

A new biting midge of the genus *Forcipomyia* Meigen, 1818 from Miocene Ethiopian amber (Diptera: Ceratopogonidae)

RYSZARD SZADZIEWSKI^{1,*}, ELŻBIETA SONTAG¹ & MADELINE V. PANKOWSKI²

¹Department of Invertebrate Zoology and Parasitology, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland

²16405 Fox Valley Terrace, Rockville, Maryland 20853, USA

 ryszard.szadziewski@ug.edu.pl;  <https://orcid.org/0000-0002-2899-6861>

 elzbieta.sontag@biol.ug.edu.pl;  <https://orcid.org/0000-0002-5966-8334>

 madelin pankowski@gmail.com;  <https://orcid.org/0000-0002-9430-0121>

*Corresponding author

Biting midges (Ceratopogonidae) are a relatively well-studied family of nematoceros flies distributed worldwide, including 6,206 extant and 296 fossil species. To date, 1,146 extant and 32 fossil species in the genus *Forcipomyia* have been recorded in the world (Borkent & Dominiak, 2020). Biting midges of the subgenus *Forcipomyia* s. str. are indicative of forests because their larvae and pupae usually live under the bark of rotting trees (Szadziewski, 2018). The oldest records of the genus are from the Eocene. *Forcipomyia* are reported from early Eocene Fushun amber (one species; Hong, 1981; Stebner *et al.*, 2016; Szadziewski, 2018; Krzemiński *et al.*, 2019), early Eocene Cambay amber (unnamed, Stebner *et al.*, 2017), middle Eocene Sakhalin amber (one species, Szadziewski & Sontag, 2013), Eocene Baltic amber from the Gulf of Gdańsk, Rovno and Bitterfeld (21 species; Szadziewski, 1988, Szadziewski, 1993, Sontag & Szadziewski, 2011), Miocene Dominican amber (10 species, Szadziewski & Grogan, 1998) and Miocene Mexican amber (unnamed, Szadziewski & Grogan, 1996).

Herein, we report the first fossil species of Ceratopogonidae from Lower Miocene Ethiopian amber. According to Bouju & Perrichot (2020), Ethiopian amber in Africa was produced by angiosperm *Hymenaea* trees in lowland, tropical, evergreen rainforests during the Lower Miocene.

Material and methods

The inclusion described in this paper was found by the third author on the sales website eBay. She purchased the specimen and donated it to the collection of the Museum of Amber Inclusions, University of Gdańsk, Poland. Morphological terms and abbreviations follow those explained by Szadziewski (1988). The photographs were taken with a LAS Montage multi-focus camera attached to a Leica DM6000.

Systematic palaeontology

Family Ceratopogonidae Newman, 1834

Subfamily Forcipomyiinae Lenz, 1934

Tribe Forcipomyiini Lenz, 1934

Genus *Forcipomyia* Meigen, 1818

***Forcipomyia rasnitsyni* sp. nov.**

(Fig. 1A–C)

Type material. Holotype female, deposited in the Museum of Amber Inclusions, University of Gdańsk, MAI 6697, infrared spectroscopy certificate from the International Amber Association no. 22251. Ethiopian amber, Miocene. Syninclusion: one worker of Formicidae.

Etymology. This new species is named in honour of professor Alexandr P. Rasnitsyn of the Paleontological Institute of the Russian Academy of Sciences in Moscow in recognition of his important contributions to the study of fossil insects.

Diagnosis. The only fossil species of *Forcipomyia* with a high tarsal ratio (2.3–2.6), very short distal female flagellomeres (AR 0.8), short and separated palpal segments 4 and 5, claws with single apices, both first radial cells present, wing length 0.81 mm. Male unknown.

Description. Female. The specimen is well preserved, complete (Fig. 1A). Body hairy, total length (without antennae) 1.4 mm. Flagellum with 13 flagellomeres, total length 0.56 mm, combined length of flagellomeres 9–13 smaller than combined length of flagellomeres 1–8, AR 0.81 (Fig. 1B). Microsetae between ommatidia not visible. Proboscis short. Palpus 5-segmented, fourth and fifth palpal segments separated, short and broad, of similar size, combined length 4+5 about 0.050 mm; third palpal segment slightly swollen on basal 2/3, length about 0.060 mm, sensory pit not visible (Fig. 1A, C). Anterior anepisternum narrow, weakly B-shaped. Wing length measured from basal



FIGURE 1. *Forcipomyia rasnitsyni* **sp. nov.**, female holotype. **A**, Total habitus. **B**, Right flagellum. **C**, Proboscis with palpi.

arculus 0.81 mm, costal ratio CR 0.51; wing membrane densely covered by long slender macrotrichia; both first radial cells present, first one slit-like, second one distinct, rectangular. Legs slender, tibiae without scales, claws simple, without modifications, empodium large. Tarsal ratio TR: hind leg TR(3) 2.28, midleg TR(2) 2.64, foreleg TR(1) 2.61. Abdomen without modifications, cerci short, seminal capsules not visible (Fig. 1A).

Male. Unknown.

Discussion

Among described fossil species of the genus, there are some having tarsal ratio (TR) higher than 2.0 like *F. rasnitsyni* sp. nov. We are listing these species and some of their key characters:

Eocene Baltic amber. *F. pyriformis* (Meunier, 1904) (fourth palpomere long), *F. berendti* Szadziewski, 1988 (fourth palpomere long), *F. eophytoheleana* Szadziewski, 1988 (fourth palpomere long), *F. krzeminskii* Szadziewski, 1988 (fourth and fifth palpal segments fused, AR 2.2), *F. kulickae* Szadziewski, 1988 (first radial cell absent), *F. eobreviflagellata* Szadziewski, 1988 (first radial cell absent), *F. miocaenica* Szadziewski, 1993 (fourth palpomere long, wing length 1.3), *F. tuberculosa* Szadziewski, 1993 (fourth and fifth palpomeres fused), *F. bifidicola* Szadziewski, 1993 (female claws bifid), and *F. succinicola* Szadziewski, 1993 (female proximal flagellomeres compressed, AR 1.5);

Miocene Dominican amber. *F. americana* Szadziewski & Grogan, 1998 (female AR 1.5), *F. woodruffi* Szadziewski & Grogan, 1998 (female AR 1.6), *F. frutetosuccinea* Szadziewski & Grogan, 1998 (fourth and fifth palpomeres slender, long), and *F. tertiaricola* Szadziewski & Grogan, 1998 (TR of hind leg 2.9).

The subgeneric position of the new species is unknown. It is probably a member of the subgenus *Synthyridomyia* Saunders or *Thyridomyia* Saunders, which are distinguished by the characters of male genitalia (DeMeillon & Wirth, 1991).

Biting midges of the genus *Forcipomyia* are mostly indicative of forests, as their larvae and pupae are mostly terrestrial and usually live under the bark of rotting trees, among mosses or plant debris. They were common in Eocene Baltic amber forests, comprising almost 16% of all biting midges (Szadziewski, 1988), and in Miocene Dominican amber forests, comprising almost 42% (Szadziewski & Grogan, 1998).

Acknowledgements

We extend our thanks to Dr. Patrycja Dominiak from Norway and the anonymous referees for their valuable comments on

the manuscript. This research was supported by the National Science Centre of Poland under Grant No. 2020/37/B/NZ8/03042.

References

- Bouju, V. & Perrichot, V. (2020) A review of amber and copal occurrences in Africa and their paleontological significance. *BSGF—Earth Sciences Bulletin*, 2020, 191, 17.
<https://doi.org/10.1051/bsgf/2020018>
- Borkent, A. & Dominiak, P. (2020) Catalog of the biting midges of the World (Diptera: Ceratopogonidae). *Zootaxa*, 4787 (1), 377 pp.
<https://doi.org/10.11646/zootaxa.4787.1.1>
- DeMeillon, B. & Wirth, W.W. (1991) The genera and subgenera (excluding *Culicoides*) of the Afrotropical biting midges (Diptera: Ceratopogonidae). *Annals of the Natal Museum*, 32, 27–147.
- Hong, Y.C. (1981) *Eocene fossil Diptera in amber in Fushun coalfield* [in Chinese, English summary]. Peking (= Beijing): Geological Publishing House, 166 pp.
- Krzemiński, W., Blagoderov, V., Azar, D., Lukashevich, E., Szadziewski, R., Wedmann, S., Nel, A., Collomb, F.M., Waller, A. & Nicholson, D.B. (2019) True flies (Insecta: Diptera) from the late Eocene insect limestone (Bembridge Marls) of the Isle of Wight, England, UK. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*, 110 (3–4), 495–554.
<https://doi.org/10.1017/S1755691018000464>
- Lenz, F. (1934) 13a. Heleidae (Ceratopogonidae). In: E. Lindner (ed.), *Die Fliegen der palaearktischen Region*, 3, 95–133 (Lfg. 78). Stuttgart.
- Meigen, J.W. (1818) Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Vol. 1, xxxvi + 333 pp., pls. 1–11. Aachen.
<https://doi.org/10.5962/bhl.title.13731>
- Meunier, F. (1904) Monographie des Cecidomyiidae, des Sciaridae, des Mycetophilidae et des Chironomidae de l'ambre de la Baltique (concl.). *Annales de la Société Scientifique de Bruxelles (Mém.)*, 28, 93–275.
<https://doi.org/10.5962/bhl.title.8565>
- Newman, E. (1834) Attempted division of British insects into natural orders. *Entomological Magazine*, 2, 379–431.
- Sontag, E. & Szadziewski, R. (2011) Biting midges (Diptera: Ceratopogonidae) in Eocene Baltic amber from the Rovno region (Ukraine). *Polish Journal of Entomology*, 80, 779–800.
<https://doi.org/10.2478/v10200-011-0058-4>
- Stebner, F., Szadziewski, R. & Wang, B. (2016) Biting midges (Diptera: Ceratopogonidae) in Fushun amber reveal further biotic links between Asia and Europe during the Eocene. *Palaeontologia Electronica*, 19 (3), 1–9.
<https://doi.org/10.26879/597>

- Stebner, F., Szadziewski, R., Singh, H., Gunkel, S. & Rust, J. (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.
<https://doi.org/10.1371/journal.pone.0169144>
- Szadziewski, R. (1988) Biting midges (Diptera, Ceratopogonidae) from Baltic amber. *Polskie Pismo Entomologiczne*, 58, 3–283.
- Szadziewski, R. (1993) Biting midges (Diptera, Ceratopogonidae) from Miocene Saxonian amber. *Acta Zoologica Cracoviensia*, 35, 603–656.
- 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.
<https://doi.org/10.1017/S1755691017000378>
- Szadziewski, R. & Grogan, W.L. (1996) Biting midges (Diptera: Ceratopogonidae) from Mexican amber. *Polish Journal of Entomology*, 65, 291–295.
- Szadziewski, R. & Grogan, W.L. (1998) Biting midges from Dominican amber. IV. Species of the tribes Dasyheleini and Forcipomyiini (Diptera: Ceratopogonidae). *Polish Journal of Entomology*, 67, 255–290.
- Szadziewski, R. & Sontag, E. (2013) A new species of *Forcipomyia* from Paleocene Sakhalin amber (Diptera: Ceratopogonidae). *Polish Journal of Entomology*, 82, 59–62.
<https://doi.org/10.2478/v10200-012-0023-x>