



General Palaeontology, Systematics, and Evolution (Invertebrate Palaeontology)

Honghea xui gen. et sp. nov., the second Earliest Jurassic damsel-dragonfly (Odonata: Camptero-phlebiidae) from the Junggar Basin, NW China

Honghea xui gen. et sp. nov. *Le deuxième exemple de demoiselle-libellule (Odonata : Camptero-phlebiidae) du Jurassique inférieur du bassin de Junggar, Chine nord-occidentale*

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ABSTRACT

A new camptero-phlebiid damsel-dragonfly, *Honghea xui* gen. et sp. nov., is described from the Lower Jurassic Badaowan Formation of the Junggar Basin, NW China. This is the second Chinese Camptero-phlebiidae recorded for the earliest Jurassic, reflecting the quick diversification and radiation of the damsel-dragonflies during this period. *H. nouveau onghea* gen. nov. is closely related to Chinese genera *Zygokaratawia* and *Ctenogampsophlebia*, both from the Middle Jurassic of the Daohugou Biota; but differs from these genera in having a larger wing size, RP2 slightly distal of Sn, and a narrower area between IR2 and RP3/4.

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R É S U M É

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Un nouveau camptéroptéroptère, *Honghea xui* gen. et sp. nov., demoiselle-libellule est décrit dans la formation Badaowan du Jurassique inférieur du bassin de Jungaar, Chine nord-occidentale. Il s'agit du deuxième Campteropteroptera chinois répertorié dans le Jurassique le plus ancien, qui reflète la diversification et la radiation rapides des demoiselles-libellules pendant cette période. *Honghea* gen. nov. est très proche des genres chinois *Zygokaratavia* et *Ctenogamsophlebia*, tous deux du Jurassique moyen du Daohugou Biota, mais en diffère par une plus grande taille des ailes, RP2 légèrement distal de Sn et une zone plus étroite entre IR2 et RP3/4.

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1. Introduction

Campteropteroptera [Handlirsch, 1920](#) is the largest family of the clade Isophlebiida [Bechly, 1996](#) ([Fleck and Nel, 2002](#)). Ten genera were recorded from the Lower Jurassic–Lower Cretaceous of northern China, mostly from the Middle Jurassic of Inner Mongolia ([Zheng et al., 2016](#)). In this paper, we describe a very well-preserved campteropteroptid dragonfly attributable to a new genus and species from the Lower Jurassic Badaowan Formation of the Tuziakeneigou outcrop of the Junggar Basin, northwestern China. This outcrop yielded hundreds of insect fossils including another campteropteroptid damsel-dragonfly: *Dorsettia sinica* [Zheng et al., 2016](#). The insect assemblage of this outcrop closely resembles that of the Lower Lias of Dorset, England, and both insect faunas probably exchanged during Early Jurassic.

2. Material and methods

The damsel-dragonfly described herein was collected from the middle part of the Badaowan Formation of the Tuziakeneigou outcrop, Karamay City, Xinjiang, northwestern China (locality in [Zheng et al., 2016](#): fig. 1). Abundant bivalves, gastropods, spinicaudatans, insects, sporopollen, and plants were reported from the Badaowan Formation ([Deng et al., 2010](#)), which was considered to be uppermost Rhaetian–Sinemurian stages ([Sha et al., 2015](#)). The insect fauna in this section is represented by *Protorthophlebia latipennis* and *Dorsettia*, both have recorded in the Lower Lias of England, and was regarded as earliest Sinemurian in age ([Zheng et al., 2016](#)).

The specimen was examined dry using a Nikon SMZ1000 stereomicroscope. Observation was augmented by temporary wetting with laboratory alcohol which improved the contrast between the fossil and the matrix, eliminating the surface irregularity of the latter. Photographs were taken using a Canon 5D digital camera and the line drawings were prepared from photographs using image-editing software (CorelDraw X7 and Adobe Photoshop CS6). The specimen is housed in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS).

The higher classification of fossil and extant Odonatoptera is based on the phylogenetic system of [Bechly \(1996\)](#). The nomenclature of the dragonfly wing

venation used in this paper is based on the interpretations of [Riek \(1976\)](#) and [Riek and Kukalová-Peck \(1984\)](#), as modified by [Nel et al. \(1993\)](#) and [Bechly \(1996\)](#). Wing abbreviations are as follows: AA: anterior anal; AP: posterior anal; Arc: arculus; Ax: primary antenodal crossvein; C: costa; Cr: nodal crossvein; CuAa: distal branch of anterior cubitus; CuAb: proximal branch of anterior cubitus; CuP: posterior cubitus; DC: discoidal cell; IR: intercalary radial vein; MAa: anterior branch of anterior median; MAb: posterior branch of anterior median; MP: posterior median; N: nodus; “O”: oblique vein; Pt: pterostigma; RA: anterior radius; RP: posterior radius; Sn: subnodal crossvein; ScP: posterior subcosta.

3. Systematic palaeontology

Order ODONATA [Fabricius, 1793](#)

Subordinal clade ISOPHLEBIOPTERA [Bechly, 1996](#)

Subclade ISOPHLEBIIDA [Bechly, 1996](#)

Superfamily ISOPHLEBIOIDEA [Handlirsch, 1906–1908](#)

Family CAMPTEROPTEROPTERIDAE [Handlirsch, 1920](#)

Genus *Honghea* gen. nov.

Type species. *Honghea xui* sp. nov.

Etymology. The generic name is after the Chinese palaeobotanist Dr Honghe Xu, in gratitude for his help with fieldtrip.

Diagnosis. Wing length ca. 45 mm; distal angle of discoidal cell not quite acute; Ax1 and Ax2 of convergent obliquity; no antefurcal crossveins; basal area between MAa and MP slightly narrower than that between MP and CuA; Pt broad, not braced; MAa short, ending on MP just below IR1 base; RP2 base slightly distal of Sn; CuAa with one row of long cells between it and MP; CuAa with one or two rows of cells between it and posterior wing margin; RP2, IR2, RP3/4 nearly straight; one row of long cells between MAa and MP, IR2 and RP3/4, and RP2 and IR2.

Honghea xui sp. nov. (Figs. 1–5)

Etymology. The specific name is after Dr Honghe Xu.

Material. Holotype, NIGP165288a, b, part and counterpart of a well-preserved male damsel-dragonfly (Fig. 1A–B); deposited in the NIGPAS.

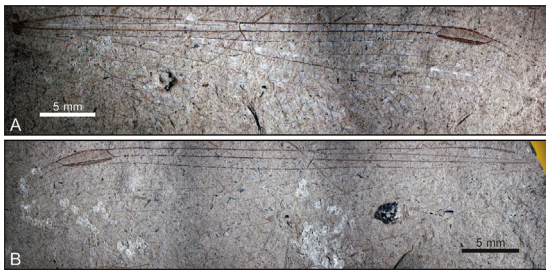


Fig. 1. (Colour online) *Honghea xui* gen. et sp. nov., holotype (NIGP165288a, b), photographs of part (A) and counterpart (B).

Fig. 1. Photographies des partie (A) et contrepartie (B) de l'holotype *Honghea xui* gen. et sp. nov. (NIGP165288a, b).

Type stratum and locality. Tuziakeneigou outcrop, Karamay City, Xinjiang, China; Badaowan Formation, Lower Jurassic (uppermost Rhaetian–Sinemurian).

Diagnosis. The same as for the monotypic genus.

Description. Specimen NIGP165288a, b (Figs. 1–5), forewing. Wing length 45.5 mm, width at level of N, 8.77 mm; distance from wing base to Arc 5.24 mm, from Arc to N 14.62 mm, from N to Pt 17.61 mm, and from Pt to wing apex 8.01 mm. Median area free of crossveins. CuP strong, separating submedian and subdiscoidal areas at 0.91 mm basal of Arc. DC open (Fig. 3). Subdiscoidal area broad, free of crossveins. MAb rather short, 0.42 mm long, and well aligned with distal free part of CuA. CuA separated from MP 5.48 mm from wing base, directly toward posterior wing margin. Area between CuAa and MP with one row of cells basally, expanded distally; CuAa with one or two rows of cell between it and posterior wing margin. MP slightly curved, reaching posterior wing margin 31.59 mm from wing base, at 69% of total wing length. MAa distally zigzagged, more or less parallel with MP, ending on MP just below IR1 base; postdiscoidal area with one row of large cells basally, narrower distally. Primary antenodal crossveins strong, Ax1 1.37 mm basal of Arc, and Ax2 3.1 mm distal of Ax1; Ax2 and Ax1 of distinct and converging obliquity. No secondary antenodal crossveins present between C and ScP; six secondary antenodal crossveins present between ScP and RA distal of Ax2. Twelve postnodal crossveins present between C and RA, not aligned with 12 postsubnodal crossveins between RA and RP1 basal of Pt. Nine antesubnodal crossveins present. No antefurcal crossvein present in area between RP and MA basal of midfork (base of RP3/4). Five postnodal crossveins present

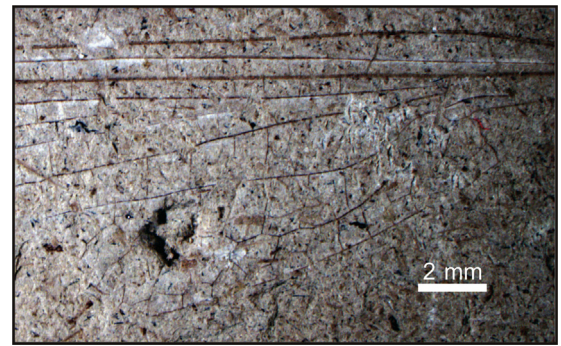


Fig. 3. (Colour online) *Honghea xui* gen. et sp. nov., holotype (NIGP 165288a), photograph of forewing base.

Fig. 3. Photographie de la base de l'aile avant d'*Honghea xui* gen. et sp. nov., holotype (NIGP 165288a).

distal of Pt. Bqr space between RP, RP2, IR2 and oblique vein “O” very long and narrow, with one row of cells and 12 crossveins. Single oblique vein “O” present, 7 cells and 7.93 mm distal of base of RP2. RP2 slightly curved. Midfork 4.87 mm distal of Arc, closer to Arc than to N. Nodal structures well preserved (Fig. 4); Sn oblique and well aligned with Cr. Base of IR2 close to midfork, 2.84 mm distally. RP2 originating 0.77 mm distal of Sn. IR1 originating five cells and 5.77 mm distal of base of RP2; IR1 basally zigzagged, more or less parallel to RP1. Pt not braced (Fig. 5), long and narrow, sclerotized, 4.56 mm long and 1.36 mm wide. Area between MAa and RP3/4 widened distally, with many cells along posterior wing margin. Area between RP3/4 and IR2 with one row of cells before level of Pt, and one or two rows of cells along posterior wing margin. Area between IR2 and RP2 with one row of narrow cells before level of distal side of Pt. Area between RP2 and IR1 with one row of cells before Pt base, slightly widened distally with two rows of cells. Area between IR1 and RP1 distally widened, with probably five rows of cells along posterior wing margin.

4. Discussion

Honghea xui belongs to Campteropteroptera by the presence of the following characters (Li et al., 2012; Nel et al., 2009): medium size; no secondary antenodal crossveins present between C and ScP; forewing discoidal cell basally opened, correlated to absence of shifting of distal side (MAb) of discoidal cell distinctly distal of arculus.

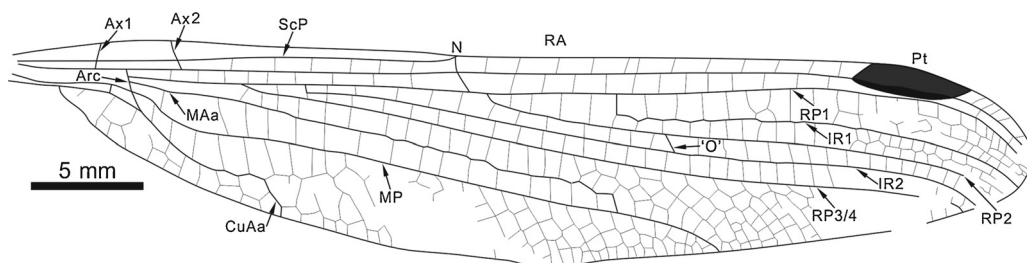


Fig. 2. *Honghea xui* gen. et sp. nov., holotype (NIGP165288), line drawing showing forewing venation based on two parts.

Fig. 2. *Honghea xui*. et sp. nov., holotype (NIGP165288), dessin au trait montrant le système de veines de l'aile avant, basé sur deux parties.

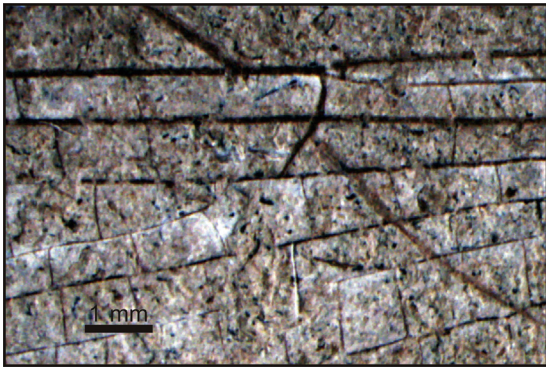


Fig. 4. (Colour online) *Hongheia xui* gen. et sp. nov., holotype (NIGP 165288b), photograph of forewing nodus.

Fig. 4. Photographie du nodus de l'aile avant d'*Hongheia xui* gen. et sp. nov., holotype (NIGP 165288b).

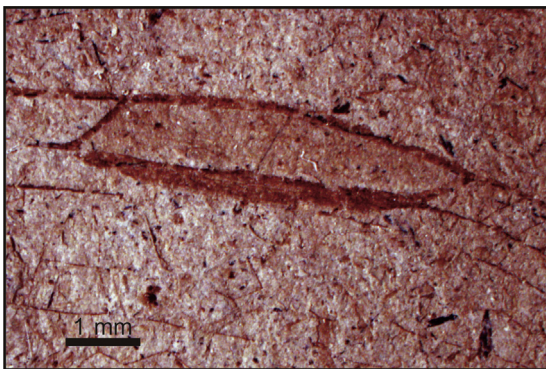


Fig. 5. (Colour online) *Hongheia xui* gen. et sp. nov., holotype (NIGP 165288a), photograph of forewing pterostigma.

Fig. 5. Photographie du ptérostigma de l'aile avant d'*Hongheia xui* gen. et sp. nov., holotype (NIGP 165288a).

Within Campteropterygidae, *H. xui* has the basal parts of areas between MAa and MP and between MP and CuA of similar widths, only one row of cells between MA and MP, one row of cells between MP and CuAa for a long distance, these forewing characters being only shared with *Karatawia* Martynov, 1925, *Melanohypsa* Pritykina, 1968, *Zygokaratawia* Nel et al., 2008, and *Ctenogampsophlebia* Petrulevičius et al., 2011. Affinities between *Karatawia* and *Hongheia* can be excluded because the former has the areas between RP2 and IR2, and RP3/4 and IR2 expanded along the wing margin, Sn aligned with RP2 base, and MAa ending on the wing margin (Nel et al., 1993). *Melanohypsa* has only the wing base preserved, however, it differs from *Hongheia* in having the arculus nearer to Ax1 than to Ax2 instead of nearer to Ax2 than to Ax1 in the latter, an acute distal angle of the discoidal cell, and several antefurcal crossveins instead of none (Nel et al., 1993; Pritykina, 1968).

Hongheia quite resembles *Zygokaratawia* in having a narrow cubito-anal area, a long basal part of CuA before its branches, the basal areas between MP and CuA being as broad as the postdiscoidal area (distally constricted), a straight MP, a zigzagged MAa being much weakened distally, a short CuAa, and a non-basally recessed pterostigma (Nel et al., 2008). However, the former has a larger size

(45 mm compared to 35 mm in the latter), no distinct constriction in the area between RP3/4 and IR2 (present in the latter), RP2 slightly distal of Sn (well aligned in the latter), one row of cells in the area between IR2 and RP3/4 (many cells along the posterior wing margin in the latter).

Hongheia nearly shares all the forewing characters of *Ctenogampsophlebia* but differs from the latter as follows: larger size (45 mm compared to ca. 35 mm long in the latter); base of RP3/4 nearer to arculus than to nodus (lying midway between the arculus and the nodus in the latter); RP2 slightly distal of Sn (aligned with Sn in the latter); larger pterostigma size (4.6 mm compared to 3.7 mm long in the latter); CuA with two rows of cells between it and posterior wing margin (three cells in the latter); and one row of long cells present between IR2 and RP3/4, and IR2 and RP2 (four cells in the latter).

In conclusion, *Hongheia* shares the most characters of *Zygokaratawia* and *Ctenogampsophlebia*, but differs from these genera in having a larger size, RP2 slightly distal of Sn, and a narrow area between IR2 and RP3/4. It has RP2 slightly distal of Sn, distinguishing from other campteropterygidae genera.

5. Conclusions

The second earliest Jurassic damsel-dragonfly, *Hongheia xui* gen. et sp. nov., is described from the Lower Jurassic Badaowan Formation of the Junggar Basin, NW China. Within Campteropterygidae, *Hongheia* gen. nov. resembles the Middle Jurassic genera *Zygokaratawia* and *Ctenogampsophlebia*, but differs from other campteropterygidae genera in having RP2 slightly distal of Sn. The new discovery adds to the diversity of campteropterygidae damsel-dragonflies in China.

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