

Research Advances

A New Species of Aetheogrammatidae (Insecta: Neuroptera) with a Preserved Proboscis from the Lower Cretaceous of NE China



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Objective

The Aetheogrammatidae is a small family of extinct Neuroptera, which comprises six species in five genera, described from the Middle Jurassic to the Lower Cretaceous of China and Kazakhstan. They are easily distinguishable due to their highly derived venation with apical portion of R1 branched in the manner of Rs. Because of dense crossveins, broad shaped wings and other shared characters Aetheogrammatidae are thought to be closely related to Kalligrammatidae, the diverse group of butterfly-like Neuroptera with a long proboscis, which could have played a role in pollination of Mesozoic gymnosperms. However, until now, no information has been available on the mouthpart morphology of Aetheogrammatidae, except for an undescribed specimen from the Lower Cretaceous of Liaoning Province, whose photo was published in the fossil catalogue. Herein, for the first time, we describe a new species of Aetheogrammatidae based on a nearly complete specimen with preserved mouthparts.

Methods

The specimen, acquired from the private collector, come from the Lower Cretaceous lacustrine strata of the Yixian formation exposed at Yangshuwanzi, Ningcheng County of Chifeng City (Inner Mongolia, China). The age of the Yixian formation is currently estimated to be late Barremian to early Aptian, more than 60 species of Neuroptera have been described from here, not to mention other fossil insects, plants and vertebrates. The photographs of the specimen were taken by Canon EOS 5D Mark III, and mouthparts were photomicrographed under Zeiss SteREO Discovery V8. Line drawings were prepared from photographs using the image-editing software Adobe Photoshop CS6. The holotype is housed in Shandong Tianyu Museum of Nature (STMN; Pingyi County, China).

Systematic paleontology

Order Neuroptera Linnaeus, 1758

Family Aetheogrammatidae Ren and Engel, 2008

Genus *Aetheogramma* Ren and Engel, 2008

Aetheogramma glycephila sp. nov.

Derivation of name. From the Greek words glycos («sweet») and philia («love»).

Type material. Holotype STMN48-1621a, b, part and counterpart.

Diagnosis. Forewing: broad, subtriangular in shape [ovoid in two other species of the genus, *A. speciosum* Ren et Engel, 2008 and *A. bistriatum* Yang et al., 2015], stem of CuP split [simple in other species], Rs with one major branch [with two main branches in other species]. Hindwing: R1 with 2–3 terminal upward branches [absent in other species], distal portion of Sc bended downward [running parallel to the wing margin in other species], with costal veinlets forked and connected by 2–3 crossveins [simple, connected by single crossveins in other species], branches of Rs deeply forked [simple in other species].

Description. Forewing 45 mm long, 30 mm wide (here and below all measurements as preserved), R1 with 2 branches, 1st (major) branch of Rs originates proximad to 1st branch of R1 and 2nd (minor) branch of Rs originates distad to 1st branch of R1, MA and MP1 simple, MP2 bifurcates three times, CuA with 3 branches, CuP with 5 branches, A1 with terminal fork, A2 pectinate. Hindwing 48 mm long, ca. 26 mm wide, R1 with two downward and 2–3 upward branches, Rs with two branches, MA and MP1 simple, MP2 bifurcates three times, CuA with two branches. Proboscis 5.4 mm long, with two paired outer long structures (probably maxillary of labial palps) and two paired inner long structures attached to the common stem (probably maxilla).

Comments. *A. glycephila* is assigned to *Aetheogramma* based on the following diagnostic characters: presence of more than one branch of R1 in hindwing [one in *Cyclicogramma* Yang et al., 2015], Rs with two branches in forewing [five in *Ectopogramma* Engel et al., 2011 and *Kalligrammina* Panfilov, 1980], 1st bifurcation of MP

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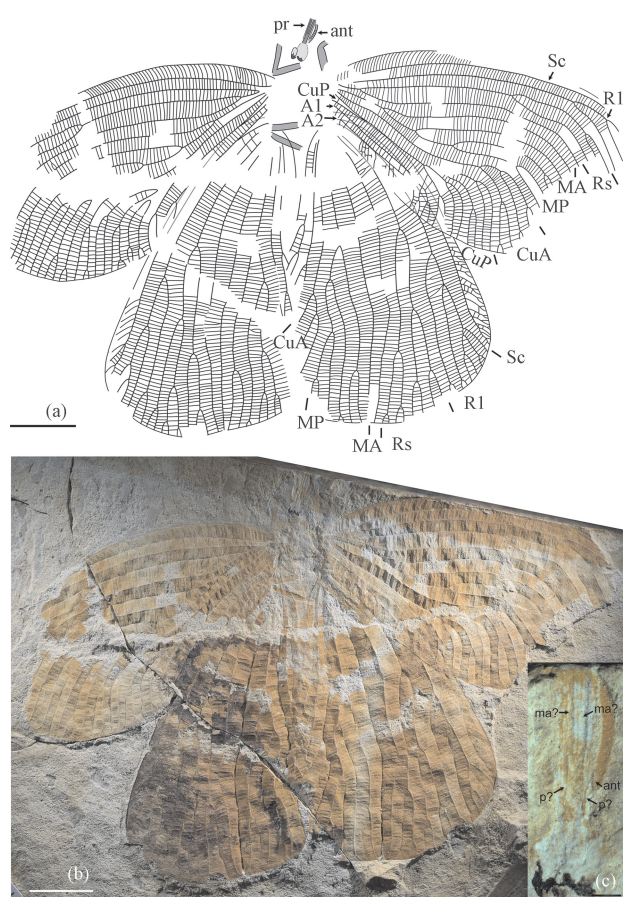


Fig. 1. *Aetheogramma glycephila* sp. nov. (Neuroptera: Aetheogrammatidae) from the Lower Cretaceous of the Yixian Formation. (a) drawing; (b) total photo; (c) close-up photo of mouthparts. Abbreviations: ant, antenna, ma, maxillary appendage, p, maxillary or labial palp, pr, proboscis. Scale bars: 10 mm, (a, b), 1 mm (c).

situated proximally, close to where MA originated from Rs in forewing [far more distally, at the level of bifurcation of CuA in *Curtogramma* Yang et al., 2015].

Conclusion

A. glycephila sp. nov. is the first formally described species of Aetheogrammatidae with a preserved proboscis. The finding expands the scope of known diversity of long-proboscid pollinators recovered from the Yixian formation. Before now, five families of pollinating insects with specialized siphonate mouthparts have been recorded from these strata: Tabanidae *s.l.* and Nemestrinidae of Diptera, Aneuretopsyichidae and Mesopsyichidae of Mecoptera and Kalligrammatidae of Neuroptera. With proboscis widely varying in length (ca. from 3 to 18 mm), these pollinators apparently visited reproductive organs of different plant species. This indicates that complex pollinating systems had been well established by the time of origin of the first angiosperms, a few of whom were reported from the Yixian formation (Han et al., 2013).

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