



A new Chinese Mesozoic dragonfly clarifies the relationships between Rudiaeschnidae and Cymatophlebiidae (Odonata: Aeshnoptera)

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Abstract

A very well preserved fossil specimen of *Rudiaeschna limnobia* Ren and Guo, 1996, is described and diagnosis for *Rudiaeschna* is emended. Its clear morphological structures, including body characters, clarify and confirm the affinities of *Rudiaeschna* and the Rudiaeschnidae with *Cymatophlebia* Deichmüller, 1886, and the Cymatophlebiidae, previously inferred only through venational characters.

Key words: *Rudiaeschna limnobia*, Rudiaeschnidae, Cymatophlebiidae, affinity, Mesozoic, China

Introduction

Ren & Guo (1996) originally placed their Mesozoic genus *Rudiaeschna* into the family Aeshnidae Leach, 1815. Bechly *et al.* (2001) erected the monotypic family Rudiaeschnidae for its potential sistergroup relationships with the Mesozoic family Cymatophlebiidae Handlirsch, 1906, within the superfamily Cymatophlebioidea Handlirsch, 1906. Li & Ren (2002) found two new specimens, from the same locality, belonging to *Rudiaeschna limnobia* Ren and Guo, 1996. But neither of these two specimens had the complete body structure preserved. Later, Lin *et al.* (2004) attributed the genus *Fuxiaeschna* to the Rudiaeschnidae. The relationship between Cymatophlebiidae and Rudiaeschnidae remains ambiguous, due to the lack of well preserved specimens with body structures. Here we describe an exquisitely preserved male fossil, demonstrating the presence of homologous expanded lobes on abdominal segment III. This specimen definitively confirms the affinities of *Rudiaeschna* and the Rudiaeschnidae with *Cymatophlebia* Deichmüller, 1886, and the Cymatophlebiidae.

This fossil specimen was collected from Yixian Formation (Huangbanjigou Village, Beipiao City, Liaoning Province) where numerous fossil insects have been previously discovered (e.g. Zhang *et al.* 2006; Tan et Ren, 2007; Yue *et al.* 2009; Ren *et al.* 2009; Ren *et al.* 2010). But the age of the Yixian Formation is still contentious. Wang *et al.* (2005) believed the Yixian Formation to be Late Tithonian to Berriasian, while others (e.g. Huang et Nel, 2009; Vernoux *et al.* 2010) considered it as the Early Cretaceous. Judging the age by comparing biota from different areas may be an acceptable method for doing so, but it is beyond the scope of this paper.

Material and methods

The study is based on one specimen (only part) preserved in ventral view, with terminalia and secondary genitalia well preserved (NO. CNU-ODO-LB2010001) (Fig. 1). The specimen is now housed in the Key Laboratory of Insect Evolution & Environmental Changes, Capital Normal University, Beijing, China. The specimen was examined with a Leica MZ12.5 dissecting microscope and illustrated with the aid of a drawing tube attached to the microscope. Line drawings were made using Adobe Photoshop CS graphic software.