



Two interesting new genera of Kalligrammatidae (Neuroptera) from the Middle Jurassic of Daohugou, China

QIANG YANG¹, VLADIMIR N. MAKARKIN^{1,2,3} & DONG REN¹

¹College of Life Sciences, Capital Normal University, Beijing, 100048, China. E-mail: rendong@mail.cnu.edu.cn

²Institute of Biology and Soil Sciences, Far East Branch of the Russian Academy of Sciences, Vladivostok, 960022, Russia

³Corresponding author. E-mail: vnmakarkin@mail.ru

Abstract

Two new genera and species of Kalligrammatidae (Neuroptera) *Apochrysogramma rotundum* **gen. et sp. nov.** and *Protokalligramma bifasciatum* **gen. et sp. nov.** are described from the Middle Jurassic of Daohugou, Inner Mongolia, China. The forewing of *Protokalligramma* **gen. nov.** is characterized by the generalised structure of MP, CuA, CuP and 1A, relatively scarce crossveins, absence of an eye-spot, and dense, long spinules ('microtrichia') occurring on its wing membrane. *Apochrysogramma* **gen. nov.** is the second genus in the subfamily Kallihemerobiinae, whose forewing easily differs from that of the type genus by the more rounded shape, much more numerous and closely spaced subcostal veinlets, branches of Rs and MP, less dense crossveins, and differently constructed eye-spot.

Key words: Kallihemerobiinae, Jurassic, fossil, lacewing

Introduction

The extinct family Kalligrammatidae attracts special attention from investigators due to their large size and presumably bright coloration. Many species possess eye-spots similar to those observed on the wings of some butterflies and large moths. It is this feature which has given them the name of the 'butterflies of the Jurassic' (Engel 2005). Other characteristics of most Kalligrammatidae are dense crossveins throughout the wing, hairs covering the entire wing membrane, pectinate MP with branches directed anteriorly, and elongate palpi. All these features make the family one of most advanced neuropteran groups to have existed during the Jurassic. Hitherto, twelve genera (29 species) of Kalligrammatidae are known from the Jurassic to the Early Cretaceous (Walther 1904; Handlirsch, 1906–1908, 1919; Martynova 1947; Panfilov, 1968, 1980; Ponomarenko 1984, 1992; Ren & Guo 1996; Jarzembowski 2001; Ren & Oswald 2002; Ren 2003; Zhang 2003; Zhang & Zhang 2003; Engel 2005; Makarkin *et al.* 2009; Yang *et al.* 2009; Makarkin 2010). Detailed taxonomic treatment and phylogenetic analysis of the family are needed.

More than 60 specimens of Kalligrammatidae have been collected at the Middle Jurassic locality of Daohugou (Province of Inner Mongolia in China) (unpubl. data). Up to now, however, only three species have been described, i.e., *Kallihemerobius pleoneurus* Ren *et Oswald*, 2002 (based on an isolated forewing), *Limnogramma mirum* Ren, 2003, and *Sinokalligramma jurassicum* Zhang, 2003 (both known by isolated hind wings). In the present paper we describe two new genera whose wing venation is quite remarkable compared with other kalligrammatid genera. The forewing of *Apochrysogramma rotundum* **gen. et sp. nov.** is largely rounded with numerous branches of Rs separately originating from R. This is the second species in the subfamily Kallihemerobiinae. It can not be assigned to the type genus, *Kallihemerobius* Ren *et Oswald*, 2002, as it differs considerably from the latter by the more rounded forewing, differently constructed (i.e. embossed) eye-spot, and a number of characters in the venation (e.g., much more numerous and closely spaced subcostal veinlets, branches of Rs and MP, considerably less dense crossveins). The other species (*Protokalligramma bifasciatum* **gen. et sp. nov.**) belongs to a remarkable new genus of the family. It easily differs from other known genera by the generalised structure of MP, CuA, CuP and 1A (all are dichotomously branched), the absence of an eye-spot, and scarce crossveins.