

A new fossil genus of Fuziidae (Insecta, Blattida) from the Middle Jurassic of Jiulongshan Formation, China

Dandan WEI

College of Life Sciences, Capital Normal University,
Beijing, 100048 (China)
weidandanok@126.com

Junhui LIANG

Tianjin Museum of Natural History,
206 Machang Road, Hexi District, Tianjin, 300074 (China)
liangjh0602@126.com

Dong REN

College of Life Sciences, Capital Normal University,
Beijing, 100048 (China)
rendong@mail.cnu.edu.cn

Wei D. D., Liang J. H. & Ren D. 2013. — A new fossil genus of Fuziidae (Insecta, Blattida) from the Middle Jurassic of Jiulongshan Formation, China. *Geodiversitas* 35 (2): 335-343. <http://dx.doi.org/10.5252/g2013n2a3>

ABSTRACT

KEY WORDS
Blattaria,
Blattida,
Blattodea,
Fuziidae,
Jiulongshan Formation,
China,
Middle Jurassic,
new genus,
new species.

Colorifuzia agenora n. gen., n. sp., attributed to the family Fuziidae Vršanský, Liang & Ren, 2009 is described from the Middle Jurassic of Jiulongshan Formation in Daohugou Village (Inner Mongolia, China). The new species is the first representative of the family with distinct pattern of coloration, indicating Fuziidae was able to adapt to diverse environments in this locality during the Middle Jurassic. Plesiomorphic characters such as considerably wide body, forewing large, coloration markings suggest *Colorifuzia* n. gen as a comparatively plesiomorphic taxon among Fuziidae.

RÉSUMÉ

MOTS CLÉS
Blattaria,
Blattida,
Blattodea,
Fuziidae,
Formation Jiulongshan,
Chine,
Jurassic moyen,
genre nouveau,
espèce nouvelle.

Un nouveau genre fossile de Fuziidae (Insecta, Blattida) du Jurassique moyen de la Formation Jiulongshan, Chine.

Colorifuzia agenora n. gen., n. sp., attribué à la famille des Fuziidae Vršanský, Liang & Ren, 2009 est décrit du Jurassique moyen de la Formation Jiulongshan à Daohugou Village (Mongolie intérieure, Chine). L'espèce nouvelle est le premier représentant de la famille montrant un motif coloré distinct, indiquant que ce Fuziidae était capable de s'adapter à divers environnements dans cette localité du Jurassique moyen. Des caractères plésiomorphes comme un corps très élargie, des ailes antérieures larges et une coloration marquée suggèrent que *Colorifuzia* n. gen. correspond à un taxon primitif au sein des Fuziidae.

INTRODUCTION

In the fossil record, cockroach (Blattida Latreille, 1810) are first documented in sediments from the Late Carboniferous (Belayevan *et al.* 2002; Brongniart 1885), namely from the earliest Pennsylvanian (Namurian B/C) Qilianshan entomofauna of China (Zhang *et al.* 2012; Guo *et al.* 2013). As a result of their long history on the earth, Blattida reached a high level of diversity, including forewings with coloration markings and intercalaries for the family Caloblattinidae Vršanský & Ansoerge, 2000, simple wing venation of the family Blattulidae Vishniakova, 1982, jumping cockroach of the family Skokidae Vršanský, 2007, and carnivorous cockroach of the family Raphidiomimidae Vishniakova, 1973. Until now, there are many families reported from fossil and extant cockroaches (Vršanský *et al.* 2002, 2009; Roth 2003; Liang *et al.* 2006; Vršanský 2010).

The Fuziidae Vršanský, Liang & Ren, 2009, including the genera *Fuzia* Vršanský, Liang & Ren, 2009 and *Parvifuzia* Guo & Ren, 2011 was established by Vršanský *et al.* (2009). The collection housed at the College of Life Sciences of the Capital Normal University (Beijing) includes hundreds of specimens of this family. Among them, five well-preserved specimens exhibit unique characters and particular coloration markings on body and/or wings, prompting us to erect a new genus *Colorifuzia* n. gen.

ABBREVIATIONS

A	anal veins;
Ant	antenna;
C	cercus;
CNU	Capital Normal University, Beijing;
CuA	cubitus anterior;
CuP	cubitus posterior;
Fant	antennal socket;
LFW	left forewing;
M	medial veins;
RFW	right forewing;
R	radius;
R1	first radius;
Rs	radius sector;
Sc	subcosta.

MATERIAL AND METHODS

The type specimens of the new genus are deposited in the fossil insect collection of the Key Laboratory

of Insect Evolution & Environmental Changes, Capital Normal University, Beijing, China. The specimens were examined with a Leica MZ 12.5 dissecting microscope and illustrated with the aid of a drawing tube attached to the microscope. Line drawings were made with Photoshop CS 8.0 graphic software. Photographs of fossils were taken by a MZ12.5 dissecting microscope (Leica, Wetzlar, Germany) and a Nikon D100 camera.

All the specimens of the new genus were found from Jiulongshan Formation in Daohugou Village, Ningcheng County, Inner Mongolia, China. There have been number of well-preserved insects described (Yao *et al.* 2006; Gao *et al.* 2009; Gu *et al.* 2009; Cui *et al.* 2010; Ren *et al.* 2010), including recently reported pterosaur parasites (Vršanský *et al.* 2010). The age of Jiulongshan Formation is still controversial, but it is generally accepted that the age is the Middle Jurassic (Ren *et al.* 2002; Shen *et al.* 2003; Chen *et al.* 2004; Gao *et al.* 2006).

SYSTEMATICS

Order BLATTIDA Latreille, 1810
 Superfamily CALOBLATTINOIDEA
 Vršanský & Ansoerge *in* Vršanský, 2000
 Family FUZIIDAE
 Vršanský, Liang & Ren, 2009

Genus *Colorifuzia* n. gen.

TYPE SPECIES. — *Colorifuzia agenora* n. gen., n. sp.

SPECIES INCLUDED. — Type species only.

ETYMOLOGY. — *Colorifuzia* is a combination of the Latin “color”, referring to its forewing’s unique coloration markings, and the type genus name “*Fuzia*”; gender feminine.

DIFFERENTIAL DIAGNOSIS. — The new genus differs from *Fuzia* and *Parvifuzia* in having relatively larger body size, coloration markings located in the area of R and M of forewing, and forewing venation rich and comparatively wide.

The new genus can be attributed within Fuziidae based on the following characters: male body elongated (Fig. 2B), male cerci with forceps (Fig. 2C); forewing costal area long, CuA expanded.

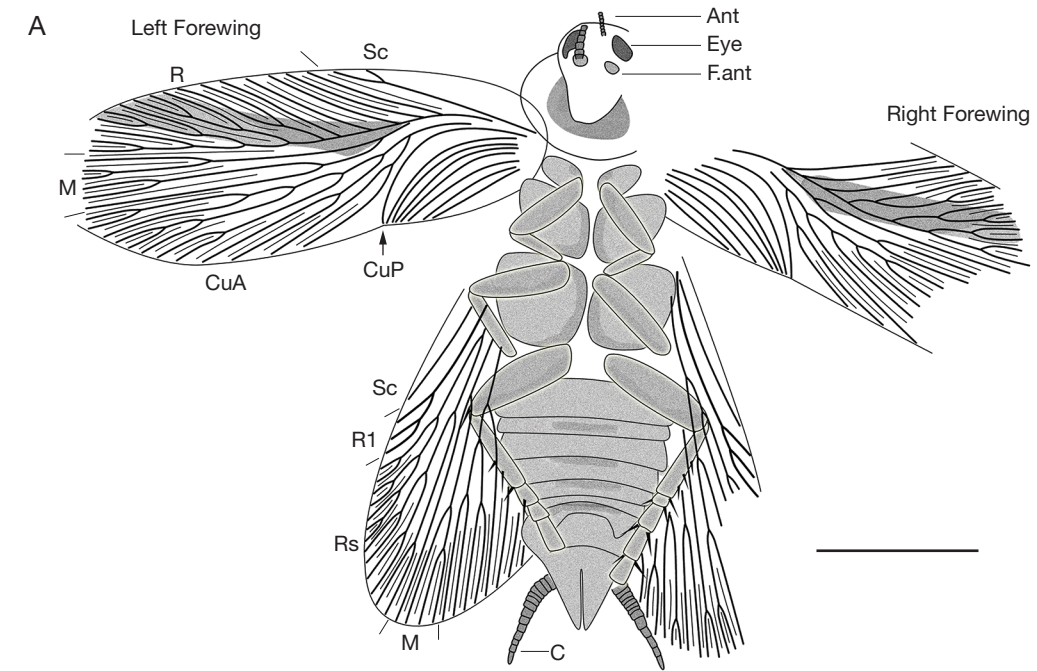


FIG. 1. — *Colorifuzia agenora* n. gen., n. sp., holotype (CNU-BLA-NN-2011001), female: **A, C**, line drawing (**A**) and photograph (**C**) of the whole specimen; **B**, detail of female terminalia with ovipositor and cerci. Scale bars: **A, C**, 5 mm; **B**, 2 mm. Abbreviations: see Material and methods

Colorifuzia agenora n. sp.
(Figs 1-4)

DIAGNOSIS. — By monotypy, as for the genus.

HOLOTYPE. — A relatively completely preserved female specimen, CNU-BLA-NN-2011001.

PARATYPES. — CNU-BLA-NN-2011003, 004, 015, 016.

TYPE LOCALITY. — Daohugou Village, Wuhua Township, Ningcheng County, Inner Mongolia, China.

TYPE HORIZON. — Jiulongshan Formation, Middle Jurassic.

ETYMOLOGY. — The name *agenora* is after the Greek prefix *agenor* (meaning “dignity”) for its sclerotised wings and large body size.

DESCRIPTION

Large-sized, strongly sclerotised species, with body length 19.5-21.5 mm (with head), width 5.1-6.5 mm. Head small, significantly elongated (length/width = 2.2-2.9 mm/1.7-2.1 mm), about 1/7 of the total body length, antennal socket and compound eye obvious at sides, mouthparts unclear.

Pronotum

Elliptical, large, as wide as the body, with dark coloration at center, length/width = 2.9-3.2 mm/4.9-5.5 mm.

Abdomen

Ten segments visible; in female, external ovipositor (Fig. 1B) very wide (length = 1.8 mm), and cerci at the terminal sternum; in male, body elongate, very narrow, cerci with 14 segments, forming forceps with notches (Fig. 2C).

Wings

Wide, coloration as in Figures 1A; 2B; 3B; 4A, B; forewing with intercalaries and rich venation, with 39-48 veins at margin; the shape of the forewing has sexual dimorphism: wide near apex in female and sharp apex in male.

Forewings

Elliptical, length/width = 14.9-16.1/5.5-6.7 mm, with more or less parallel margins and characteristic coloration marking (dark maculas are

located between R and M, beginning from M and extending to the apex of the wing to form a stripe) (Figs 1A; 2B; 3B; 4A, B); costal area very long (about 2/5 of the wing's length); intercalaries pale; Sc simple or bifurcated near margin (Fig. 2A), curved upward and somewhat thickened, longer than clavus; R slightly curved and with 15-23 branches, R branches sometimes fused at margin, which is the exception of deformity to *Colorifuzia* (Fig. 3A); M branched basally and reaching apex, with 2-6 veins; CuA gently curved, expanded with 11-17 branches; CuP strongly curved; clavus short, less than a third of the wing's length; A arc bending, with 5-8 veins.

Hind wings

Many terminal branches, with intercalaries; Sc simple; darkened R1 with 2-4 branches and Rs with 10-15 branches; M with 3-6 branches, reaching apex; CuA with more than seven veins.

Leg

Slender; legs gradually get longer from the front to the hind legs; femora more or less as long as tibiae in all legs (length of fore femora and tibiae 2.2 mm and 2.1 mm, respectively; length of mid femora and tibiae 2.5 mm and 2.2 mm, respectively; length of hind femora and tibiae 3.3 mm and 3.1 mm, respectively); hind leg with spines on the tibia, width of hind femora and tibiae 0.8 mm and 0.4 mm, respectively.

DISCUSSION

The afore-mentioned characters support that *Colorifuzia* n. gen. belongs to the family Fuziidae. *Colorifuzia* shows many synapomorphies (forewing large, coloration markings) within Caloblattinidae Vrsansky & Ansonge, 2000. Thus, the unique coloration markings absent from other genera of Fuziidae and found frequently among Caloblattinidae might indicate that *Colorifuzia* is a comparatively plesiomorphic taxon among Fuziidae.

The Fuziidae is thought to have an endemic distribution, with three genera found in Daohugou

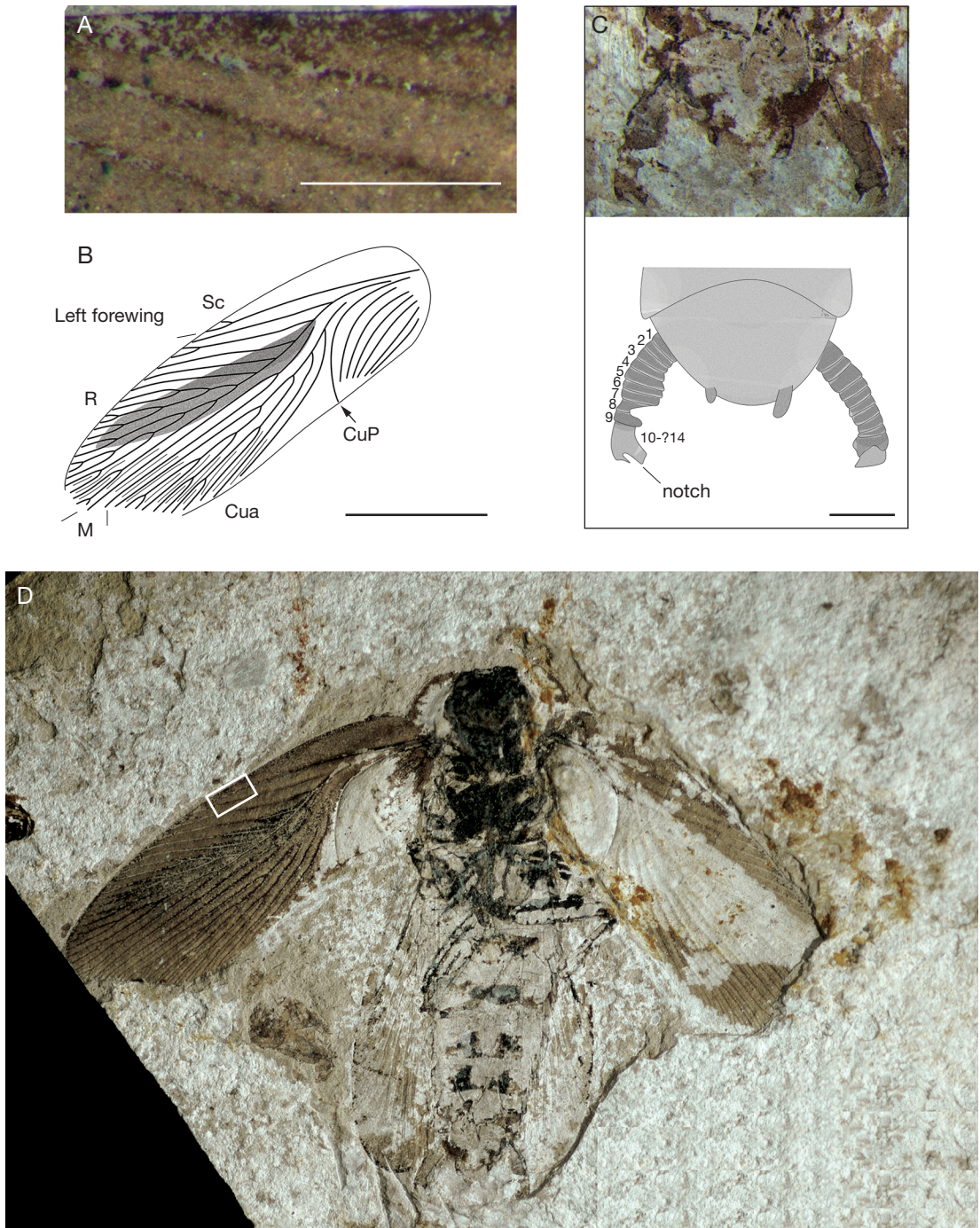


FIG. 2. — *Colorifuzia agenora* n. gen., n. sp., paratype (CNU-BLA-NN-2011015), male: **A**, detail of the male forewing Sc (white rectangle on **D**); **B**, **D**, line drawing (**B**) and photograph (**D**) of forewing; **C**, line drawing and photograph of detail of male paratype terminalia with forceps-like cerci. Scale bars: A, 1 mm; B, D, 5 mm; C, 2 mm. Abbreviations: see Material and methods.

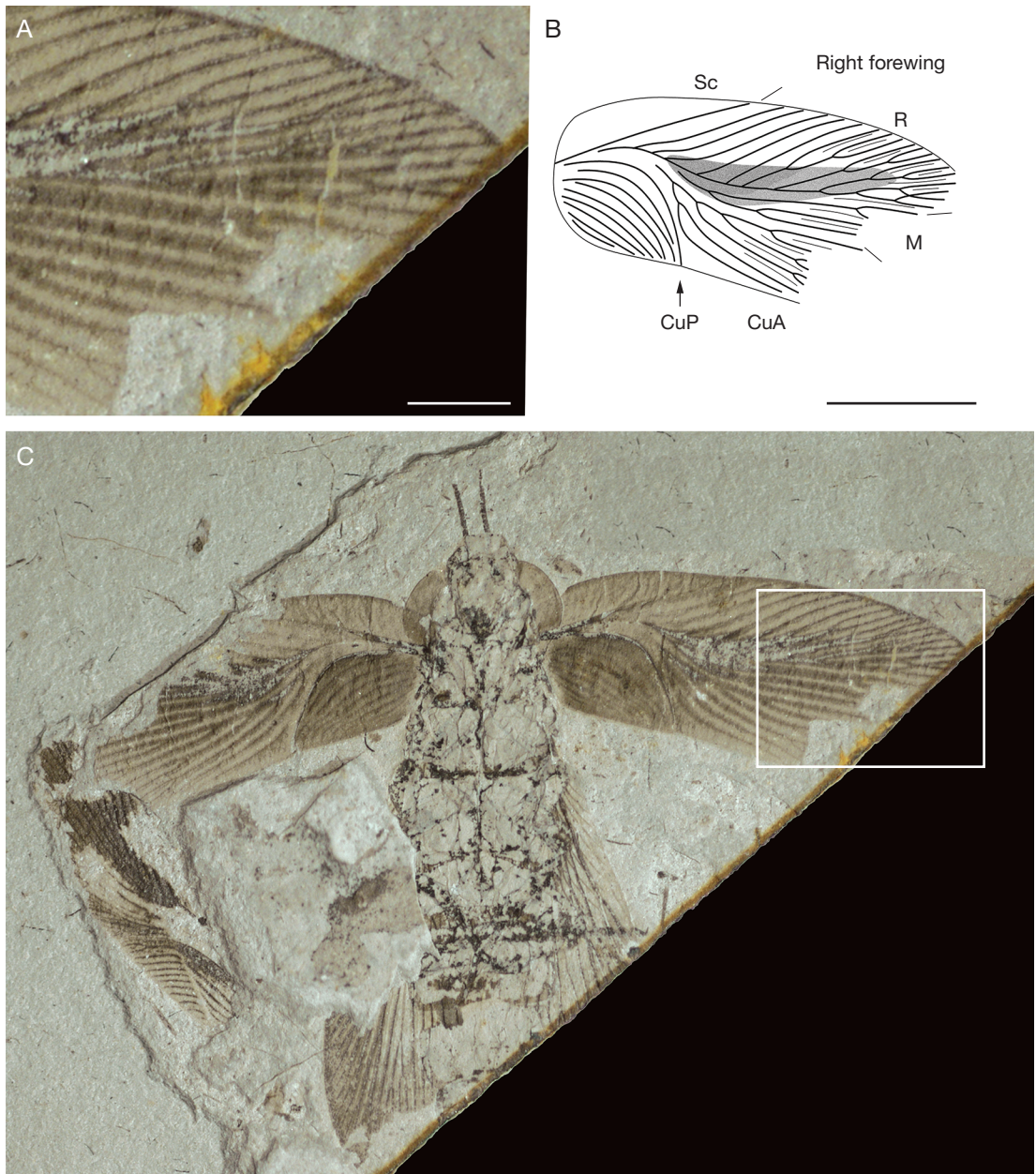


FIG. 3. — *Colorifuzia agenora* n. gen., n. sp. (Wei *et al.* 2012); **A-C**, paratype (CNU-BLA-NN-2011016), male; **A**, detail of the male right forewing venation; **B**, line drawing of forewing; **C**, photograph. Scale bars: A, 1 mm; B, 5 mm.

locality only. There are hundreds of specimens of Fuziidae in the CNU collection, ranging from large-sized *Colorifuzia* (body length 19.5-21.5 mm) to

small-sized *Parvifuzia* (body length 9.7-10.45 mm), suggesting very prosperous, quick development at that time.

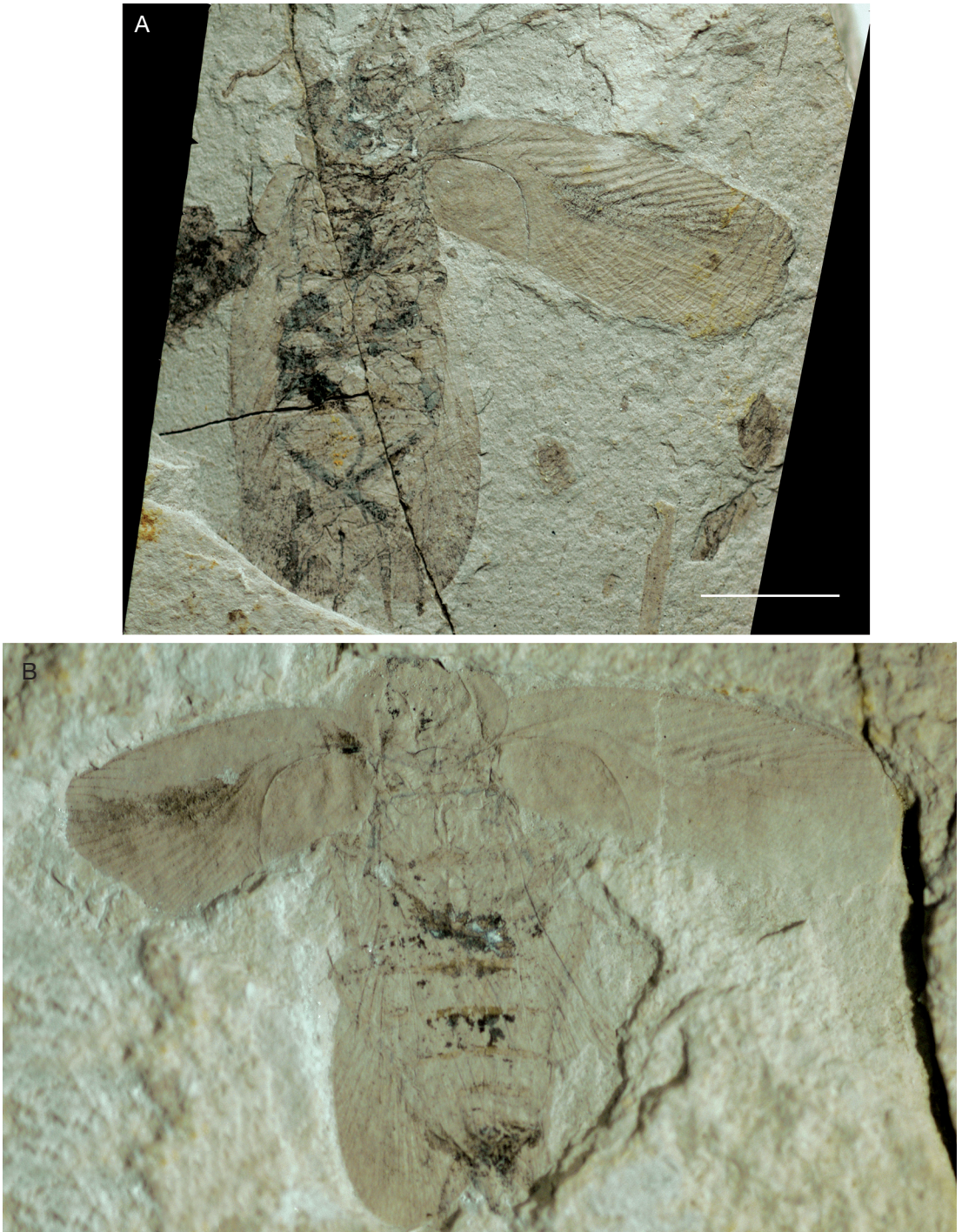


FIG. 4. — *Colorifuzia agenora* n. gen., n. sp., paratype (CNU-BLA-NN-2011003, 004), female: **A**, CNU-BLA-NN-2011003; **B**, CNU-BLA-NN-2011004. Scale bar: 5 mm.

This new genus overturns the idea that forewings of the Fuziidae was without coloration markings (Vršanský *et al.* 2009).

Acknowledgements

We sincerely thank Dr Peter Vršanský, Dr Chung-Kun Shih and two anonymous reviewers for revision of the manuscript, and are grateful to Yingying Cui, Dr Yunzhi Yao, Junjie Gu, Qiang Yang, Taiping Gao, Chaofan Shi and other students of our laboratory for help. This research is supported by the National Natural Science Foundation of China (nos 31230065, 41272006), Project of Great Wall Scholar and Key project of Beijing Municipal Commission of Education (grants KZ201310028033).

REFERENCES

- BELAYEVAN N. V., BLAGODEROV V. A., DMITRIEV V. Y., ESKOV K. Y., GOROCHOV A. V., IVANOV V. D., KLUGE N. Y., KOZLOV M. V., LUKASHEVICH E. D., MOSTOVSKI M. B., NOVOSKHONOV V. G., PONOMARENKO A. G., POPOV Y. A., PRITYKINA L. N., RASNITSYN A. P., SHCHERBAKOV D. E., SINITSHENKOVA N. D., STOROZHENKO S. Y., SUKATSCHEVA I. D., VISHNIAKOVA V. N., VRŠANSKÝ P. & ZHERIKHIN V. V. 2002. — *History of Insects*. Kluwer Academic Publishers, Dordrecht, 517 p.
- BRONGNIART C. 1885. — Les insectes fossiles des terrains primaires. Coup d'œil rapide sur la faune entomologique des terrains paléozoïques. *Bulletin de la Société des amis des Sciences naturelles de Rouen* 1885: 50-68.
- CHEN W., JI Q., LIU D. Y., ZHANG Y., SONG B. & LIU X. Y. 2004. — Isotope geochronology of the fossil-bearing beds in the Daohugou area, Ningcheng, Inner Mongolia. *Geological bulletin of China* 23 (12): 1165-1169 (in Chinese with English summary).
- CUI Y. Y., BÉTHOUX O., SHIH C. K. & REN D. 2010. — A new species of the Family Juraperlidae (Insecta: Grylloblattida) from the Middle Jurassic of China. *Acta Geologica Sinica* (English Edition) 84 (4): 710-713.
- GAO T. P., REN D. & SHIH C. K. 2009. — The First Xyelotomidae (Hymenoptera) from the Middle Jurassic in China. *Annals of the Entomological Society of America* 102 (4): 588-596.
- GU J. J., ZHAO Y. Y. & REN D. 2009. — New fossil Prophalangopsidae (Orthoptera, Hagloidea) from the Middle Jurassic of Inner Mongolia, China. *Zootaxa* 2004: 16-24.
- GUO Y., BÉTHOUX O., GU J. J. & REN D. 2013. — Wing venation homologies in Pennsylvanian 'cockroachoids' (Insecta) clarified thanks to a remarkable specimen from the Pennsylvanian of Ningxia (China). *Journal of Systematic Palaeontology* 11: 41-46.
- GUO Y. X. & REN D. 2011. — A New Cockroach Genus of the Family Fuziidae from Northeastern China (Insecta: Blattida). *Acta Geologica Sinica* (English Edition) 85 (2): 501-506.
- LATREILLE P. A. 1810. — *Considérations générales sur l'ordre naturel des animaux composant les classes des Crustacés, des Arachnides et des Insectes avec un tableau méthodique de leurs genres disposés en familles*. Schoell, Paris, 1-444.
- LIANG J. H., REN D., YE Q. P., LIU M. & MENG X. M. 2006. — [The fossil Blattaria of China—a review of present knowledge.] *Acta Geologica Sinica* 31: 102-108 (in Chinese).
- REN D., GAO K. Q., GUO Z. G., JI S., TAN J. J. & SONG Z. 2002. — Stratigraphic division of the Jurassic in the Daohugou area, Ningcheng, Inner Mongolia. *Geological bulletin of China* 21 (8-9): 584-59 (in Chinese with English abstract).
- REN D., SHIH C. K., GAO T. P., YAO Y. Z. & ZHAO Y. Y. 2010. — *Silent Stories-Insect Fossil Treasures from Dinosaur Era of the Northeastern China*. Beijing: Science Press, 191 p.
- ROTH L. M. 2003. — Systematics and Phylogeny of cockroaches (Dicty.: Blattaria). *Oriental Insects* 37: 1-186.
- SCHNEIDER J. W. & WERNEBURG R. 2006. — Insect biostratigraphy of the Euramerican continental Late Pennsylvanian and Early Permian, in LUCAS S. G., CASSINIS G. & SCHNEIDER J. W. (eds), *Non-Marine Permian Biostratigraphy and Biochronology*. Geological Society, London, *Special Publications* 265: 325-336.
- SHEN Y. B., CHEN P. J. & HUANG D. Y. 2003. — Age of the fossil conchostracans from Daohugou of Ningcheng, Inner Mongolia. *Journal of Stratigraphy* 27: 311-313 (in Chinese with English abstract).
- VISHNIAKOVA V. N. 1973. — Problems of the Insect Palaeontology, in NARCHUK E. P. (ed.), *Lectures on the XXIV Annual Readings in Memory of N.A. Kholodkovsky (1-2 April, 1971)*. Leningrad: Nauka Press 64-77 (in Russian).
- VRŠANSKÝ P. 2000. — Decreasing variability—from the Carboniferous to the Present! (validated on independent lineages of Blattaria). *Paleontological Journal* 34 (3): 374-379.
- VRŠANSKÝ P. 2007. — Jumping cockroaches (Blattaria, Skokidae fam.n.) from the late Jurassic of Karatau in Kazakhstan. *Biologia, Bratislava* 62 (5): 588-592.
- VRŠANSKÝ P. 2010. — Cockroach as the Earliest Eusocial Animal. *Acta Geologica Sinica* (English Edition) 84 (4): 793-808.
- VRŠANSKÝ P., VISHNIAKOVA V. N. & RASNITSYN A. P. 2002. — Order Blattida Latreille, 1810. The cockroaches, in RASNITSYN A. P. & QUICKE D. L. J.

- (eds), *History of Insects*. Kluwer Academic Publisher, Dodrecht: 263-271.
- VRŠANSKÝ P., LIANG J. H. & REN D. 2009. — Advanced morphology and behaviour of extinct earwig-like cockroaches (Blattaria: Fuziidae fam. nov.). *Geologica carpathica* 60 (6): 449-462.
- VRŠANSKÝ P., REN D. & SHIH C. K. 2010. — Nakridletia ord. n. — enigmatic insect parasites support sociality and endothermy of pterosaurs. *Amba projekty* 8 (1): 1-16. Bratislava.
- YAO Y. Z., CAI W. Z., REN D. & SHIH C. K. 2006. — New fossil rhopalids (Heteroptera: Coreoidea) from the Middle Jurassic of Inner Mongolia, China. *Zootaxa* 1384: 41-58.
- ZHANG Z. J., SCHNEIDER J. & HONG Y. C. 2012. — The most ancient roach (Blattida): A new genus and species from the earliest Late Carboniferous (Namurian) of China, with discussion on the phylomorphogeny of early blattids. *Journal of Systematic Palaeontology* 11: 27-40.

*Submitted on 8 September 2011;
accepted on 12 April 2012;
published on 28 June 2013.*