



A new genus of Saucrosmylinae (Insecta, Neuroptera) from the Middle Jurassic of Daohugou, Inner Mongolia, China

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Abstract

A new genus and new species of Saucrosmylinae (Insecta, Neuroptera) is described as *Huiyingosmylus bellus* **gen. et sp. nov.**, based on a well-preserved forewing from the Middle Jurassic of Daohugou, Inner Mongolia, China. *Huiyingosmylus* **gen. nov.** is characterized by the large size of forewing, relatively wide R1 space with several rows of cells, anteriorly bent Rs, dense crossveins over the entire wing and undulate outer margin. A key to the genera of Saucrosmylinae is provided.

Key words: Neuroptera, Saucrosmylinae, *Huiyingosmylus*, Middle Jurassic, China

Introduction

The subfamily Saucrosmylinae Ren & Yin, 2003, provisionally assigned to the family Osmylidae (Insecta, Neuroptera), is characterized by the large body size, the wing R1 area with numerous crossveins producing several rows of cells, vein Rs bent antero-distally and CuA bounding a large triangular area. Its systematic position is questionable and is considered as a distinct family by several authors (Wang *et al.* 2011, Yang *et al.* 2012, Makarkin *et al.* 2013). In the meantime, the exceptional preservation of the wing details of the new find provides additional biological information (see below). Until the present study, only four genera from the Middle Jurassic of Inner Mongolia, China, have been attributed to Saucrosmylinae, including *Saucrosmylus* Ren & Yin, 2003; *Rudiosmylus* Ren & Yin, 2003; *Laccosmylus* Ren & Yin, 2003 and *Bellinympha* Wang *et al.*, 2010.

In this study, a new genus and new species of Saucrosmylinae is described as *Huiyingosmylus bellus* **gen. et sp. nov.** based on a well-preserved forewing from the Middle Jurassic Daohugou Beds near Daohugou Village, Wuhua Township, Ningcheng County, Chifeng City, Inner Mongolia, China. The Daohugou Beds, consisting of grey tuff, tuffaceous siltstone and mudstone, are now considered to be one of the most important insect Lagerstätten (Rasnitsyn & Zhang 2004). The fossil insects at this locality are commonly preserved as compressions in grey tuffaceous siltstones, found together with small freshwater conchostracans (Wang *et al.* 2009).

All photographs were taken using a Canon PowerShot SX100IS digital camera. The line drawing was prepared on photographs using the image-editing software CorelDRAW 12. The traditional venational terminology of Comstock (1918) (*sensu* Wootton 2003) with the recent interpretation of Oswald (1993) and Archibald & Makarkin (2006) is used in this study. Wing vein abbreviations are as follows: C, costa; Sc, subcosta; R, radius; R1, first branch of R; Rs, radial sector; Rs1, most basal branch of Rs; M, media; MA, media anterior; MP, media posterior; Cu, cubitus; CuA, cubitus anterior; CuP, cubitus posterior; 1A–3A, first to third anal veins. The specimen described in this paper is housed at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (prefix NIGP).

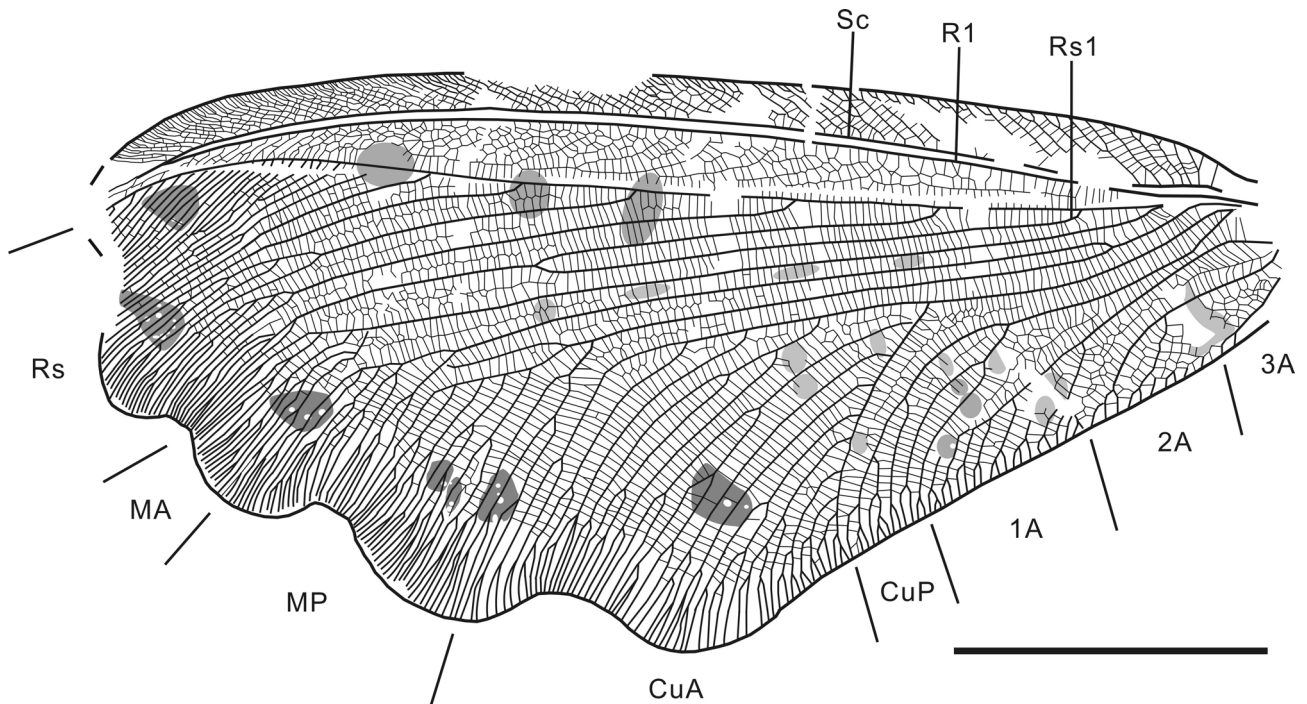


FIGURE 2. Line drawing of the holotype NIGP156190. Scale bar = 20 mm.

Key to genera of Saucrosmylinae

1. At least forewing known 2
- Only hindwing known 4
2. Forewing with outer margin slightly undulate *Saucrosmylus*
- Forewing with outer margin strongly undulate 3
3. Pinna-like markings on the wing surface; Rs sharply bent anteriorly towards R1 *Bellinympha*
- Spotted markings on the wing surface; Rs slightly bent anteriorly towards R1 *Huiyingosmylus*
4. Hindwing with at most 4 rows of cells in R1 area; Rs slightly bent anteriorly towards R1 *Rudiosmylus*
- Hindwing with at most 7 rows of cells in R1 area; Rs sharply bent anteriorly towards R1 *Laccosmylus*

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References

- Archibald, S.B. & Makarkin, V.N. (2006) Tertiary giant lacewings (Neuroptera: Polystoechotidae): revision and description of new taxa from western North America and Denmark. *Journal of Systematic Palaeontology*, 4, 119–155.
<http://dx.doi.org/10.1017/s1477201906001817>
- Comstock, J.H. (1918) *The wings of insects*. Comstock Publication Company, Ithaca, NY, 430 pp.
- Edmunds, M. (1974) *Defence in animals*. Longman, Harlow (Essex), xvii + 357 pp., 8 pls.
- Leach, W.E. (1815) Artikel entomology. *Edinburgh Enclopaedia*, 9 (1), 57–172.
- Linnaeus, C. (1758) *Systema naturae per regna tria naturae secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis, 10th ed., Vol. 1*. Salvii, Holmiae, 824 pp.

- Makarkin, V.N., Yang, Q., Shi, C.F. & Ren, D. (2013) The presence of the recurrent veinlet in the Middle Jurassic Nymphidae (Neuroptera) from China: a unique condition in Myrmeleontoidea. *ZooKeys*, 325, 1–20.
<http://dx.doi.org/10.3897/zookeys.325.5453>
- Oswald, J.D. (1993) Revision and cladistic analysis of the world genera of the family Hemerobiidae (Insecta: Neuroptera). *Journal of the New York Entomological Society*, 101, 143–299.
- Rasnitsyn, A.P. & Zhang, H.C. (2004) Composition and age of the Daohugou hymenopteran assemblage from Inner Mongolia, China. *Palaeontology*, 47, 1507–1517.
<http://dx.doi.org/10.1111/j.0031-0239.2004.00416.x>
- Ren, D. & Yin, J.C. (2003) New ‘osmylid-like’ fossil Neuroptera from the Middle Jurassic of Inner Mongolia, China. *Journal of the New York Entomological Society*, 111, 1–11.
[http://dx.doi.org/10.1664/0028-7199\(2003\)111\[0001:nofnft\]2.0.co;2](http://dx.doi.org/10.1664/0028-7199(2003)111[0001:nofnft]2.0.co;2)
- Wang, B., Li, J.F., Zhang, H.C. & Fang, Y. (2009) Preliminary elemental analysis of fossil insects from the Middle Jurassic of Daohugou, Inner Mongolia and its taphonomical implications. *Chinese Science Bulletin*, 54, 783–787.
<http://dx.doi.org/10.1007/s11434-008-0561-5>
- Wang, Y.J., Liu, Z.Q., Wang, X., Shih, C.K., Zhao, Y.Y., Engel, M.S. & Ren, D. (2010) Ancient pinnate leaf mimesis among lacewings. *Proceedings of the National Academy of Sciences of United States of America*, 107, 16212–16215.
<http://dx.doi.org/10.1073/pnas.1006460107>
- Wang, Y.J., Ren, D. & Shih, C.K. (2011) An enigmatic Neuroptera family from the Middle Jurassic China with a discussion of the evolutionary significances. In: *XI International Symposium on Neuropterology*. Ponta Delgada, Portugal, pp. 13–15.
- Wootton, R.J. (2003) Wings. In: Resh, V.H. & Carde, R.T. (Eds.), *Encyclopedia of insects*. Academic Press, London, pp. 1186–1192.
- Yang, Q., Makarkin, V.N., Winterton, S.L., Khramov, A.V. & Ren, D. (2012) A remarkable new family of Jurassic insects (Neuroptera) with primitive wing venation and its phylogenetic position in Neuropterida. *PLOS ONE*, 7, e44762.
<http://dx.doi.org/10.1371/journal.pone.0044762>