

FIRST RECORD OF THE RELICT AUSTRALIAN GENUS *MEUNIEROHELEA* IN MIOCENE DOMINICAN AMBER (DIPTERA: CERATOPOGONIDAE)

RYSZARD SZADZIEWSKI*, ELŻBIETA SONTAG
& BŁAŻEJ BOJARSKI

*Department of Invertebrate Zoology and Parasitology, University of Gdańsk,
Wita Stwosza 59, 80-308 Gdańsk*

**Corresponding author: e-mail: ryszard.szadziewski@ug.edu.pl*

Abstract.— A new fossil species *Meunierohelea fudalai* sp. nov. from Miocene Dominican amber (16 Ma) is described and illustrated. The genus *Meunierohelea* is known from one extant species occurring in NE Australia, four named species from Eocene Baltic amber (45 Ma), and three species from Eocene Indian amber from Cambay (53 Ma). The present record indicates that, during its phylogenetic history, this group of predatory biting midges had a broad, probably worldwide, distribution.



Key words.— *Meunierohelea fudalai*, new species, historical distribution, biogeography

INTRODUCTION

Biting midges (Ceratopogonidae) are a large family of nematocerous flies with almost 6300 extant (Borkent 2016) and 290 fossil species (Szadziewski 2018, and further records).

The genus *Meunierohelea* Szadziewski is known from one extant species living in NE Australia, four named species from Eocene Baltic amber (45 Ma) deposited in the Gulf of Gdańsk (Szadziewski 1988), Bitterfeld (Szadziewski 1993) and Rovno (Sontag & Szadziewski 2011), and from three species from Eocene Indian amber from Cambay (53 Ma) (Stebner *et al.* 2017). The females of biting midges in *Meunierohelea*, like other members of the tribe Ceratopogonini, are/were predators of other small insects. The female of the extant *M. caligula* (Debenham) has mandibles armed with 8-9 well-developed teeth (Debenham 1988).

The genus *Meunierohelea* was not reported among the 339 inclusions of biting midges from Miocene

Dominican amber (16 Ma) studied by Szadziewski and Grogan (1994). More than 25 years later, a well-preserved female of this genus was found in this amber by the collector and amber dealer John Fudala from the USA. The purpose of this paper is to describe a new species based on this inclusion.

MATERIALS AND METHODS

The inclusion described in this paper is embedded in a piece of amber from the Dominican Republic, which was donated to the Museum of Amber Inclusions (University of Gdańsk, Poland, MAIG) by John Fudala (Janusz Fudala) from the USA. The piece of amber MAIG No. 6267 containing *Meunierohelea* is divided into several pieces with 14 syninclusions: Diptera 2, Coleoptera 2, Hymenoptera 4 and Hemiptera 6.

The photographs were taken with a LAS Montage multifocus attached to a Leica DM6000 compound microscope. The morphological terms and abbreviations are those explained by Szadziewski (1988, 1996).

DESCRIPTION

Order **Diptera** Linnaeus, 1758

Family **Ceratopogonidae** Newman, 1834

Subfamily **Ceratopogoninae** Newman, 1834

Tribe **Ceratopogonini** Newman, 1834

Genus ***Meunierohelea*** Szadziewski, 1988 [March 1988]

Type species. *M. nielseni* Szadziewski, 1988 (fossil, Eocene Baltic amber), by original designation.

Syn. *Chimaerohelea* Debenham, 1988 [May 1988]

Type species *Ch. caligula* Debenham, 1988 (extant, north Queensland), by original designation.

Diagnosis. The genus has a unique wing venation with a long and straight vein M2 which extends anteriorly towards the wing base. The first and second radial cells are usually well separated by the anastomosed vein R_{1+2+3} . The second radial cell is long and narrow, and usually open at the distal end. The legs are slender, unmodified, and the fourth tarsomeres are cylindrical. The female claws are relatively short and simple on all legs.

Meunierohelea fudalai sp. nov.

Diagnosis. The species can be distinguished from other fossil congeners by the flagellum without sensilla coeloconica, the very short first radial cell, and female antennal ratio less than 1.0. Male unknown.

Type material. Holotype female, MAIG No. 6267. Dominican amber. Donated by J. Fudala. This piece of amber contains the following syninclusions: Diptera: Chironomidae 1, Cecidomyiidae 1; Coleoptera: Mordellidae 1; Hymenoptera: Formicidae 4; Hemiptera: Fulgoro-morpha: 3 nymphs, 2 exuviae, Delaphidae 1 adult.

Description. Female (Fig. 1A). Body complete, uniformly dark brown. Total length without flagellum 1.42 mm. Flagellum (Fig. 1B, C) composed of 13 flagellomeres, length 0.87 mm, proximal flagellomeres cylindrical and long, distal flagellomeres greatly elongate, antennal ratio 0.99, sensilla coeloconica absent. Proboscis moderately long. Palpus 5-segmented, short, palpal segment 3 about 40 μ m long, with rounded sensory pit, palpal segment 4 very short (Fig. 1D). Eye separation not visible. Scutum with long setae. Legs slender, without modifications; claws slender, moderately long about 30 μ m, equal, without basal inner teeth; tarsomeres 1–2 of all legs with 2 rows of palisade setae; fourth tarsomeres cylindrical. Tibial spur of fore leg long, hind tibial spur indistinct. Tarsal ratio of fore leg TR(1) 2.25, TR(2) 2.77, TR(3) 1.92. Wing narrow without anal lobe, length 1.13 mm, costal ratio 0.76 (Fig. 1A). Wing membrane without macrotrichia. First

radial cell short, about 1.4 times shorter than anastomosed vein R_{1+2+3} ; second radial cell with opened apex, 2.6 times longer than first one (Fig. 1E). Vein M₂ long, straight, with atrophied base. Abdomen without modifications, cerci short, seminal capsule not visible.

Male. Unknown.

Etymology. This species is named after our good friend John Fudala (Janusz Fudała) from the USA, who has donated many inclusions in Dominican amber to the Museum of Amber Inclusions at the University of Gdańsk.

DISCUSSION

The new species can be distinguished from other fossil congeners by the flagellum without sensilla coeloconica, the very short first radial cell, and the female antennal ratio (AR) less than 1.0. It is similar to the extant *M. caligula* (Debenham, 1988) from Australia in having a short first radial cell. However, the female of the extant species is smaller, with a wing length of 0.90 mm and also differs in having a very short palpal segment 3, and a lower AR – 0.84 (Debenham 1988).

At present, the genus *Meunierohelea* contains the following nine species:

M. borkenti Stebner & Szadziewski, 2017 in Stebner *et al.* 2017 (Eocene Indian amber);

M. caligula (Debenham, 1988) (extant, NW Australia);

M. cambayana Stebner & Szadziewski, 2017 in Stebner *et al.* 2017 (Eocene Indian amber);

M. fudalai sp. nov. (Miocene Dominican amber);

M. gedanicola Szadziewski, 1988 (Eocene Baltic amber, Gulf of Gdańsk);

M. miocaenica (Szadziewski, 1993) (Eocene Baltic amber from Bitterfeld);

M. nielseni Szadziewski, 1988 (Eocene Baltic amber from the Gulf of Gdańsk, Bitterfeld and Rovno; Szadziewski 1988, 1993, Sontag and Szadziewski 2011);

M. orientalis Stebner & Szadziewski, 2017 in Stebner *et al.* 2017 (Eocene Indian amber);

M. wirthi Szadziewski, 1988 (Eocene Baltic amber, Gulf of Gdańsk).

The broad distribution of *Meunierohelea* in the past well illustrates the opinion, expressed by Handlirsch (1913), that the recent distribution of many taxa is no indication of their place of origin or dispersion. The present record indicates that this is a relict group of predatory biting midges which had a broad, probably worldwide, distribution during its phylogenetic history (Fig. 2), and shows that paleontological data are necessary to test biogeographic hypotheses (Szadziewski 2008, 2018).

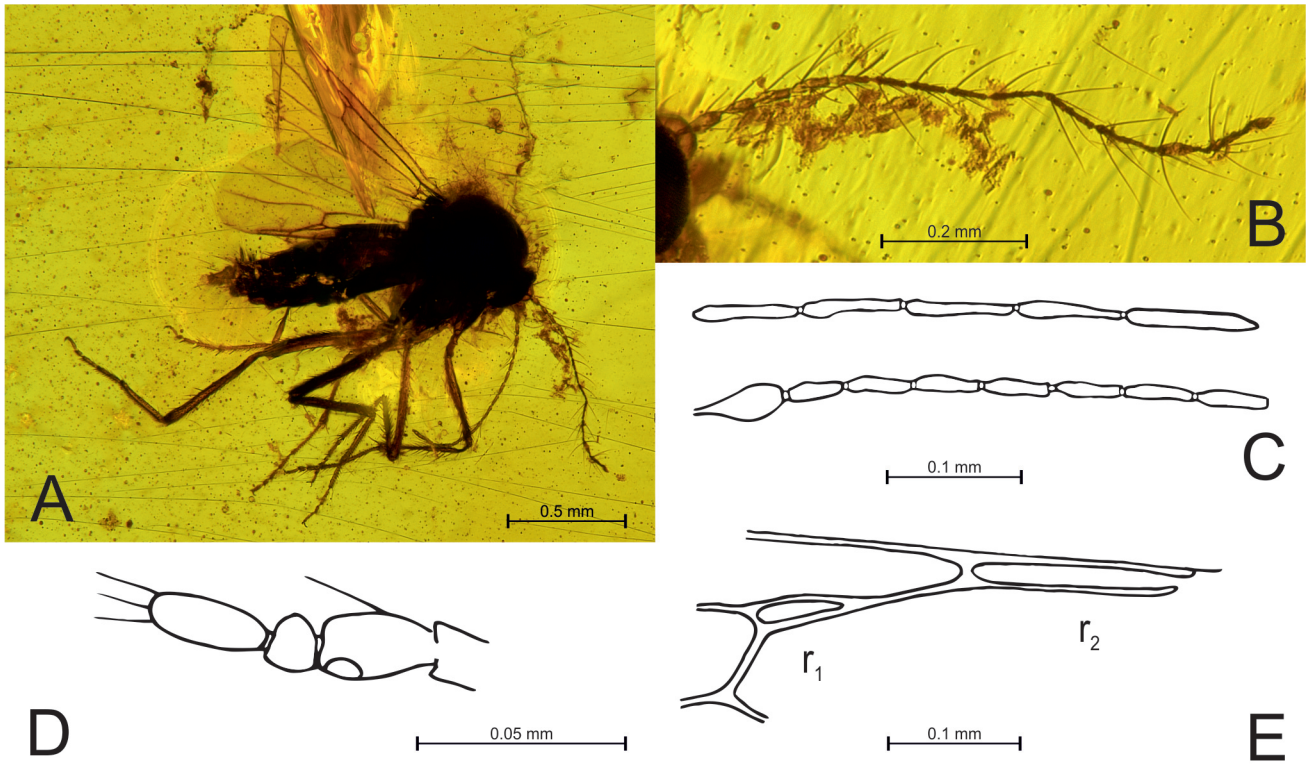


Figure 1. *Meunierohelea fudalai* sp. nov., holotype female; A – total habitus, B, C – flagellum, D – palpus, E – first radial cells.

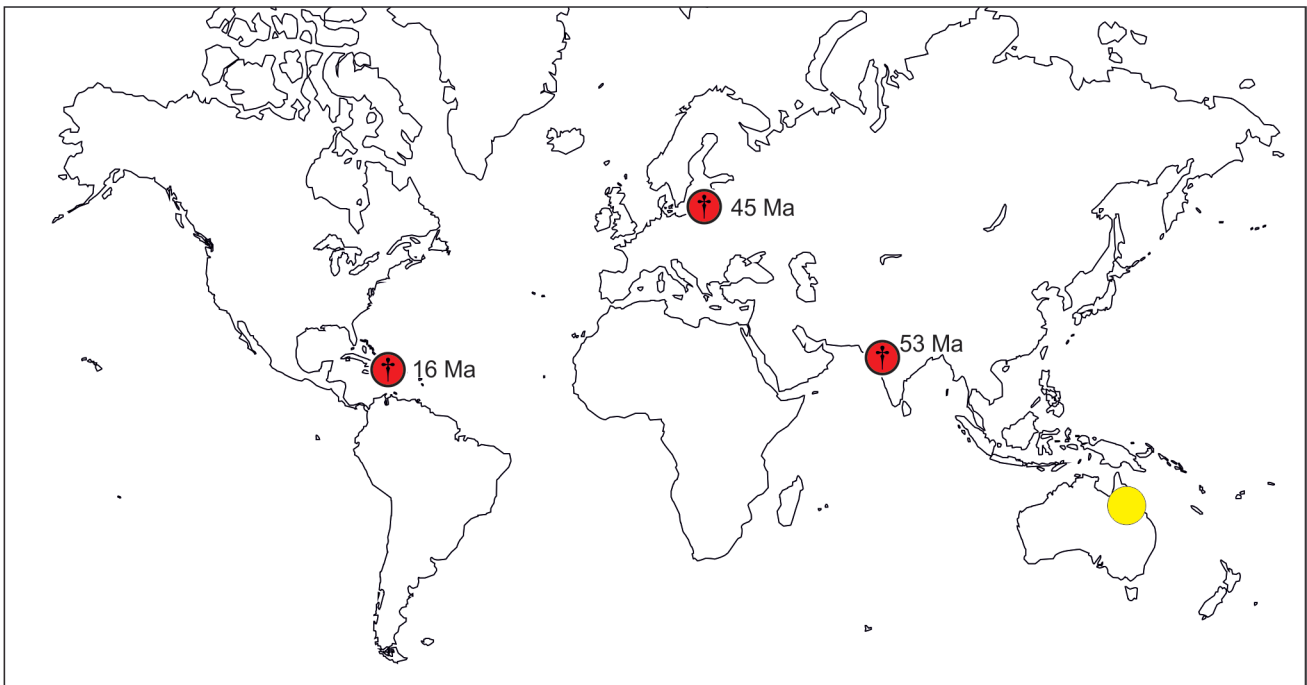


Figure 2. Historical distribution of the relict genus *Meunierohelea*. Explanations: Ma – million years ago, yellow circle – extant distribution, red circle – ancient distribution.

ACKNOWLEDGEMENTS

We are much indebted to the collector and amber dealer John Fudala from Illinois (USA) for donating the inclusion described above to the Museum of Amber Inclusions at the University of Gdańsk, and to Peter Senn from Gdynia (Poland) for the linguistic correction of the manuscript. Special thanks are due to the anonymous reviewers for their critical reviews and valuable comments.

REFERENCES

- Borkent, A. 2016. World species of biting midges (Diptera: Ceratopogonidae). Available from: <http://www.inhs.uiuc.edu/research/FLYTREE/CeratopogonidaeCatalog.pdf>.
- Debenham, M. I. 1988. *Chimaerohelea*, a new genus of Ceratopogonidae (Diptera) from north Queensland. *Invertebrate Taxonomy*, 1: 801–806 (19 May 1988, after Evenhuis 1994).
- Evenhuis, N. L. 1994. Catalogue of the fossil flies of the world (Insecta: Diptera). Backhuys Publishers, Leiden, 600 pp.
- Handlirsch, A. 1913. Beiträge zur exakten Biologie. Sitzungsberichte der Akademie der Wissenschaften mathematisch-naturwissenschaftliche Klasse, 122: 361–481.
- Linnaeus, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Tomus I. Editio decima, reformata. L. Salvii, Holmiae [= Stockholm]. [4]+824 pp.
- Newman, E. 1834. Attempted division of British insects into natural orders. *Entomological Magazine*, 2: 379–431.
- Sontag, E. and R. Szadziewski. 2011. Biting midges (Diptera: Ceratopogonidae) in Eocene Baltic amber from the Rovno region (Ukraine). *Polish Journal of Entomology*, 80: 779–800.
- Stebner, F., Szadziewski, R., Singh, H., Gunkel, S. and J. Rust. 2017. Biting midges (Diptera Ceratopogonidae) from Cambay amber indicate that the Eocene fauna of the Indian subcontinent was not isolated. *PLoS ONE* 12(1) e0169144. doi10.1371/journal.pone.0169144.
- Szadziewski, R. 1988. Biting midges (Diptera, Ceratopogonidae) from Baltic amber. *Polish Journal of Entomology*, 58: 3–283.
- Szadziewski, R. 1993. Biting midges (Diptera, Ceratopogonidae) from Miocene Saxonian amber. *Acta Zoologica Cracoviensia*, 35: 603–656.
- Szadziewski, R. 1996. Biting midges from Lower Cretaceous amber of Lebanon and Upper Cretaceous Siberian amber of Taimyr (Diptera, Ceratopogonidae). *Studia Dipterologica*, 3: 23–86.
- Szadziewski, R. 2008. Age and recent distribution of extant genera of Ceratopogonidae (Diptera) present in the fossil record. *Alavesia*, 2: 87–99.
- Szadziewski, R. 2018. Biting midges (Diptera: Ceratopogonidae) as indicators of biostratigraphy, ecological reconstructions and identification of amber deposits. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*, 107: 219–230.
- Szadziewski, R. and W. L. Grogan. 1994. Biting midges from Dominican amber. I. A new fossil species of *Baeodasymyia* (Diptera: Ceratopogonidae). *Proceedings of the Entomological Society of Washington*, 96: 219–229.

Received: April 14, 2020

Accepted: June 5, 2020

Printed: June 30, 2020