

# Stuttgarter Beiträge zur Naturkunde

## Serie B (Geologie und Paläontologie)

Herausgeber:

Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart

Stuttgarter Beitr. Naturk.	Ser. B	Nr. 317	8 pp., 2 figs.	Stuttgart, 28. 3. 2002
----------------------------	--------	---------	----------------	------------------------

### A new genus of kalligrammatid lacewings from the Middle Jurassic of China (Neuroptera: Kalligrammatidae)

By Dong Ren, Beijing/China and John D. Oswald,  
College Station/Texas, USA

With 2 Figures

#### Abstract

*Kallihemerobius pleioneurus* n. g. n. sp. is described and illustrated from the Jurassic Jiulongshan Formation of eastern Inner Mongolia, China. *Kallihemerobius* is noteworthy for the pectinate anterior radial trace of its forewing. Although this trait is generally regarded as characteristic of the neuropteran family Hemerobiidae, the new genus is assigned to the family Kalligrammatidae on the basis of other forewing traits.

#### Zusammenfassung

Aus der Jiulongshan-Formation (Jura) der östlichen Inneren Mongolei, China, wird *Kallihemerobius pleioneurus* n. g. n. sp. beschrieben und abgebildet. *Kallihemerobius* ist bemerkenswert wegen der pectinaten (kammförmigen) Verzweigung des Radius anterior auf dem Vorderflügel. Obwohl dieses Merkmal gewöhnlich als bezeichnend für die Neuropteren-Familie Hemerobiidae betrachtet wird, wird die neue Gattung der Familie Kalligrammatidae aufgrund anderer Merkmale des Vorderflügels zugeordnet.

#### Introduction

The family Kalligrammatidae comprises a group of rather large neuropterans currently described only from Jurassic-age compression fossils. To date, eight genera (*Angarogramma* PONOMARENKO; *Kalligramma* WALTHER; *Kalligrammina* PANFILOV in DOLIN et al.; *Kalligrammula* HANDLIRSCH; *Lithogramma* PANFILOV; *Meioneurites* HANDLIRSCH; *Palparites* HANDLIRSCH; *Sophogramma* REN & GUO) and 18 species have been described from a variety of sites in Europe [Germany] and Asia [Kazakhstan, Mongolia, Russia, China] (CARPENTER 1992; HANDLIRSCH 1906–08, 1919; LAMBKIN 1994; MARTYNOVA 1947, 1962; PANFILOV 1968, 1980; PONOMARENKO 1984, 1992; REN & GUO 1996; WALTHER 1904). An undescribed

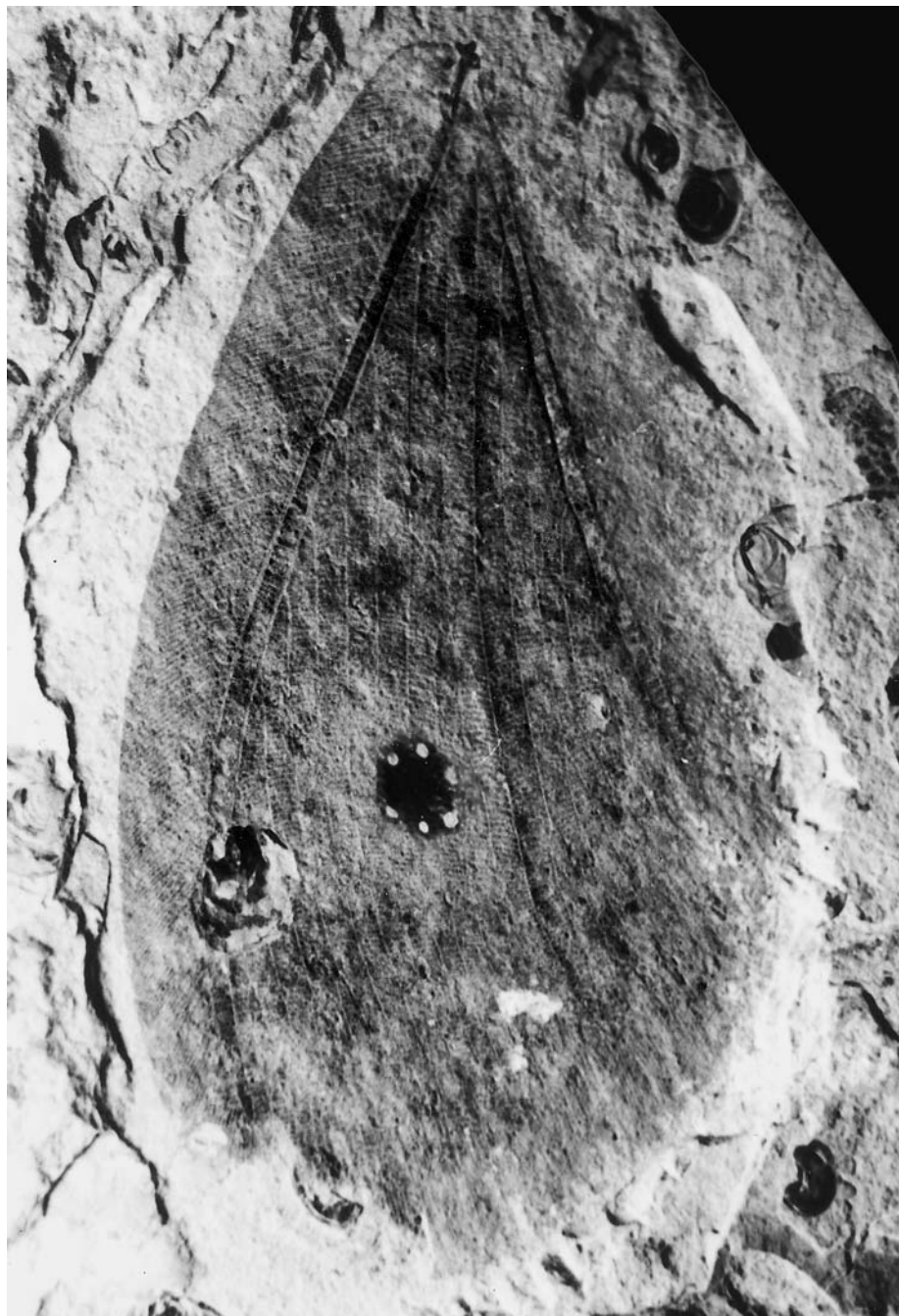


Fig. 1. *Kallibemerobius pleioneurus* n. g. n. sp., holotype (NGMC no. NN99010), photograph. Same scale as Fig. 2.

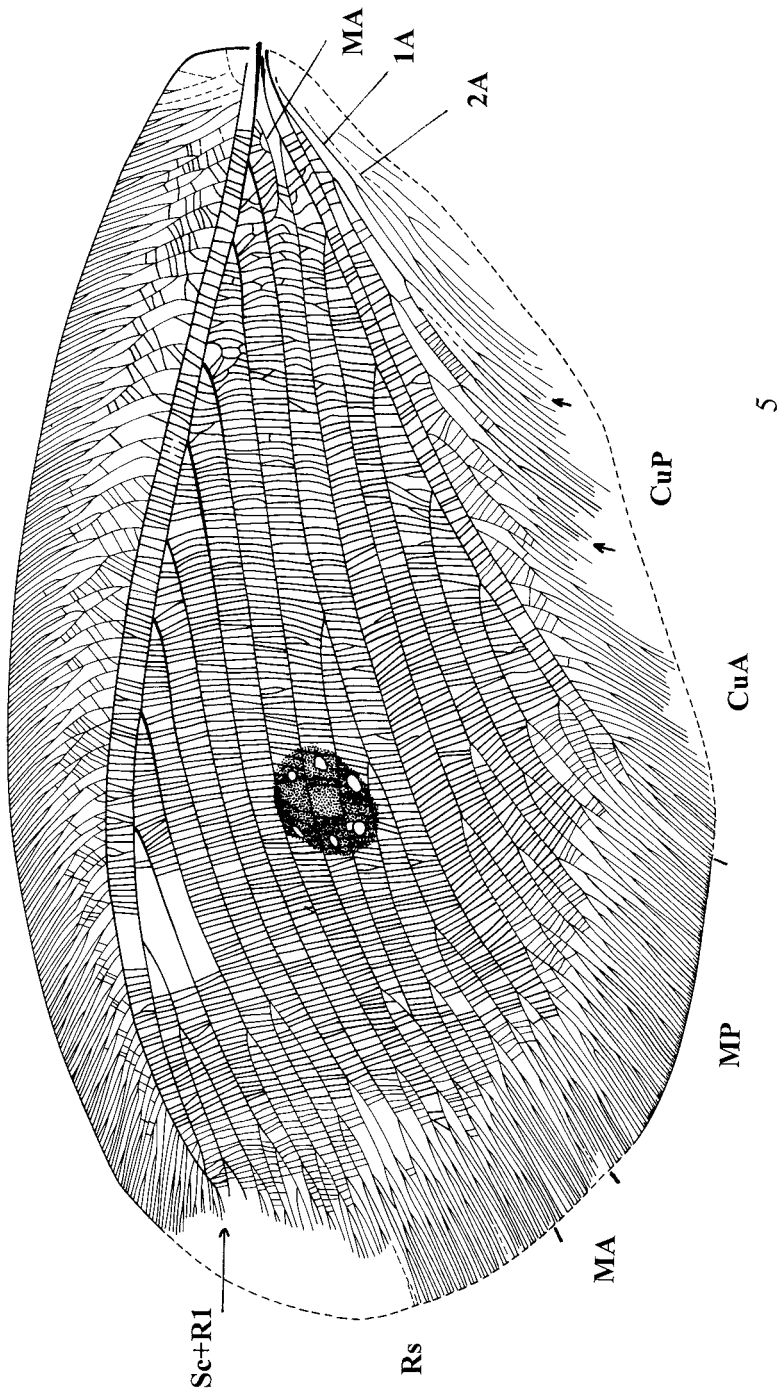


Fig.2. *Kallihemerobius pleioneurus* n. g. n. sp., holotype (NGMC no. NN99010), line drawing (the absence of crossveins in the sub-costal and radial spaces directly below the “pterostigmal” region is due to occluding debris and is artifactual). Scale 5 mm.

kalligrammatid-like specimen has also recently been figured by BECHLY (1998: 98) and BECHLY et al. (2001: 53, fig. 43) from the Lower Cretaceous of Brazil. If confirmed as a kalligrammatid this specimen would significantly extend both the geographic and temporal ranges of the family. No kalligrammatids are currently known from North America, Africa or Australia.

The present paper describes and discusses a distinctive new kalligrammatid species from the Middle Jurassic Jiulongshan Formation, a lacustrine sedimentary sequence with outcrops in northeastern China (REN et al. 1995). The paleoenvironment reconstructed for this formation is that of a volcanic region cut by mountain streams (REN & LU 1996). Jiulongshan strata have yielded a diverse arthropod fauna that includes insects belonging to the orders Ephemeroptera, Odonata, Plecoptera, Blattodea, Orthoptera, Heteroptera, Homoptera, Neuroptera, Mecoptera, Hymenoptera and Diptera (HONG 1983; REN 1993, 1996) and freshwater conchostracans (ZHANG & SHEN 1987). These fossils, and other data, have been used to estimate the age of the Jiulongshan Formation as Late Aalenian or Early Bajocian, early Middle Jurassic (WANG 2000). The lacewing fossil described below was collected by one of the authors (D. REN) from a section of the Jiulongshan Formation composed of gray tuffaceous sandstone and sandy mudstone that is exposed in the village of Dao-hugou, Inner Mongolia, China.

### Material and Methods

**Material:** This study is based on a single specimen contained in the collection of the National Geological Museum of China (NGMC).

**Illustrations:** The line drawing was prepared with the aid of a camera lucida attached to a Wild M5 dissecting microscope.

**Terminology:** Venational terminology follows OSWALD (1993a).

### Systematic paleontology

Order Neuroptera LINNAEUS, 1758

Family Kalligrammatidae HANDLIRSCH, 1906

Genus *Kallihemerobius* n. g.

Type species: *Kallihemerobius pleioneurus* n. sp.

Derivation of name: Kalli- (from Greek *kállos*, beauty) + -hemerobius (from *Hemerobius*, type genus of the neuropteran family Hemerobiidae); gender: masculine.

Included species: (1) *Kallihemerobius pleioneurus* n. sp.: Middle Jurassic Jiulongshan Formation of Inner Mongolia, China.

**Diagnosis.** – *Kallihemerobius* can be distinguished by the pectinately branched anterior radial trace of the forewing, a trait not known in any other taxon currently assigned to the family Kalligrammatidae.

**Description.** – As for *Kallihemerobius pleioneurus* n. sp. (see below).

*Kallihemerobius pleioneurus* n. sp.

Figs 1–2

**Holotype:** a nearly complete left forewing (forewing inferred from broad costal area) exposed in dorsal view, parts of apical and cubitoanal margins missing or obscured. Sex unknown. NGMC no. NN99010.

Type locality: China, Inner Mongolia, Ningcheng county, Shantou township, Dao-hugou village.

Type horizon: Jiulongshan Formation, early Middle Jurassic (late Aalenian – early Bajocian stages).

Derivation of name: pleio- (from Greek *pleion*, more) + -neurus (from Gr. *neuron*, nerve), in reference to the dense crossvenation of the holotype.

Diagnosis. – As for *Kallihemerobius* n. g. (see above).

Description. – Forewing (Figs. 1–2): shape obovate, margin apparently continuously convex, though some marginal regions missing (apex) or obscured (cubitoanal margin); length ca. 50 mm, maximum width ca. 29 mm; crossveins very numerous and dense over most of wing, but largely absent adjacent to wing margin; nygmata not discernable; a conspicuous dark oval macula with an internal ring of six small pale spots present in center of wing disc; trichosors present, distinct along margin of MP space (probably more generally distributed around at least distal parts of wing margin, but undetectable due to poor preservation of much of this margin); costal space very wide (in basal half of wing >4 times width of subcostal space), with numerous forked subcostal veinlets, many of which are linked by multiple crossveins; differentiated pterostigmal region apparently absent; humeral area of costal space poorly preserved, presence or absence of recurrent humeral veinlet unclear; subcostal space densely crossvenate; R1 fused with Sc distally; Sc+R1 probably terminating on margin near wing apex (exact position uncertain because wing apex is lacking); Rs almost completely incorporated into R1, resulting in a condition in which anterior radial trace is linear and pectinately branched on posterior side (similar to the condition found in many hemerobiids); anterior radial trace with 10 oblique branches proximal to its fusion with Sc; basalmost branch of anterior radial trace (interpreted here as MA) a short arched vein fused distally with stem of second branch of anterior radial trace (see Discussion below), the latter branched near middle of wing and possibly marking divergence of MA from R; posterior MP trace linear and pectinately branched on anterior side, with six primary, mostly long-stemmed MP branches occupying a broad area of posterior remigium; anterior CuA trace linear, simple at base, pectinate on posterior side more distally, paralleling posterior MP trace nearly to wing margin; CuP dichotomously branched; 1A and 2A long and dichotomously branched; 3A obscure.

## Discussion

Based on the intraspecific variation frequently observed in the venation of extant neuropterans, we suspect that the short, arched condition of the vein interpreted here as the base of the MA represents individual variation in the holotype of *K. pleioneurus*. The “normal” MA state for this species would probably be a condition in which it was not fused with the basal branch of the anterior radial trace.

The most striking venational trait of *Kallihemerobius* is its pectinately branched anterior radial trace. Pectinate branches such as these are often referred to descriptively in the Neuroptera as multiple “radial sectors”. This condition is unknown in other kalligrammatids, and only rarely encountered in other neuropteran groups – most notably in the family Hemerobiidae, where it is almost universal (OSWALD 1993a). Close examination of the holotype reveals no evidence that this condition in



*K. pleioneurus* is a preservational artifact. It appears, rather, to represent a true reassociation of the branches of the typically pectinate neuropteran Rs with the anterior radial trace.

The presence of this condition in *K. pleioneurus* suggests a possible phylogenetic association with the family Hemerobiidae. Although such an association cannot be entirely ruled out, it seems unlikely. Recent phylogenetic work on extant hemerobiids by OSWALD (1993a, 1993b, 1994) supports the hypothesis that high “Rs” numbers are derived within this family, with multiple lineages independently trending toward the development of higher “Rs” numbers. If *Kallihemerobius* was a hemerobiid, its high “Rs” number (10) would place it in a very derived position within the Hemerobiidae – a situation that is difficult to reconcile with its numerous apparent similarities with the family Kalligrammatidae (see below). Unfortunately, other putative synapomorphies of the basal lineages of extant hemerobiids are not useful for interpreting the phylogenetic affinities of *Kallihemerobius* because none pertain to features of the forewing.

We here place *Kallihemerobius* in the Kalligrammatidae based on the following suite of characters (primarily from MARTYNOVA [1962] and CARPENTER [1992]), which it shares with most other kalligrammatid genera: (1) posterior MP trace pectinate on anterior side, (2) crossveins extremely numerous and dense over entire wing except for immediately adjacent to wing margins, (3) at least one prominent macula or eye-spot present on the remigium, typically located near the center of the wing, (4) MA branched in distal portion of wing only, i.e., with a long simple stem, (5) Sc and R1 fused distally, (6) costal area broad, (7) wing size large. This assignment, however, must be regarded as tentative because synapomorphies rigorously demonstrating the monophyly of the Kalligrammatidae have yet to be identified.

In assigning *Kallihemerobius* to the Kalligrammatidae, we interpret its strongly pectinate anterior radial trace to be a convergent similarity with the Hemerobiidae. Unlike the situation in the Hemerobiidae, however, no kalligrammatid taxa are presently known that exhibit “Rs” counts intermediate between the high number seen in *Kallihemerobius* and the single Rs present in other known kalligrammatid genera. It will be interesting to see if future kalligrammatid discoveries bridge this character state gap.

### Acknowledgements

This project received financial support from the National Natural Science Foundation of China (39870093, 30025006, 49972001), the Young Scientist Program of the Ministry of Land and Resources of the People's Republic of China (9801) and the Beijing Natural Science Foundation (5002013).

### References

- BECHLY, G. (1998): Santana – Die Schatzkammer fossiler Insekten aus der Unterkreide Brasiliens. – Fossilien, 1998/2: 95–99; Korb.
- BECHLY, G., HAAS, F., SCHAWALLER, W., SCHMALFUSS, H. & SCHMID, U. (2001): Ur-Geziefer – Die faszinierende Evolution der Insekten. – Stuttgarter Beitr. Naturk., C, 49: 96 pp.; Stuttgart.
- CARPENTER, F. M. (1992): Treatise on Invertebrate Paleontology. Part R. Arthropoda 4. Vols. 3 and 4: Superclass Hexapoda. 3: xxi + 1–277, 4: ii + 279–655; Lawrence/Kansas (Geological Society of America and University of Kansas). – [Neuropterida parts: 4: 338–356]
- HANDLIRSCH, A. 1906–1908. Die fossilen Insekten und die Phylogenie der rezenten Formen. 1430 pp.; Leipzig (W. Engelmann).

- (1919): Eine neue Kalligrammide (Neuroptera) aus dem Solnhofener Plattenkalke. – *Senckenbergiana*, 1: 61–63; Frankfurt a.M.
- HONG, Y. (1983): Middle Jurassic fossil insects in North China. 223 pp.; Beijing (Geological Publishing House). – [Chinese with English abstract]
- LAMBKIN, K. J. (1994): *Palparites deichmuelleri* HANDLIRSCH from the Tithonian Solnhofen Plattenkalk belongs to the Kalligrammatidae (Insecta: Neuroptera). – *Paläontologische Zeitschrift*, 68: 163–166; Stuttgart.
- MARTYNOVA, O. M. (1947): Kalligrammatidae (Setchatokrylye) iz yurskikh slantsev Kara-Tau (Kazakhskaya SSR) [=Kalligrammatidae (Neuroptera) from Jurassic shales of Kara-Tau (Kazakh SSR)]. – *Doklady Akademii nauk SSSR (N.S.)*, 58: 2055–2068; Moskva. – [Russian]
- (1962): Nadotryad Neuropteroidea. – *In*: ROHDENDORF, B. B. (Ed.): *Osnovy Paleontologii*, Vol. 9; Moskva (Akademiia Nauk SSSR). – [Russian] – [English translation: MARTYNOVA, O. M. (1991): Superorder Neuropteroidea. – *In*: DAVIS, D. R. (Ed.): *Fundamentals of Paleontology*, Vol. 9. Arthropoda, Tracheata, Chelicerata. Pp. 383–404; Washington, D.C. (Smithsonian Institution Libraries and The National Science Foundation).]
- 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; New York. – [1993a]
- (1993): A new genus and species of brown lacewing from Venezuela (Neuroptera: Hemerobiidae), with comments on the evolution of the hemerobiid forewing radial vein. – *Systematic Entomology*, 18: 363–370; Oxford. – [1993b]
- (1994): A new phylogenetically basal subfamily of brown lacewings from Chile (Neuroptera: Hemerobiidae). – *Entomologica Scandinavica*, 25: 295–302; Copenhagen.
- PANFILOV, D. V. 1968. Kalligrammatidy (Neuroptera, Kalligrammatidae) iz yurskikh otlozhenii Karatau [=Kalligrammatids (Neuroptera, Kalligrammatidae) from the Jurassic deposits of Karatau]. – *In*: ROHDENDORF, B. B. (Ed.): *Yurskie nasekomye Karatau* [=Jurassic insects of Karatau]. – *Otdelenie Obshchei Biologii*: 166–174; Moskva (Akademiya Nauk SSSR). – [Russian]
- (1980): Novye predstaviteli setcharokrylykh (Neuroptera) iz yury Karatau [=New representatives of lacewings (Neuroptera) from the Jurassic of Karatau]. – *In*: DOLIN, V. G., PANFILOV, D. V., PONOMARENKO, A. G. & PRITYKINA, L. N.: *Iskopaemye nasekomye mezozoya* [=Fossil insects of the Mesozoic]. *Naukova Dumka*: 82–111; Kiev (Akademiya Nauk Ukrainskoj SSR, Institut Zoologii). – [Russian]
- PONOMARENKO, A. G. 1984. Neuroptera from the Jurassic in eastern Asia. *Paleontologicheskii Zhurnal*, 1984/3: 64–73; Moskva. – [Russian] – [English translation (1985): *Paleontological Journal*, 18/3: 59–69; New York.]
- (1992): Setchatokrylye (Insecta, Neuroptera) iz nizhnego mela Zabaykal'ya [=Neuroptera (Insecta) from the Lower Cretaceous of Transbaykalia]. – *Paleontologicheskii Zhurnal*, 1992/3: 43–50; Moskva. – [Russian] – [English translation: 1992, *Paleontological Journal*, 26/3: 56–66; New York.]
- REN, D. 1993. Discovery of fossil bittacids in China. – *Acta Geologica Sinica*, 7: 219–224; Beijing.
- (1996): On the new fossil genera and species of Neuroptera from Late Jurassic of Northeast China. – *Acta Zootaxonomica Sinica*, 21: 461–480; Beijing.
- REN, D. & GUO, Z. (1996): On the new fossil genera and species of Neuroptera (Insecta) from the Late Jurassic of northeast China. – *Acta Zootaxonomica Sinica*, 21: 461–480; Beijing.
- REN, D. & LU, L. (1996): Late Mesozoic fauna assemblages of Yanliao area, North China, and its paleoecological and paleogeographical significance. – *Acta Geoscientia Sinica*, 17 (Suppl.): 148–154; Beijing. – [Chinese with English abstract]
- REN, D., LU, L. & GUO, Z. (1995): Faunae and stratigraphy of Jurassic-Cretaceous in Beijing and the adjacent areas. 222 pp.; Beijing (Seismic Publishing House). – [Chinese with English abstract]
- WANG, S. (2000): *The Stratigraphical Monographies of China: Jurassic*. 154 pp; Beijing (Geological Publishing House). – [Chinese]
- WALTHER, J. (1904): Die Fauna der Solnhofener Plattenkalke. – *Denkschriften der Medizinisch-Naturwissenschaftlichen Gesellschaft zu Jena*, 11: 133–214; Jena.

ZHANG, W. & SHEN, Y. (1987): Discovery of Jurassic conchostracans with well-preserved soft parts and notes on its biological significance. – *Acta Palaeontologica Sinica*, **26**: 127–145; Beijing.

Addresses of the authors:

D. Ren, Department of Biology, Capital Normal University, Beijing 100037, China.  
Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Science, Nanjing 210008, China.  
E-mail: sarahshi@public.east.net.cn

J. D. Oswald, Department of Entomology; Texas A&M University; College Station, TX 77843-2475, USA  
E-mail: j-oswald@tamu.edu