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The oldest known record of Taeniopterygidae in the Middle Jurassic of Daohugou, Inner Mongolia, China (Insecta: Plecoptera)

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Abstract

Two new genera and three new species of family Taeniopterygidae, *Jurataenionema inornatus* Liu and Ren, **gen.** et **sp. nov.**, *Jurataenionema stigmaeus* Liu and Ren, **gen.** et **sp. nov.** and *Protaenionema fuscalatus* Liu and Shih, **gen.** et **sp. nov.** are described from Daohugou village (Middle Jurassic), Inner Mongolia, China. These are the oldest records of Taeniopterygidae. The venations of these two genera were very simple, providing evidence that the costal crossveins and the occasional apical crossveins are derived characters. We suggest the same is true of the extra branches of Rs and CuA in family Taeniopterygidae. Extra branches and crossveins added through geologic time might have improved aerodynamics of the wings.

Key words: Plecoptera, Taeniopterygidae, Daohugou, Inner Mongolia, Middle Jurassic

Introduction

The family Taeniopterygidae contains about 80 extant species that are distributed mainly in Europe and North America and a few are in Central Asia (Ricker & Ross 1975, Zhiltzova 1972, Zwick 1973). Two species in two genera are recorded in China from the Himalayas of Tibet and Baima Jokul of Yunnan Province (Du 1999). Taeniopterygid fossils are very rare, with only 6 species in 4 genera having been reported (Liu & Ren 2006). Among them, 3 species were found in Cenozoic strata and belong to two extant genera (Sinitshenkova 1997); the remaining species were collected from Early Cretaceous rocks in Mongolia and Siberia and belong to extinct genera (Sinitshenkova 1986, 1987).

Recently, we collected numerous Plecoptera fossils from Daohugou Village, Inner Mongolia, China (Liu *et al*. 2006). Nine specimens possess typical characters of Taeniopterygidae, which include venation, tarsus and cerci. They are the oldest specimens of this family, living in the Middle Jurassic about 164 Ma.

The lacustrine deposits at Daohugou Village contained a diverse insect fauna composed of at least fourteen orders and more than 50 genera and 200 species (Zhang 2002, Yao *et al*. 2006, Tan *et al*. 2006, Zhang *et al*. 2006) and many other animal fossils: conchostracans (Zhang & Shen 1987, Shen *et al*. 2003), salamanders (Wang 2004, Gao & Shubin 2003), pterosaurs (Wang *et al*. 2002, Czerkas & Ji 2002), feathered maniraptora (Zhang *et al*. 2002), and mammalia (Ji *et al*. 2006).

The age of Daohugou beds is still debated, ranging from the early Middle Jurassic to Early Cretaceous by various authors, even the same authors, as their research progressed, provided different opinions at different times (Zhang 2005). Recently, Ar–Ar and SHRIMP U–Pb dating shows that the age of intermediate–acidic volcanic rocks overlying the Daohugou fossil–bearing beds (N41° 18.979', E119° 14.318') is about 164–165

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