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A new hemeroscopid dragonfly from the Lower Cretaceous of Northeast China (Odonata: Hemeroscopidae)

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Abstract: A new genus and species of hemeroscopid dragonfly, *Abrohemeroscopus mengi* gen. *et* sp. nov., of the family Hemeroscopidae Pritykina, 1977, from the Lower Cretaceous Jiufotang Formation, Liaoning Province, Northeastern China, is described and illustrated. This new genus is rather similar to *Hemeroscopus* Pritykina, 1977, but differs from the latter in the following characters: (1) hindwing anal loop is smaller, only with 6 - 7 cells (plesiomorphy); (2) Rspl is absent (plesiomorphy); (3) the hindwing vein CuAa is curved and has five distinct posterior branches (plesiomorphy); (4) the forewing MP is not shortened, reaching the posterior wing margin slightly beyond the level of the nodus (plesiomorphy); (5) pterostigmata more distinctly braced (plesiomorphy); (6) the hindwing area between MP and CuAa is narrow, with only one row of cells near the discoidal triangle (plesiomorphy). This is the oldest fossil record of the Hemeroscopidae in China.

Key words: Taxonomy; Hemeroscopidae; new genus; new species; Lower Cretaceous; China

INTRODUCTION

The extinct family Hemeroscopidae was erected by Pritykina (1977). This family lived during the Early Cretaceous and is known from fossils collected in China (Beijing), the Transbaikal region and Mongolia (Carpenter, 1992; Ren, 1995; Bechly *et al.*, 1998; Huang and Nel, 2001). Recently, the authors discovered two new Hemeroscopid specimens in the Jiufotang Formation, Lower Cretaceous (Berriasian-Hauterivian) that could not be assigned to any described genus and species. These specimens are the oldest Chinese fossils of the Hemeroscopidae.

The new fossils described below were collected at Beishan, Potaizi Village, Toutai Township, Yixian County, Liaoning Province, China. A survey of the insect fauna of Jiufotang Formation was conducted by Ren *et al.* (1995) and Reu and Lu (1996). The type material is deposited in the Dalian Natural History Museum, Dalian, China.

Figures were prepared with the aid of a camera lucida attached to LEICA MZ12.5 dissecting microscope.

The nomenclature of dragonfly wing venation used in this paper is based on the interpretations of Riek (1976) and Riek and Kukalova-Peck (1984), as amended by Kukalova-Peck (1991), Nel *et al.* (1993) and Bechly (1996). The higher classification of fossil and extant Odonatoptera is based on the new phylogenetic system of Bechly (1996). The Classification of the Euanisoptera is based on the work of Bechly *et al.* (2001).

SYSTEMATICS

Order Odonata Fabricius, 1793

Suborder Anisoptera Selys in Selys & Hagen, 1854

Euanisoptera Bechly, 1996

Exophytica Bechly, 1996

Brachystigmata Bechly, 1996

Family Hemeroscopidae Pritykina, 1977

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Genus *Abrohemeroscopus* gen. nov.

Type species: *Abrohemeroscopus mengi* gen. *et* sp. nov.

Etymology: The generic name is derived from the Greek "*abr-*" (pretty) and *Hemeroscopus* (type genus of the family). The gender is masculine.

Diagnosis: This new genus is rather similar to *Hemeroscopus* Pritykina, 1977, but differs from the latter in the following characters: (1) hindwing anal loop is smaller, only with 6 - 7 cells (plesiomorphy); (2) Rspl is absent (plesiomorphy); (3) the hindwing vein CuAa is curved and has five distinct posterior branches (plesiomorphy); (4) the forewing MP is not shortened, reaching the posterior wing margin slightly beyond the level of the nodus (plesiomorphy); (5) pterostigmata more distinctly braced (plesiomorphy); (6) the hindwing area between MP and CuAa is narrow, with only one row of cells near the discoidal triangle (plesiomorphy).

Comment: All these characters cannot be postulated to be autapomorphic and this new genus is currently based on overall similarity (symplesiomorphies). The long CuAa with five posterior branches in the hindwing represents a uniquely retained plesiomorphy within Hemeroscopidae that could indicate a more basal position of *Abrohemeroscopus* gen. nov.

Discussion: There is a rigorous cladistic analysis of the Hemeroscopidae by Bechly *et al*. (1998, 2001) who characterized the Hemeroscopidae Pritykina, 1977 by the following apomorphies: (1) a broad pentagonal hindwing anal loop, more or less posteriorly closed, without midrib; (2) the forewing and hindwing subdiscoidal triangles are similar and unicellular; (3) the postnodal crossveins are not aligned with the corresponding postsubnodal crossveins; (4) vein Mspl is absent and vein Rspl is absent or only weakly developed, with only one row of cells between it and IR2; (5) vein IR1 is short, originating on RP1 below the distal half of the pterostigma (pseudo-IR1 of Pananisoptera); (6) the primary antenodal crossveins AX1 and AX2 are distinctly stronger than the secondaries with only few (1 - 4) secondaries between them; (7) the area between IR2 and RP2 is widened distally, with two or three rows of cells basal of the pterostigma; (8) there is only one oblique crossvein 'O', four or five cells distal of the subnodus; (9) the hindwing vein CuAa has few (only 3 - 4) posterior branches, the most distal one being secondarily branched from CuAa; (10) the area between CuA and MP is basally widened with at least one double cell below the discoidal triangle; (11) the so-called "gaff" (= basal part of CuA between the fusion of CuA with AA and its first branching into CuAa and CuAb) is very elongated and straight in the hindwing; (12) the male hindwing has an anal angle and a three-celled anal triangle.

Abrohemeroscopus gen. nov. shares almost all the above-mentioned characters except character 10 Character 12 can not be used here because of the lack of fossil male specimens. In the new genus the area between CuA and MP in the hindwing is narrow, with only one row of cells near the discoidal triangle. This character is symplesiomorphic within the Anisoptera. Thus we attribute it to the Hemeroscopidae.

Abrohemeroscopus mengi gen. *et* sp. nov. (Figs. 1 - 4)

Holotype: Specimen No. DL0157-1, No. DL0157-2, part and counterpart in the Dalian Natural History Museum, Dalian, China; a complete well-preserved pair of wings (female), while the head and thorax poorly-preserved. Abdomen missing. So far, abundant *Hyphalosaurus*-like fossils (a long-necked diapsid reptile) found at this fossil site (Gao *et al*, 1999), but none of formal geological sections has been reported.

Locality and horizon: Beishan, Potaizi Village, Toutai Township, Yixian County, Liaoning Province, China; Jiufotang Formation, Lower Cretaceous (Berriasian-Hauterivian).

Etymology: The specific name is dedicated to Mr. Meng Qing-Jin, Director of Dalian Natural History Museum, for the loan of material for this study.

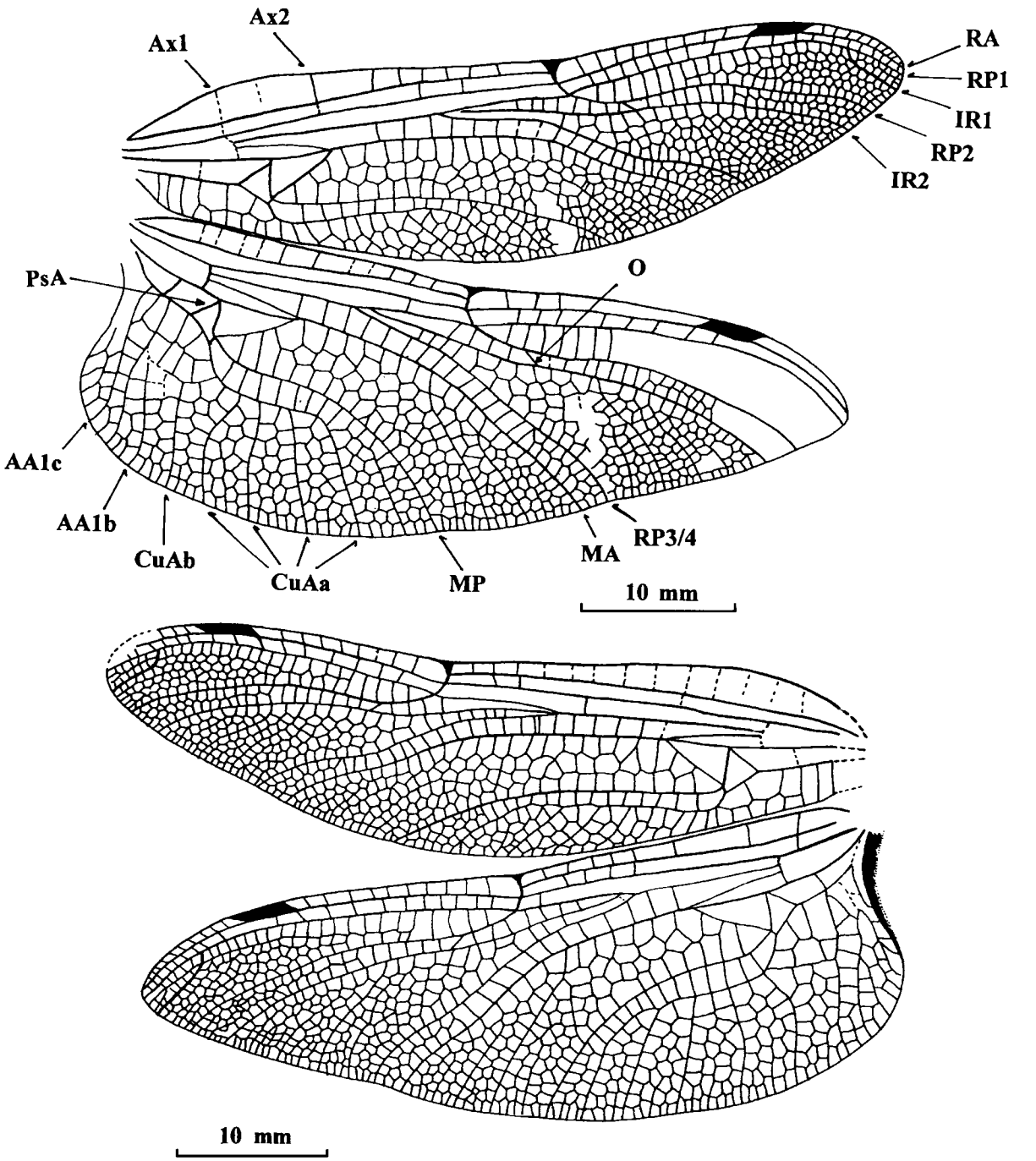
Diagnosis: As for the genus.

Figs. 1 – 2 *Abrohemeroscopus mengi* gen. *et* sp. nov., photographed in dry condition
1. Holotype, No. DL0157-1, part; 2. Holotype, No. DL0157-2, counterpart.

Description: Forewing. Length 52 mm, width 13 mm. The pterostigma is not very long and narrow, 4 mm long and max. 0.9 mm wide; pterostigma not parallel sided, since its basal side is somewhat less oblique than its distal side; the pterostigmal brace is strong and distinctly oblique, aligned with the basal side of the pterostigma; the pterostigma covers two cells; there are ten postnodal crossveins between costal margin and RA distal of the pterostigma; only eight or nine postnodal crossveins are present between nodus and pterostigma, non-aligned with the corresponding postsubnodal crossveins between RA and RP1; there is no distinct "libellulid gap" (*sensu* Bechly, 1996) of postsubnodal crossveins directly distal of the subnodus; the nodus is of the "normal" Anisoptera-type; the subnodus is not extremely oblique; IR1 is a short vein, originating on RP1 slightly distal of the pterostigma; there are only two rows of cells in the area between pseudo-IR1 and RP1, and four rows of cells in the wider area between pseudo-IR1 and RP2; RP1 and RP2 are basally parallel with only one row of cells between them, but somewhat basal of the pterostigma they diverge and have two or three row of cells between them; the base of RP2 is aligned with the subnodus; there is only one oblique crossvein 'O' between RP2 and IR2, two or three cells distal of the subnodus; there is one row of cells in the basal area between RP2 and IR2, more distally there are two rows between them, and at the posterior wing margin both veins are separated by four small cells; the area between RP2 and IR2 is distally widened; RP2 and IR2 are gently curved, but not undulating, and reach the posterior margin obliquely; the midfork (base of RP3/4) is 8 mm basal of the subnodus, and the origin of IR2 is more than 1.0 mm distal of the midfork; there are at least four bridge crossveins (Bqs) between RP and IR2 basal of the subnodus; antesubnodal crossveins (between RA and RP basal of the subnodus and distal of the arculus) are obscure; at least five antefurcal (postmedian) crossveins between RP and MA basal of the RP-midfork; there is no Rspl and no long secondary vein in the area between IR2 and RP3/4; no Mspl; the postdiscoidal area is wide with three rows of cells directly distal of the discoidal triangle and 13 – 16 cells between MA and MP at the posterior wing margin; the postdiscoidal area is distally somewhat widened; RP3/4 and MA are more or less parallel, are slightly undulating on the level of the oblique crossvein 'O'; the area between RP3/4 and MA is slightly widened distally with two to three rows of cells between them (RP3/4 and MA separated by four or five cells at the wing margin), while there is only one row of cells between them till the level of the oblique crossvein 'O'; the discoidal triangle is very wide and somewhat longitudinal elongate, unicellular; the distal side MAb is straight; the hypertriangle is free; a distinct secondary anteriors branch PsA (pseudo-anal vein) of AA delimits an unicellular subdiscoidal triangle; there are one or two rows of cells in the anal area below AA; the CuP-crossing (= anal crossing *sensu* Fraser, 1957) is present but obscure; there are no supplementary cubito-anal crossveins; MP is very gently curved and very long, ending on the level of the oblique crossvein 'O'; the area between CuA and MP is distally widened near the wing margin; CuAa is rather well-defined; only three or four basal posterior branches of CuAa are rather well defined; the arculus is angled, and the bases of RP and MA are shortly but distinctly separated at the arculus; only the two obscure primary antenodal crossveins AX1 and AX2 are aligned and stronger than the non-aligned secondary antenodal crossveins (at least 13 in the first row); AX1 is near the arculus and AX2 is near distad of discoidal triangle; there is at least two secondary antenodal crossveins between AX1 and AX2 in each row; the basal brace AX0 is not preserved. Hindwing. The venation is very similar to that of the forewing; length, 50 mm; width on the level of the nodus, 16.5 mm (max. width 19 mm); the nodus is in a relatively basal position, compared to the forewing; the pterostigma is not very long and narrow, 4 mm long and max. 1 mm wide; the pterostigma is not parallel sided, since its basal side is somewhat less oblique than its distal side; the pterostigmal brace is strong and oblique, aligned with the basal side of the pterostigma; the pterostigma covers at least two cells; there are ten postnodal crossveins between the costal margin and RA distal of the pterostigma; ten postnodal crossveins are pr-

esent between the nodus and pterostigma, not aligned with the corresponding postsubnodal crossveins between RA and RP1; there is no distinct "libellulid gap" (*sensu* Bechly, 1996) of postsubnodal crossveins directly distal of the subnodus; the nodus is of the "normal" Anisoptera-type; the subnodus is not extremely oblique; IR1 is a short vein, originating on RP1 distal of the pterostigma; there are only two rows of cells in the area between pesudo-IR1 and RP1, and five rows of cells in the wider area between pseudo-IR1 and RP2; RP1 and RP2 are basally parallel with mostly only one row of cells between them, but somewhat basal of the pterostigma they become divergent with two or more rows of cells between them; the base of RP2 is aligned with the subnodus; there is only one oblique crossvein 'O' present between RP2 and IR2, and two or three cells distal of the subnodus; there is one row of cells in the basal area between RP2 and IR2, more distally there are two rows between them, and at the posterior wing margin both veins are separated by six cells; the area between RP2 and IR2 is distally widened; RP2 and IR2 are gently curved, but not undulating, and reach the posterior margin obliquely; the midfork (base of RP 3/4) is 8 mm basal of the subnodus, and the origin of IR2 is 1.5 mm distal of the midfork; there are four bridge crossveins (Bqs) between RP and IR2 basal of the subnodus; at least one antesubnodal crossvein (between RA and RP basal of the nodus and distal of the arculus) are concentrated in the median part of this wing space, so that there is a "gap" of antesubnodal crossveins directly distal of the arculus and directly basal of the subnodus (presence of a "cordulegastrid gap" *sensu* Bechly, 1996); at least three antefurcal (postmedian) crossveins between RP and MA basal of the RP-midfork; there is no Rspl, but one or two rather long and convex secondary veins (intercalaries) are present in the area between IR2 and RP3/4; there is no Mspl, but two rather long and convex secondary veins (intercalaries) are present in the distal postdiscoidal area between MA and MP; the postdiscoidal area is wide with three rows of cells directly distal of the discoidal triangle and 17 – 18 cells between MA and MP at the posterior wing margin; the postdiscoidal area is distally widened; RP3/4 and MA are more or less parallel, but are slightly undulating on the level of the oblique crossvein 'O'; the area between RP3/4 and MA is slightly widened distally with 2 – 3 rows of cells between them (RP3/4 and MA are separated by three cells at the wing margin), while there is only one row of cells between them till the level of the oblique crossvein 'O'; the discoidal triangle is rather narrow and distinctly elongate longitudinally, unicellular; the distal side MAb is straight; the hypertriangle is free; the costal side of the hypertriangle is rather straight; the basal space and subbasal space are free of crossveins; a distinct secondary anterior branch PsA of AA delimits an unicellular subdiscoidal triangle; there are nine-ten rows of cells in the anal area below AA; there is not a distinct anal angle (thus it is a female specimen); the CuP-crossing is 2mm basal of the arculus; there are no supplementary cubito-anal crossveins; MP is gently curved and ends at the level of the nodus; the area between MP and CuAa is basally distinctly widened with only one row of cells between both veins below the discoidal triangle, and with three rows of cells between them near the posterior wing margin; the "gaff" is straight and very elongated; CuAb (the most basal posterior branch of CuA) is strongly angular to the "gaff"-portion of CuA at the base, while the most basal part of CuAa is aligned with the "gaff" (unique curvature of the base of CuAa); CuAb and a posterior branch of AA enclose a relatively wide and transverse six-celled anal loop which is somewhat indistinctly closed posteriorly; there is one posterior branch of AA; CuAa has five posterior branches; the arculus is indistinctly angled; the two primary antenodal crossveins AX1 and AX2 are obscured aligned, secondary antenodal crossveins poorly preserved; AX1 is basal of the arculus; the basal brace AX0 is not preserved.

The details of the wing's venation depicted in Figs. 3 – 4.



Figs. 3 – 4　*Abrohemeroscopus mengi* gen. *et* sp. nov., holotype, No. DL0157-2

3. Venation of right forewing and hindwing; 4. Venation of left forewing and hindwing.

References

Bechly G, 1996. Morphologische Untersuchungen am Flugelgeader der rezenten Libellen und deren Stammgruppenvertreter (Insecta: Odonatoptera), unter besonderer Berucksichtigung der Phylogenetischen Systematik und des Grundplanes der Odonata. *Petalura* (Sp. Vol.), 2: 1 – 402.

Bechly G, Nel A, Martinez-Delclos X, Fleck G, 1998. Four new dragonflies from the Upper Jurassic of Germany and the Lower Cretaceous of Mongolia (Anisoptera: Hemeroscopidae, Sonidae, and Proterogomphidae fam. nov.). *Odonatologica*, 27 (2): 149 – 187.

Bechly G, Nel A, Martinez-Delclos X, Jarzembowski E A, Coram R, Martill D, Fleck G, Escuillie F, Wisshak M M, Maisch M, 2001. A revision and phylogenetic study of Mesozoic Aeshnoptera, with description of numerous new taxa (Insecta: Odonata: Anisoptera). *Neue Palaontologische Abhandlungen*, 4: 1 – 219.

Carpenter F M, 1992. Treatise on Invertebrate Palaeontology. Part R. Arthropoda 4 (3). Geol. Soc. America Inc. and Univ. Kansas, Boulder, Colorado and Laurence. 79 - 85.

Gao K, Tang Z, Wang X, 1999. A long-necked diapsid reptile from the Upper Jurassic/Lower Cretaceous of Liaoning Province, Northeastern China. *Vertebrate PalAsiatica*, 37 (1): 1 - 8.

Huang D, Nel A, 2001. New 'hemeroscopid' larvae from the Lower Cretaceous of China: systematic and phylogenetic implications (Anisoptera). *Odonatologica*, 30 (3): 341 - 344.

Kukalova-Peck J, 1991. Fossil history and the evolution of hexapod structures. In: Naumann I D ed. The Insects of Australia. A Textbook for Students and Research Workers. 2nd ed. Melbourne: Melbourne University Press. 141 - 179.

Pritykina L N, 1977. New dragonflies from Lower Cretaceous deposits of Transbaikalia and Mongolia. *Trans. Joint Soviet-Mongol. Paleont. Exped.*, 4: 81 - 96.

Ren D, Lu L, 1996. Late Mesozoic fauna assemblages of Yanliao area, North China, and its paleoecological and paleogeographical significance. *Acta Geoscientia Sinica*, 17 (Suppl.): 148 - 154 (in Chinese with English abstract).

Ren D, Lu L, Guo Z, Ji S, 1995. Faunae and stratigraphy of Jurassic-Cretaceous in Beijing and the adjacent areas. Beijing: Seismic Publishing House. 1 - 222 (in Chinese with English abstract).

Riek E F, 1976. A new collection of insects from the Upper Triassic of South Africa. *Annals of the Natal Museum*, 22: 791 - 820.

Riek E E, Kukalova-Peck J, 1984. A new interpretation of dragonfly wing venation based upon early Carboniferous fossils from Argentina (Insecta: Odonatoidea) and basic character states in pterygote wings. *Canadian Journal of Zoology*, 62: 1 150 - 1 166.

中国东北早白垩世一种新的昼蜓化石

(蜻蜓目: 昼蜓科)

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摘要: 本文记述昼蜓科化石一新属新种——孟氏丽昼蜓 *Abrohemeroscopus mengi* gen. *et* sp. nov.。化石采自辽宁省义县早白垩世九佛堂组地层中。新属与巴依萨昼蜓 *Hemeroscopus* Pritykina, 1977 在形态上比较相似, 但在演化程度上更为原始, 主要体现在下面几个方面: (1) 后翅臀套较小, 仅有 6 ~ 7 个翅室; (2) 径增脉 (Rspl) 缺; (3) 后翅 CuAa 脉弯曲, 带有 5 个明显的后分支; (4) 前翅 MP 脉不显短, 终止于翅后缘近翅结处; (5) 翅痣下有一个明显的支脉; (6) 后翅 CuAa 和 MP 域基部较窄, 在三角室下方仅有 1 排翅室。这是昼蜓科化石在中国的最老记录。

关键词: 分类学; 昼蜓科; 新属; 新种; 早白垩世; 中国

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