1982, Evenhuis 1994, Ren 1998, Ren *et al.* 1995, Kovalev & Mostovski 1997, Nagatomi & Yang 1998, Mostovski 2000, Mostovski & Jarzembowski 2000, Krzeminski & Krzeminska 2003, Mostovski *et al.* 2003). However, historically, the Rhagionidae has included a rather heterogeneous mixture of genera, some of which are seemingly related to other families of lower Brachycera, especially the Stratiomyidae, the Xylophagidae, and the Tabanidae. Therefore, the precise limits of the family have remained unclear and are much debated (James & Turner 1981).

Rhagionidae is one of the most archaic Diptera and can date back to the early middle Triassic. The oldest Brachycera (Rhagionidae: *Gallia alsatica* Krzeminski & Krzeminska 2003) were discovered in the Vosges Mts (France, Alsace) by Louis Grauvogel and Jean-Claude Gall (Krzeminski & Krzeminska 2003). Since the Middle Jurassic, the Brachycera

(including Rhagionidae) became frequent and started to dominate in the Cretaceous. There were the following four known genera in the Middle Jurassic which are distributed only in Russia of the Palaearctic region (Nagatomi & Yang 1998): *Jurabrachyceron* Kovalev, 1981, *Kubekovia* Kovalev, 1985, *Palaeobrachyceron* Kovalev, 1981, *Palaeobolbomyia* Kovalev, 1982.

At present, lots of Brachycera fossils have been recovered from Jiulongshan Formation near Village of Daohugou in Ningcheng County, Chifeng City, Inner Mongolia, China. A new genus with a new species of Rhagionidae is described here. The new fossil is a nearly complete adult, except antenna and part of legs obscure. Furthermore, it is the first time that Rhagionidae from Daohugou village has been discovered.

The geological section at Daohugou village is composed of grey tuffaceous sandstone and sandy mudstone, and the paleoenvironment reconstructed for this locality is a volcanic region with mountain streams (Ren & Krzeminski 2002). It contains a diverse insect fauna composed of complete specimens of Ephemeroptera, Odonata, Plecoptera, Blattodea, Orthoptera, Heteroptera, Homoptera, Neuroptera, Coleoptera, Hymenoptera and Diptera (Hong 1982, Ren *et al.* 1995), some freshwater conchostracans (Shen *et al.* 2003), salamanders (Gao & Shubin 2003), a kind of theropod and two kinds of pterosaur (Ji & Yuan 2002). Surrounding gymnosperm forests were dominated by Ginkgopsida (*Ginkgoites*, *Ginkgo*, *Baiera*, *Czekanowskia*, *Phoenicopsis*), Coniferopsida (*Pityophyllum*, *Rhipidiocladus*, *Elatocladus*, *Schizolepis*, *Podozamites*), Lycoposidas (*Lycopodites*, *Selaginellites*), Sphenopsida (*Equisetum*), Filicopsida (*Todites*, *Coniopteris*), Cycadopsida (*Anomozamites*) (Mi *et al.* 1996). All these paleontological data were interpreted as indicating humid and warm-temperate climate (Tan & Ren 2002).

The accurate Ar-Ar and SHRIMP U-Pb dating shows that the age of intermediate-acid volcanic rocks overlying the Daohugou fossil-bearing beds is about 164–165 Ma, and that the age of this fossil-bearing beds is older than or equal to 165 Ma (Chen *et al.* 2004). Additionally, Rasnitsyn and Zhang (2004) also concluded that the composition of Daohugou assemblage is intermediate between the early Late Jurassic assemblage of Karatau, Kazakhstan and assemblage from near the Lower/Middle Jurassic boundary by comparing the hymenopteran fossil compositions from Daohugou and Karatau. Therefore Daohugou biota is probably older than the Karatau assemblage and of Middle Jurassic age (about Bathonian or little older) (Ren *et al.* 2002, Wang 2000).

### Materials and methods

This study is based on one specimen housed in the fossil insect collection of the Key Lab of Insect Evolution & Environment Change, Capital Normal University, Beijing, China. Line drawings were prepared with the aid of a camera lucida attached to a LEICA MZ12.5 stereomicroscope.

Basic terminology follows McAlpine (1981) and James & Turner (1981).

**Genus *Sinorhagio* gen. nov.**

**Type species.** *Sinorhagio daohugouensis* sp. nov.

**Diagnosis.** Flagellum long, nearly spine-like, tapering toward tip. Crossvein h located at middle of cell c and slightly beyond origin of Rs. Mouths of cell sc, cell  $r_1$  and cell  $r_{2+3}$  subequal in width; mouth of cell  $r_4$  much narrower than that of cell  $r_{2+3}$ . Vein  $R_{2+3}$  long, straight apically; vein  $R_5$  ending slightly beyond wing tip. Rs nearly as long as trunk of  $R_4+R_5$ . Veins  $M_1$  and  $M_2$  convergent basally at cell d; vein  $CuA_1$  present and arising from cell bm (= basal medial). Cell cup closed with a short petiole apically.

**Distribution.** The genus is known from China only and is currently represented by one species.



**FIGURE 1.** *Sinorhagio daohugouensis* sp. nov. (female). Body, photograph.

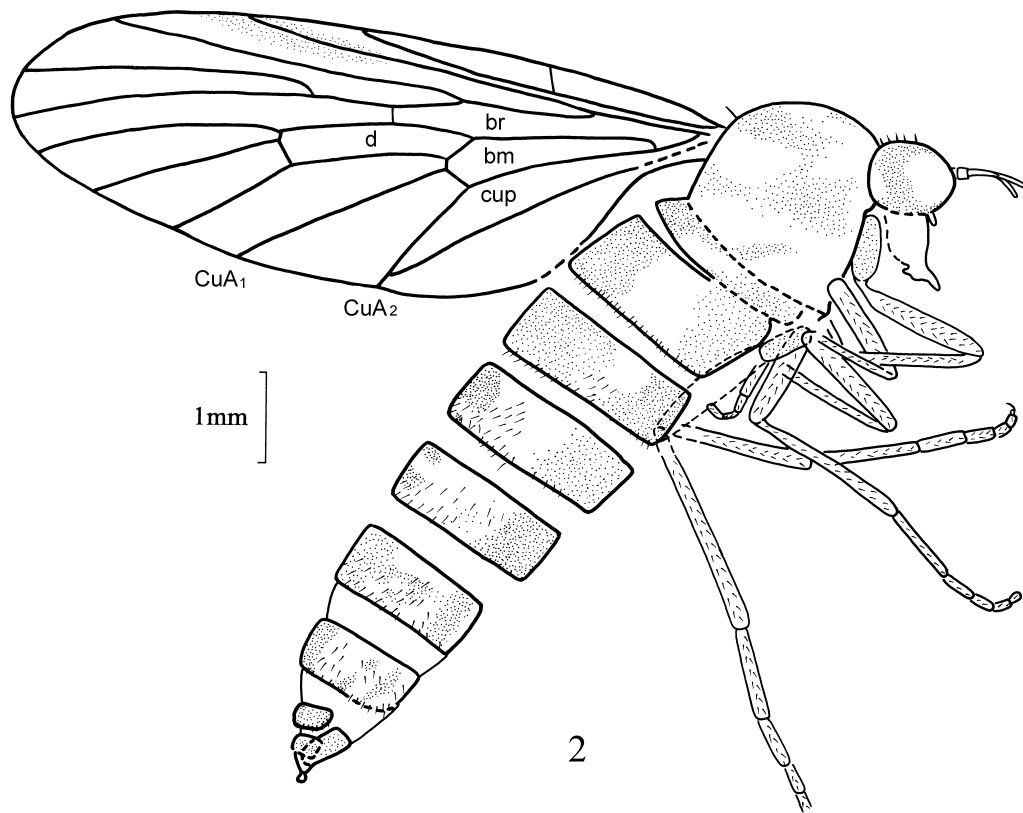


FIGURE 2. *Sinorhagio daohugouensis* sp. nov. (female). Body, camera lucida drawing.

**Etymology.** From Greek *Sin* (China) and the genus *Rhagio*.

**Remarks.** Among the four known genera, *Sinorhagio* gen. nov. is more similar to *Kubekovia* Kovalev, 1985 and *Palaeobrachyceron* Kovalev, 1981. The new genus could be placed next to *Kubekovia* Kovalev (including only one known species) as they are similar in the following characters:  $R_s$  long, cell  $r_4$  long, vein  $R_5$  ending slightly beyond wing tip, cell  $d$  slender, and mouth of cell  $m_3$  open wide. Both genera belong to the same geologic age, the Middle Jurassic. But *Sinorhagio* is easily separated from *Kubekovia* Kovalev, 1985 by having crossvein  $h$  located at middle of cell  $c$  and slightly distal of the origin of  $R_s$ , the mouth of the cell  $r_1$  is nearly as wide as that of the cell  $r_{2+3}$ , veins  $M_1$  and  $M_2$  are convergent basally at cell  $d$ , and the cell  $cup$  is closed with a short petiole apically. In *Kubekovia*, crossvein  $h$  is located at base of cell  $c$  and slightly proximal of the origin of  $R_s$ , the mouth of cell  $r_1$  is wider, the position of  $M_2$  is normal, and the cell  $cup$  is nearly closed without a petiole (Kalugina & Kovalev 1985, Nagatomi & Yang 1998).

The wing venation of *Sinorhagio* gen. nov. is similar to that of *Palaeobrachyceron* Kovalev, 1981 in having veins  $M_1$  and  $M_2$  convergent basally at cell  $d$ , cell  $cup$  is closed

with a short petiole apically, but can be distinguished from *Palaeobrachyceron* by the long spine-like antenna, vein  $R_{2+3}$  long and straight apically, the mouth of cell  $r_1$  nearly as wide as that of cell  $r_{2+3}$ , and cell bm and cell d slender. In *Palaeobrachyceron*, the antennal flagellum is coniform with a rather thick base, vein  $R_{2+3}$  is curved upward apically, the mouth of cell  $r_{2+3}$  is wider, cell bm is larger, and cell d is shorter and wider (Kovalev 1981, Nagatomi & Yang 1998).

***Sinorhagio daohugouensis* sp. nov. (Figs. 3–4)**

**Description.** Female body length 10.1 mm, wing length 8.0 mm, wing width 2.9 mm.

Head subround in lateral view, length about 1.0 mm; vertex with row of short setae. Antenna bare and long, slightly shorter than head; scape obscure, pedicel nearly square, flagellum long, roughly 7 times as long as pedicel; nearly spine-like, tapering toward tip (but segmentation obscure in the specimen) (Fig. 3). Proboscis long and thick, subequal to head height; palpus partially preserved.

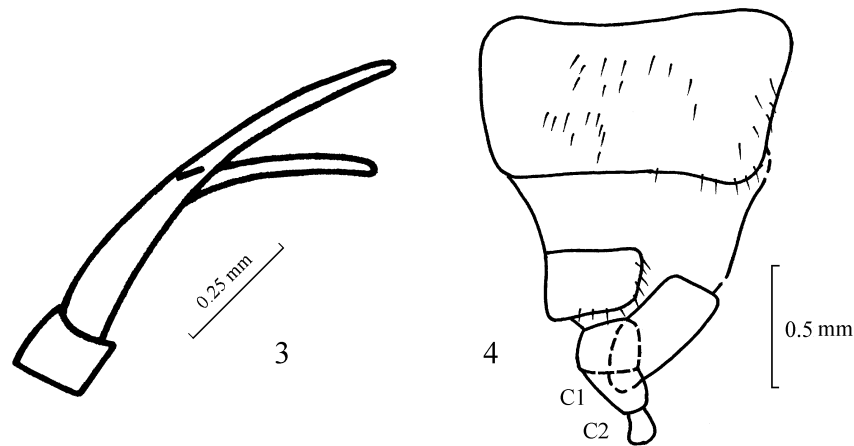
Thorax black. Only one acrostichal seta on mesonotum preserved. Most legs visible with pubescence. Hind tibia with 1 spur, spur of mid tibiae not preserved; first tarsomere of mid and hind legs distinctly longer than following tarsomeres. Hyaline wing: Pterostigma present. C vein with short setulae. Sc ending at middle of wing. Crossvein h located at middle of cell c and slightly distal of the origin of Rs. Vein  $R_{2+3}$  long, straight apically; vein  $R_5$  ending slightly beyond wing tip. Rs nearly as long as trunk of  $R_4+R_5$ . Relative lengths of  $R_5$  and trunk of  $R_4+R_5$  about 2: 1. Veins  $M_1$  and  $M_2$  convergent basally at cell d; vein  $CuA_1$  present and arising from cell bm, crossvein m-cu short.  $CuA_2$  longer than 1/2 of cell bm. Mouths of cell sc, cell  $r_1$  and cell  $r_{2+3}$  subequal in width; mouth of cell  $r_4$  much narrower than that of cell  $r_{2+3}$ . Cell  $r_4$  longer than cell  $m_1$ . Cell br (= basal radial) longer than cell bm. Cell d slender, crossvein r-m located nearly at middle of trunk of  $R_4 + R_5$ . Five posterior cells present, all of them open wide. Cell cup closed with a short petiole apically. Anal lobe narrow.

Abdomen long, covered with setulae; narrowing toward tip, with 9 visible segments (segment IX obscure); segment II widest, but boundary of segments I and II obscure in the specimen. Cerci two-segmented (Fig. 4).

**Holotype.** One almost complete well-preserved body with wings, female, No. CNU-B-NN2005001 housed in Key Lab of Insect Evolution & Environment Change, Capital Normal University, Beijing, China.

**Locality and horizon.** Daohugou Village, Shantou township, Ningcheng county, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic (Aalenian-Bajocian).

**Etymology.** The species is named after the type locality: Daohugou village (China).



FIGURES 3–4. *Sinorhagio daohugouensis* sp. nov. (female). 3. Antenna (excluding scape); 4. apex of abdomen. C<sub>1</sub> and C<sub>2</sub>, segments 1–2 of cercus.

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