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New Middle Jurassic tangle-veined flies from Inner Mongolia, China

KUIYAN ZHANG, DING YANG, DONG REN, and FENGCHEN GE

Many Jurassic fossil nemestrinid flies have been found in the Palaearctic region. China is an important locality for fossil nemestrinid flies. Up to now, 2 genera with 3 species have been discovered in China. In the present paper, a third genus and species, *Ahirmoneura neimenguensis* Zhang, Yang, and Ren, gen. et sp. nov., from the Middle Jurassic Daohugou Formation of China is described. A key to genera of fossil nemestrinid flies from China is given.

Introduction

The family Nemestrinidae (tangle-veined flies) is a cosmopolitan group of brachyceran Diptera consisting of about 300 described species in over 20 genera. They are found in all zoogeographic regions, most abundant and diverse in the Palaearctic, Australian, and Afrotropical regions, sparse in the Nearctic region. All known nemestrinid larvae are parasites of grasshoppers and scarabaeid beetle larvae. Bernardi (1973) have summarized the genera of Nemestrinidae around the world, including the morphology and distribution of fifteen extant and five fossil genera belonging to six subfamilies. Before this paper, 12 genera and 28 species of fossil Nemestrinidae have been described (Bequaert 1936; Bernardi 1973; Evenhuis 1994; Ren 1998; Mostovski 1998; Ansorge and Mostovski 2000; Mostovski and Martínez-Delclòs 2000). They have been found from the Jurassic to Tertiary of Germany, Kazakhstan, China, Spain, Russia, and USA. Besides, the genera *Rhagionemestrius* Ussatchev, 1968 and *Sinonemestrius* Hong and Wang, 1990 were removed from the family Nemestrinidae by Nagatomi and Yang (1998) as two independent families, Rhagionemestriidae and Sino-nemestriidae.

Ren (1998) found 2 genera and 3 species of fossil Nemestrinidae for the first time from Western Liaoning of China. These are *Florinemestrius pulcherrimus* Ren, 1998, *Protonemestrius juras-*

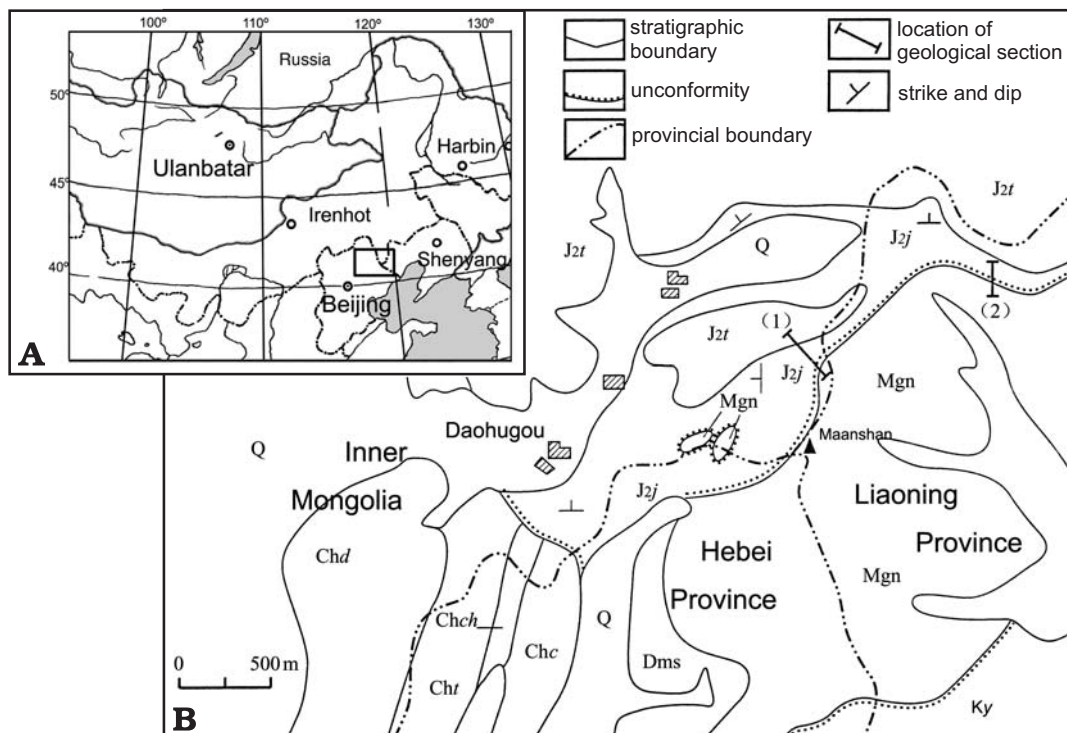


Fig. 1. Location of the type locality of *Ahirmoneura neimenguensis* Zhang, Yang, and Ren, gen. et sp. nov. Daohugou Village, Shantou Township, Ningcheng County, Inner Mongolia, China. A. Outlined location. B. Detailed location. Abbreviations: Chc, Changchougou Formation; Chch, Chuanlinggou Formation; Chd, Dahongyu Formation; Cht, Tuanshanzi Formation; J2j, Jiulongshan Formation; J2t, Tiaojishan Formation; Ky, Yixian Formation; Q, Quaternary; Dms, Dalaiyingzi erosion surface; Mgn, Maanshan gneiss.

sicus Ren, 1998, *Protonemestrius beipiaoensis* Ren, 1998. These two genera were discovered from the Late Jurassic Yixian Formation of Beipiao City, Liaoning Province. In the present paper, we describe the oldest nemestrinid from China from the Middle Jurassic (Aalenian-Bajocian) deposits of Jiulongshan Formation (Daohugou Village, Shantou Township, Ningcheng County, Inner Mongolia Province). During the past several years, the Daohugou locality (Fig. 1) became famous of excellently preserved animal and plant fossils known as Daohugou biota. The palaeoenvironmental reconstructions of the Daohugou site, suggest humid and warm-temperate climate for this volcanic region with mountain streams (Ren and Krzeminski 2002; Ren et al. 2002; Liu et al. 2004).

Institutional abbreviation.—CNU, Capital Normal University, Beijing, China.

Other abbreviations.—bm, basal medial; br, basal radial; C, costa; CuA₁, CuA₂, anterior branches of cubitus; d, discal; M₁, M₂, M₃, posterior branches of media; m₁, m₂, m₃, medial; R₁, anterior branch of radius; R₂, R₄, R₅, posterior branches of radius; r₁, r₂, r₄, r₅, radial; r-m, radial-medial; Rs, radial sector; Sc, subcosta; sc, subcostal.

Systematic palaeontology

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

Order Diptera Linné, 1758

Family Nemestrinidae Macquart, 1834

Genus *Ahirmoneura* Zhang, Yang, and Ren, nov.

Type species: *Ahirmoneura neimengguensis* Zhang, Yang, and Ren, sp. nov.

Derivation of the name: The generic name refers to the difference between the new genus and *Hirmoneura*.

Diagnosis.—Body large. Eyes large, dichoptic, ommatidia clearly visible. Wing elongate and rather narrow: Base of vein C swollen and sclerotized with dense setulae. Vein Sc short, ending slightly beyond middle of wing, far from level of fork of vein R₄₊₅. In apical part of wing, veins running parallel to anterior margin, ending before wing-tip. Vein R₃ absent; vein R₄ cambered basally. Crossvein r-m located at extreme base of cell d. Vein M₂ arising from apex of cell d; veins M₃ and CuA₁ fused before wing margin with a petiole. Vein CuA₁ arising from apex of cell d. Abdomen incomplete, 4 segments preserved. Segment I widest.

Remarks.—Judging from the wing venation, *Ahirmoneura* gen. nov. is similar to *Hirmoneura* Meigen, 1820 by having crossvein r-m present, vein M₂ reaching the anterior margin of the wing, veins M₃ and CuA₁ fused before wing margin with a petiole, alula broad. But, the new genus differs from *Hirmoneura* in vein Sc ending slightly beyond the middle of the wing, crossvein r-m at the extreme base of cell d, vein Rs distinctly longer than the distance between vein R₂ and crossvein r-m, vein M₂ arising from the apex of cell d, the mouth of cell r₁ over twice as long as that of cell r₂, cell r₄ longer than cell m₁, cell br much shorter than cell bm. In *Hirmoneura*, vein Sc is

ending far beyond the middle of the wing, crossvein r-m is located at the apical part of cell d, vein Rs is distinctly shorter than the distance between vein R₂ and crossvein r-m, vein M₂ is arising from cell m₃, the mouth of cell r₁ is less than twice as long as that of cell r₂, cell r₄ is shorter than cell m₁, cell br is much longer than cell bm.

Key to genera of fossil (Jurassic) nemestrinid flies from China:

1. Crossvein r-m at extreme base of cell d; vein M₂ arising from cell d *Ahirmoneura*
— Crossvein r-m at apical part of cell d; vein M₂ arising from cell m₃ 2
2. Crossvein between veins M₁ and M₂ present; veins M₂ and CuA₁ + M₃ converged at a point at base *Florinemestrius*
— Crossvein between veins M₁ and M₂ absent; veins M₂ and CuA₁ + M₃ diverged at base *Protonemestrius*

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

Ahirmoneura neimengguensis Zhang, Yang, and Ren, sp. nov.

Fig. 2.

Derivation of the name: After the type region: Inner Mongolia (Chinese pronunciation is “nei meng gu”).

Holotype: CNU-B-NN2006003, an almost complete adult body with wings in dorsal view.

Type locality: Daohugou Village, Shantou Township, Ningcheng County, Inner Mongolia, China.

Type horizon: Aalenian-Bajocian Jiulongshan Formation, Middle Jurassic.

Material.—Only holotype specimen.

Dimensions.—Body length over 22.5 mm, wing length 15.5 mm, wing width 5.0 mm.

Diagnosis.—The same as for the genus.

Description.—A large, dark fly. Head hemispherical in dorsal view, without hairs. Eyes large; dichoptic, ommatidia visible clearly. Antenna and proboscis not preserved.

Only anterior part of thorax preserved. Legs partly visible with dense pubescence. Wing elongate, rather narrow, pubescent; supernumerary crossvein absent. Base of vein C distinctly swollen, sclerotized with dense setulae. Vein Sc short, ending slightly beyond middle of wing, far from level of fork of vein R₄₊₅. In apical part of wing, veins running parallel to anterior margin, ending before wing-tip. So-called diagonal vein (consisting of elements of Rs, common stem of veins R₄ and R₅, crossvein r-m, M₁, M₂, M₃, and CuA₁) absent. Vein R with four branches, vein R₃ absent; base of vein R₄ cambered. Crossvein r-m located at extreme base of cell d. Veins M₁ and M₂ diagonal and parallel; vein M₂ arising from apex of cell d, ending slightly before wing tip; veins M₃ and CuA₁ fused before wing margin with a petiole. Crossvein m-cu absent. Vein CuA₁ arising from apex of cell d. Vein CuA₂ shorter than 1/2 of cell bm. Apex of vein A not preserved. Mouth of cell sc longer than that of cell r₁.

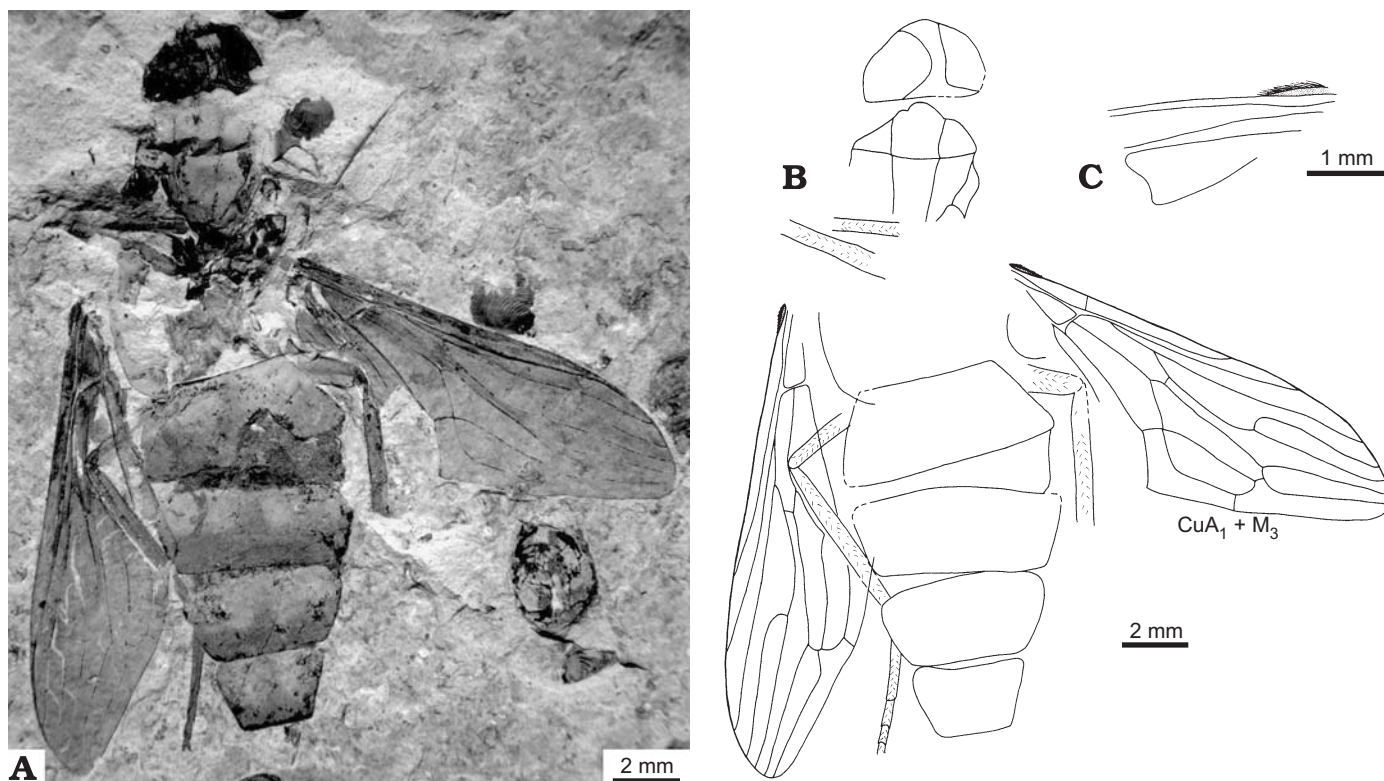


Fig. 2. Nemestrinid fly *Ahirmoneura neimenguensis* Zhang, Yang, and Ren, gen. et sp. nov., holotype CNU-B-NN2006003, from the Daohugou Village, Inner Mongolia, China; Aalenian-Bajocian Jiulongshan Formation, Middle Jurassic. **A.** Body with wings photograph in dorsal view. **B.** Camera lucida drawing, based on the original photograph, in dorsal view. **C.** Camera lucida drawing, base of vein C details.

Mouth of cell r_1 longer than wing margin between veins R_2 and R_5 . Mouth of cells r_4 , r_5 , m_1 subequal in length. Cell r_4 longer than cell m_1 . Cell br short and small, apical portion of cell br narrow but unpointed. Cell d longer than cell m_3 . Five posterior cells present, cell m_1 shorter than cell m_2 , cell m_3 closed far before wing margin with a petiole. Anal lobe narrow. Alula broad.

Abdomen robust, covered with setulae. Abdomen incomplete, 4 segments preserved, apex not preserved. Segment I widest, abdomen segments narrowing toward tip. Gender unknown.

Discussion

The presence of so-called diagonal veins is the most conspicuous diagnostic character in most nemestrinid flies, including all known extinct genera. *Ahirmoneura* gen. nov. is unique among Nemestrinidae in lacking so-called diagonal veins, crossvein r-m located at the extreme base of cell d, vein M_2 arising from cell d, cell m_3 ending before cell d. These unusual characters, which are different from the extant genera and other extinct genera of Nemestrinidae, might be the plesiomorphies. Some similar states also have been observed in *Sinonemestrinus* Hong and Wang, 1990. It provides evidence on how the composite “diagonal vein” was assembled over evolutionary time. Especially, the positional transformation of crossvein r-m and cell m_3 plays a vital part in the progress of the venational evolution of family Nemestrinidae.

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