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First record of the fossil snakefly genus *Mesoraphidia* (Insecta: Raphidioptera: Mesoraphidiidae) from the Middle Jurassic of China, with description of a new species

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Abstract

Mesoraphidia daohugouensis **sp. nov.** is described from the Middle Jurassic Jiulongshan Formation of Inner Mongolia, China. It is diagnosed by the following character states: subquadrate pronotum, narrowly elliptical forewing, distally darkened pterostigma closed respectively by a proximal costal crossvein and a distal radial veinlet, absence of pterostigmal crossvein. The new species represents the first record of Mesoraphidiinae from the Middle Jurassic of China.

Key words: Mesoraphidiinae, taxonomy, Daohugou, Mesozoic

Introduction

Raphidioptera (snakeflies) is a distinctive, small holometabolous insect order belonging to the superorder Neuropterida. Adult snakeflies are characterized by the prognathous head, the narrowly elongate prothorax, and the long ovipositor. Snakeflies are considered to be prosperous in the Mesozoic, with high species diversity and global distribution, but underwent significant extinction at the end of the Cretaceous, leaving extant species as a relict group restricted to the northern hemisphere (Aspöck 1998; Engel 2002; Liu *et al*. 2014).

In the Mesozoic era, Raphidioptera comprises 35 genera and ca. 93 species in six extinct families: Baissopteridae, Chrysoraphidiidae, Juroraphidiidae, Mesoraphidiidae, Metaraphidiidae and Priscaenigmatidae from Eurasia, North America and South America (Liu *et al.* 2013, 2014; Makarkin & Khramov 2014). Only Inocelliidae and Raphidiidae are the snakefly representatives in the Cenozoic. Seven of these families are placed in two suborders (Engel 2002; Liu *et al*. 2014), i.e. Priscaenigmatomorpha (including Chrysoraphidiidae and Priscaenigmatidae) and Raphidiomorpha (including Baissopteridae, Inocelliidae, Mesoraphidiidae, Metaraphidiidae, and Raphidiidae). However, Juroraphidiidae represents a remarkable transitional lineage between these two suborders but lacks subordinal affiliation (Liu *et al*. 2014).

The family Mesoraphidiidae is the predominant group among the Mesozoic snakeflies, presently including 21 genera and 63 species (Bechly & Wolf-Schwenninger 2011; Engel 2002; Engel & Ren 2008; Jepson & Jarzembowski 2008; Jepson *et al*. 2009, 2011; Makarkin & Khramov 2014; Pérez-de la Fuente *et al*. 2010, 2012). Based on the classification proposed by Bechly and Wolf-Schwenninger (2011), Mesoraphidiidae comprises three subfamilies, i.e. Alloraphidiinae, Mesoraphidiinae, Ororaphidiinae and one tribe Nanoraphidiini without clear subfamilial affiliation. Actually, a number of genera placed into Mesoraphidiidae lack clear taxonomic positions. Therefore, the taxonomy of Mesoraphidiidae is in need of comprehensive revision and the monophyly of this family should be tested based on modern phylogenetic methods.

Mesoraphidia currently contains 23 species, among which 10 species were recorded from China (Bechly & Wolf-Schwenninger 2011; Jepson & Jarzembowski 2008; Jepson *et al*. 2009, 2011; Pérez-de la Fuente *et al*. 2010, 2012). Four genera, i.e. *Caloraphidia* Ren, 1997, *Mioraphidia* Ren, 1997, *Phiradia* Willmann, 1994, *Xynoraphidia* Ren, 1997, were synonymized with *Mesoraphidia* (Engel 2002). In addition, several species placed in the genera

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