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Revision of the genus *Suljuktocossus* Becker-Migdisova, 1949 (Hemiptera, Palaeontinidae), with description of a new species from Daohugou, Inner Mongolia, China

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Abstract

In this paper a complete specimen of fossil Palaeontinidae, *Suljuktocossus yinae* sp. nov. from Daohugou (Jiulongshan Formation) in Inner Mongolia, China is described. This new species is established based on both complete forewings and hindwings. According to this specimen, the diagnosis of the genus *Suljuktocossus* is revised. Moreover, based on the distribution of the genus *Suljuktocossus*, we consider the age of the Daohugou biota as Middle Jurassic.

Key words fossil, morphology, Cicadomorpha, Middle Jurassic

Introduction

The genus *Suljuktocossus* erected by Becker-Migdisova is represented only by an incomplete forewing from the Early Jurassic of Shurab, Tadzhikistan (Becker-Migdisova, 1949). Recently another species belonging to this genus from the Daohugou biota, Inner Mongolia was reported (Wang *et al*., 2007). From the same beds, the specimen we discovered is in remarkably good condition; both forewings and hind wings can be seen clearly.

Previously, the rich entomofauna from the Jiulongshan Formation in Daohugou Village, Ningcheng County, Inner Mongolia was dated as Middle Jurassic (Ren *et al*., 1995; Ren & Krzemiski, 2002; Ren *et al*., 2002; Shen *et al*., 2003; Chen *et al*., 2004; Liu *et al*., 2004; Gao & Ren, 2006; Huang *et al*., 2006; Ji *et al*., 2006; Yao *et al*., 2006; Tan & Ren, 2006; Liu *et al*., 2007), Late Jurassic (Zhang, 2002) or Early Cretaceous (Wang *et al*., 2005). Among these rich insect fossils, 14 genera and 27 species of palaeontinids were recorded from Daohugou biota (Wang *et al*., 2006a-c; Wang *et al*., 2007; Wang & Ren, 2006; Wang & Ren, 2007; Wang *et al*., 2007a-c). This specimen of *Suljuktocossus* sheds new light on the age of the Daohugou fossil-bearing beds. Up to now, 3 species of *Suljuktocossus* are known from the Lower Jurassic of Shurab in Tadzhikistan and Daohugou, Inner Mongolia in China. These three species have a close relationship. Based on accurate Ar-Ar and SHRIMP U-Pb dating shows that the age of Daohugou intermediate-acid volcanic rocks overlying the Daohugou fossil-bearing beds is about 164-165 Ma, and that the age of this fossil-bearing beds is older than or equal to 165 Ma (Liu *et al*., 2004). We adopt statement of Middle Jurassic age (Jiulongshan Formation) as proposed from the analysis of the Coleoptera (Tan & Ren, 2006), Plecoptera (Liu *et al*., 2007) and Hemiptera fossils assemblage recently described by Yao et al. (2006) and Wang et al. (2006a).

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Material and methods

The specimen was examined by the dissecting microscope (Type: LEICA MZ12.5) and illustrated with the aid of a drawing tube. The specimen studied here is deposited in the Key Lab of Insect Evolution and Environmental Change, College of Life Science, Capital Normal University, Beijing, China. The wing venation nomenclature used in this paper is based on the interpretation of Becker-Migdisova (1949).

Systematic descriptions

Order Hemiptera Linnaeus, 1785
Suborder Cicadomorpha Evans, 1946
Family Palaeontinidae Handlirsch, 1906 =Cicadomorphidae Evans, 1956
Genus *Suljuktocossus* Becker-Migdisova, 1949
Type species: *Suljuktocossus prosboloides* Becker-Migdisova, 1949.

Revised diagnosis: Forewing triangular with blurry CP and nodal line. Sc arising from basal single and parallel R before fusing with R_1. M 4-branched. CuA curved at basal, connected with M by a short crossvein m-cua, and dividing into CuA_1 and CuA_2. Crossvein m_4-cua curved, and connected with CuA at the dividing point. CuP slightly curved before ending to margin. A 2-branched. A_2 with 2 branches and the longer branch fused with A_1 a little before distal end of clavus.

Hind wing with obvious indentation. Sc coalesced with R for a short distance and upwards single to indentation. M 4-branched. M_1 separated from M basally, and fused with Rs for a long interval. The stem of M_{3+4} long and a little curved, M_{3+4} bifurcating in to M_3 and M_4 distad of CuA dividing point. CuA connected with M_{3+4} by a short crossvein. CuP simple. A with 2 branches.

Species included: Three species: *S. prosboloides*, Becker-Migdisova, 1949, *S. chifengensis* Wang, Zhang and Fang, 2007 and *S. yinae* sp. nov.

Remarks: Until now, 14 genera and 27 species assigned to the family Palaeontinidae have been reported from Daohugou, Inner Mongolia in China. The genus *Suljuktocossus* Becker-Migdisova, 1949 was erected just based on a single incomplete forewing. The material described here consists of complete forewings and hind wings with part and counterpart.

Among these genera, *Suljuktocossus* Becker-Migdisova, 1904 is similar to *Pseudocossus* Martynov, 1931 in forewing, but differs from the latter with blurry CP and nodal line, Sc without branches and the longer branch of A_2 fused with A_1 before distal end of clavus.

It differs from *Gansucossus* (Hong, 1983) Wang, Zhang and Fang, 2006 in hind wing with stem M long and A_1 terminated in anal margin.

Based on hind wings venation (Sc coalesced with R for a short distance and upwards single to indentation, M_1 fused with Rs for a long interval and M_{3+4} bifurcating in to M_3 and M_4 distad of CuA dividing point), this genus is quite similar to *Shurabocossus* Becker-Migdisova, 1949, but it differs from the latter mainly by the following combination of features: R 3-branched and A_2 short and extended downwards to the anal margin near base.

***Suljuktocossus yinae* sp. nov.**
(Figs. 1, 2)

Diagnosis: Forewing with M_{1+2} separated distad of M_{3+4}, m_4-cua slightly S-shaped and m-cua connected with M at the point of M arising from R+M. Hind wing as for genus.

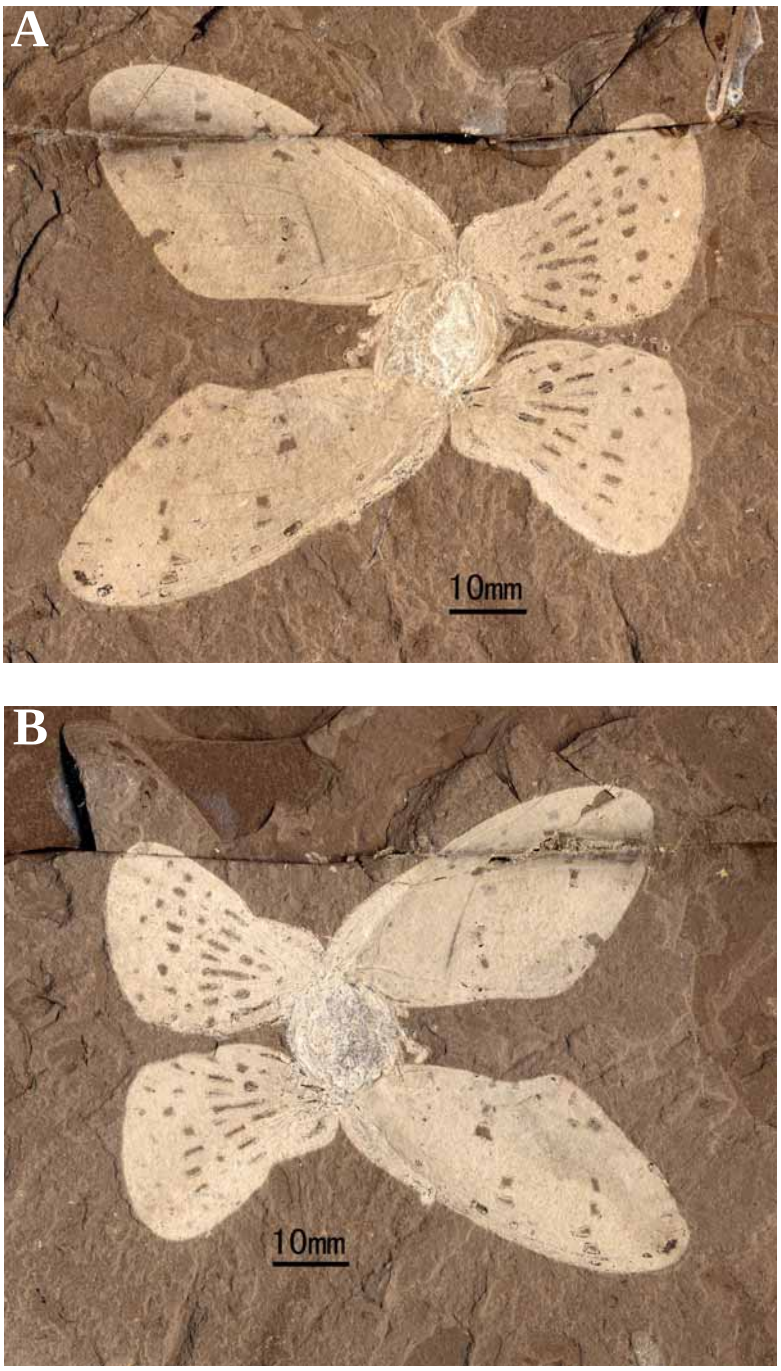

FIGURE 1. *Suljuktocossus yinae* sp. nov., holotype: A, photograph of part, No. CNU-H-NN2007001-1; B, photograph of counterpart, No. CNU-H-NN2007001-2.

Description. Body compressed with both forewings and hind wings. Thorax and abdomen preserved, but obscure. One leg, probably hind leg, partly preserved. 2 segments of tarsi and second longer than first. Pretarsus visible.

Forewing length 56mm, width 27mm. Anterior margin blurry indented where nodal line reaches margin. CP present and ending at nodal indentation. Sc without branches, paralleling R+M for long interval and curved slightly upwards slightly before point of R+M separation, fused with R_1 beyond point of R division into R_1 and Rs. R+M arising basally. R bifurcating at same level of M separation into M_{1+2} and M_{3+4}. M_{1+2} separated

distad of M_{3+4}, and divided into M_1 and M_2 slightly before indentation. M_1 connected with Rs by short crossvein r-m. Crossvein m-cua connected with M at point of M separation from R+M. Stem of Cu short at base, forking into CuA and CuP. CuA curved when meeting crossvein m-cua, and bifurcating into CuA_1 and CuA_2 distad of M separated into M_{1+2} and M_{3+4}, but basas of M_{3+4} bifurcation. Crossvein m_4-cua slightly S-shaped and connected with CuA at point of CuA forking. CuP departing from Cu basally and slightly curved before reaching margin. Clavus small with 2 anal veins. A_2 with 2 branches, shorter branch curved downward to margin at base; longer branch fused with A_1 little before distal end of clavus. Nodal line traceable as indentation fused with R_1 for a short distance and cutting Rs little beyond point of Sc fusing with R_1, then reaching M just beyond M fork, finally fused with m_4-cua to connection with CuA_2, following latter for a short distance and then reaching CuP at distal end of clavus.

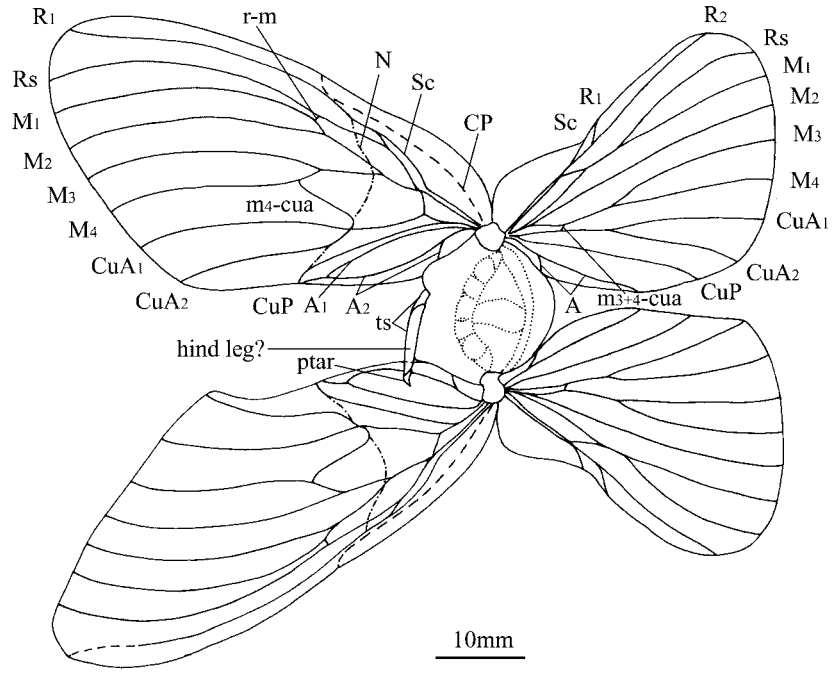

FIGURE 2. *Suljuktocossus yinae* sp. nov., line drawing of holotype, No. CNU-H-NN2007001-1. *ts*. tarsus; *ptar*, pretarsus.

Hind-wing length 35mm, width 25mm. Hind-wing with obvious indentation. Sc arising basally, fused with R at the point of R branching into R_{1+2} and Rs, and extended a short distance, curved upwards single to indentation. R parallel Sc before branching into R_{1+2} and Rs. R_1 arising from R_{1+2} at same level of indentation, then subparallel to Sc before ending at costal margin. R_2 flattened before reaching costal margin above apex of wing. Rs curved and fused with M_1 for a long interval after dividing from R. M 4-branched. M_1 separated from M basally, and slightly convex before fusing with Rs. M_2 straight and arising from M after the point of M_1 separated from M. Stem of M_{3+4} long, connected with CuA by short crossvein m_{3+4}-cua and little curved when crossvein meeting M_{3+4}. M_{3+4} branched into M_3 and M_4 at same level of indentation. CuA bifurcated slightly basad than M_{3+4}. CuP simple. A 2-branched. A_2 short and curved downwards to anal margin near base. Both forewings and hind wings with distinct color pattern consisting of regular dark patches on a pale ground.

Etymology: This species is named after Miss. Yin Ruiyue who collected this fossil and donated it to us.

Material: The new species is established based on compressed body with a pair of forewings and hind-wings. Holotype: Both forewings and hind-wings, part and counterpart, No.: CNU-H-NN2007001-1, CNU-H-NN2007001-2.

Horizon and locality: Jiulongshan Formation, Middle Jurassic, Daohugou Village, Ningcheng County, Inner Mongolia in China.

Remarks: This species is assigned to *Suljuktocossus* by the main characters of forewing, such as CP present, Sc arises from basal single and parallel R before fusing with R_1, crossvein r-m short, the nodal line developed, are consistent with the type species.

The new species can be distinguished from the type species in the following features on the forewing: a short crossvein r-m near indentation, m_4-cua slightly S-shaped and m-cua connected with M at the point of M arising from R+M.

This species is also similar to *S. chifengensis* Wang, Zhang and Fang, 2007, but it is different from the latter in the following features on the forewing: M_{1+2} forking near indentation and M_4 not sharply curved.

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