

A NEW MAYFLY FAMILY (INSECTA: EPHEMEROPTERA) FROM EOCENE BALTIC AMBER

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Abstract.— The female imago specimen belonging to a new species *Baba lapidea* **gen. nov.** and a new family Babidae **fam. nov.** from Eocene Baltic amber is described and illustrated. This insect combines characters common with Fimbriatotergergaliae (on fore wing MP₂ and CuA curved near base; on hind wing MA lacks triad; first tarsal segment shortened and fused with tibia) with a plesiomorphy never found in Fimbriatotergergaliae (mesonotal suture transverse). Possibly, *Baba* **gen. nov.** represents a sister taxon of Fimbriatotergergaliae Kluge, 2004.



Key words.— Phylogeny, Insecta, Ephemeroptera, Babidae, new family, *Baba*, new genus, *Baba lapidea*, new species, Eocene, Baltic amber.

INTRODUCTION

The new mayfly family described below, was mentioned by one of us (Kluge 2004: 351) under a non-ranking hierarchical name *Baba/fg(1)* and ranking names “Babidae Kluge, Godunko et Krzeminski (in press)” and “*Baba* Kluge, Godunko et Krzeminski (in press)”. These typified names remained to be unavailable, until types were not formally designated. This paper contains the first formal description of the family Babidae **fam. nov.**, the genus *Baba* **gen. nov.** and the species *Baba lapidea* **sp. nov.**, which makes these names available and provides availability to the name *Baba/fg(1)*. This taxon is known as a single female specimen from the Eocene Baltic amber; here it is described and illustrated for the first time. *B. lapidea* **sp. nov.** has an unusual combination of morphological characters, which allows to assume that it is a representative of a formerly unknown taxon, whose rank is equal to Fimbriatotergergaliae (which traditionally are regarded as several superfamilies). Morphological terms used here are explained by Kluge (2004).

TAXONOMY

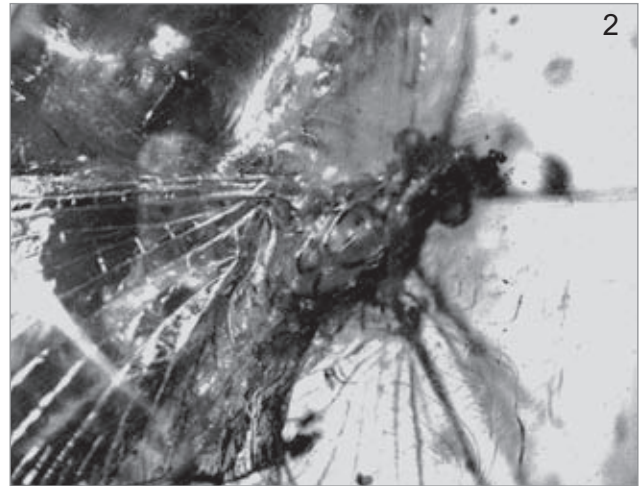
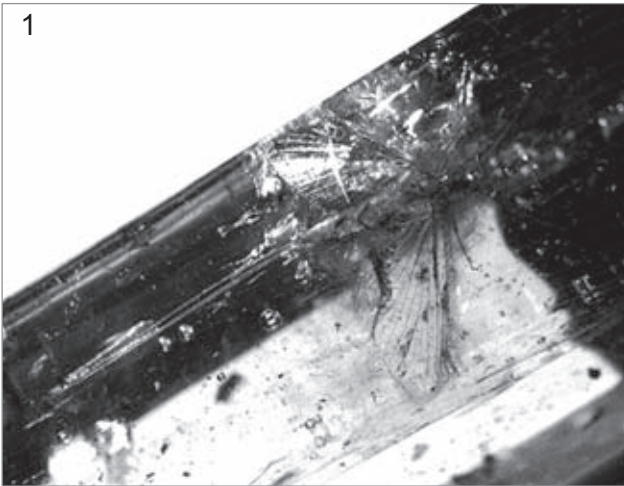
Order **Ephemeroptera** Hyatt et Arms, 1891

Babidae **fam. nov.**

Babidae Kluge, Godunko et Krzeminski: Kluge, 2004: 351 nomen nudum.

Type genus. *Baba* **gen. nov.**, by present designation.

Diagnosis. The new taxon differs from other Ephemeroptera by the following combination of features: mesonotal suture transverse (unlike all Fimbriatotergergaliae); furcasternal protuberances of mesothorax contiguous (plesiomorphy); first tarsal segment shortened and fused with tibia (as in Fimbriatotergergaliae); claws ephemeropteroid (plesiomorphy); fore wing with MP₂ and CuA curved near base (as in Fimbriatotergergaliae); MA of hind wing without triad (as in Fimbriatotergergaliae).



Figures 1–2. *Baba lapidea* gen. and sp. nov., holotype (No 809), female imago. (1) Body in dorsal view; (2) head and thorax in dorsal view. Without scale.

Baba gen. nov.

Baba Kluge, Godunko et Krzeminski: Kluge, 2004: 351 nomen nudum.

Type species. *B. lapidea* sp. nov., by present designation.

Diagnosis. The same as for the family Babidae (see above).

Etymology. The generic name of *Baba* gen. nov. (feminine gender) is derived from the old Slavonic word “baba” – woman.

Baba lapidea sp. nov. (Figs 1–8)

Description. Female imago. Fore wing length 7 mm; paracercus length 10 mm, cerci length 9 mm. Head wide, eyes widely separated. Pronotum rather large, with anterior and posterior margins somewhat elevated (Figs 1–3). Mesonotum oval; mesonotal suture deep and transverse (Figs 2, 6, 8). Furcasternal protuberances contiguous (only their anterior margin is preserved, while the most part is damaged). Patella-tibial suture distinct on mid and hind legs, absent on fore legs (as in majority of Ephemeroptera). Tarsi typical of Furcatergaliae: first segment shortened and fused with tibia; this is well-visible in fore leg, while in middle and hind legs first segments are indistinct and tarsi look as 4-segmented (Fig. 7). Claws ephemeropteroid (i.e. anterior blunt, posterior pointed). On fore wing MP_2 and CuA are curved near base; in cubital field several branched and simple veins arising from CuA; AA without bifurcation and without veins arising posteriorly (Fig. 4). Hind wing with prominent costal projection; triad RS as long as non-branched portion of RS; MA without triad; triad of

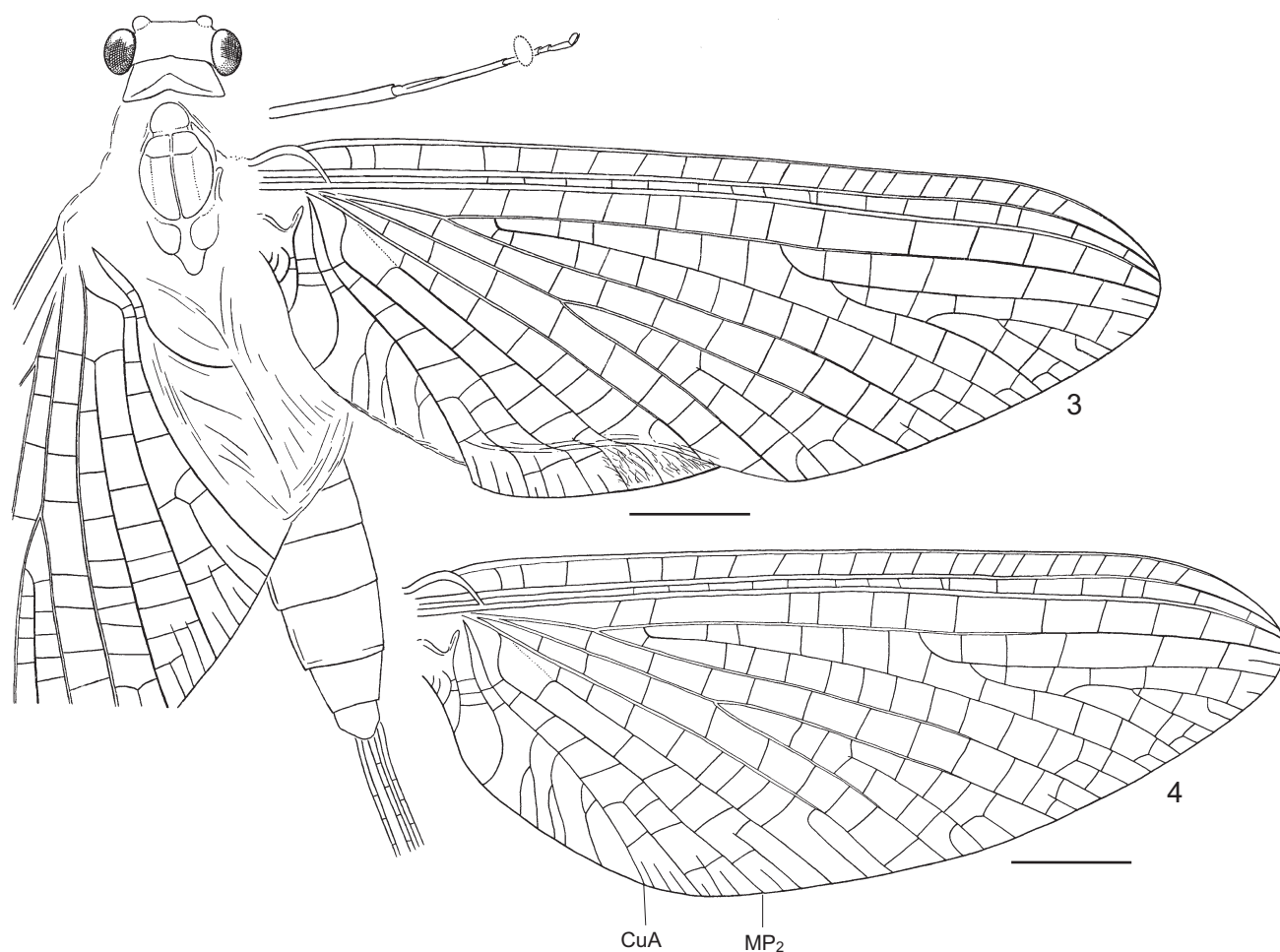
MP long and basally fused with CuA, thus MP_2 arises from CuA (Fig. 5). Paracercus a little longer than cerci.

Male imago, male and female subimagoes, and nymph are unknown.

Type. Holotype: female imago in Eocene Baltic amber with well preserved terga, wings, legs and cerci, but incompletely preserved thoracic sterna and pleura; housed in the amber collection of the Natural History Museum of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland, inventory number 809.

Etymology. The species name is derived from the Latin word “lapidea” – stone.

Relationships. In the previous publication (Kluge 2004), *Baba* gen. nov. was not integrated into the phylogenetic system of Ephemeroptera, but mentioned among “Furcatergaliae incertae sedis”. *Baba* undoubtedly belongs to Furcatergaliae Kluge, 1998 what is confirmed by tarsal structure and absence of furcation of MA on hind wing. From other Furcatergaliae (and other mayflies in general), *Baba* differs by a unique combination of characters: it has curvature of MP_2 and CuA as in Fimbriatotergaliae, but its mesonotal suture is transverse, in contrast to all Fimbriatotergaliae. The curvature of MP_2 and CuA on fore wing is an apomorphy of Fimbriatotergaliae Kluge, 2004: it exists in all Pinnatitergaliae Kluge, 2000 (or superfamily Ephemeroidea Latreille, 1810 in some other classifications) and in Neoephemeridae Traver, 1935 (or Neoephemera/fg1 sensu Kluge 2004), but is secondary lost in Caenoptera Kluge, 2000. Mesonotal suture of *Baba* has plesiomorphic structure – deep, transverse, almost straight; this never occurs in Fimbriatotergaliae, whose mesonotal suture is either sharply curved and stretched backward by sides of median line, or lost (Kluge 2004). In a single true representative of



Figures 3–4. *Baba lapidea* gen. and sp. nov., holotype (No 809), female imago. (3) Body in dorsal view; (4) right fore wing in dorsal view, reconstruction. Scale bars = 1 mm.

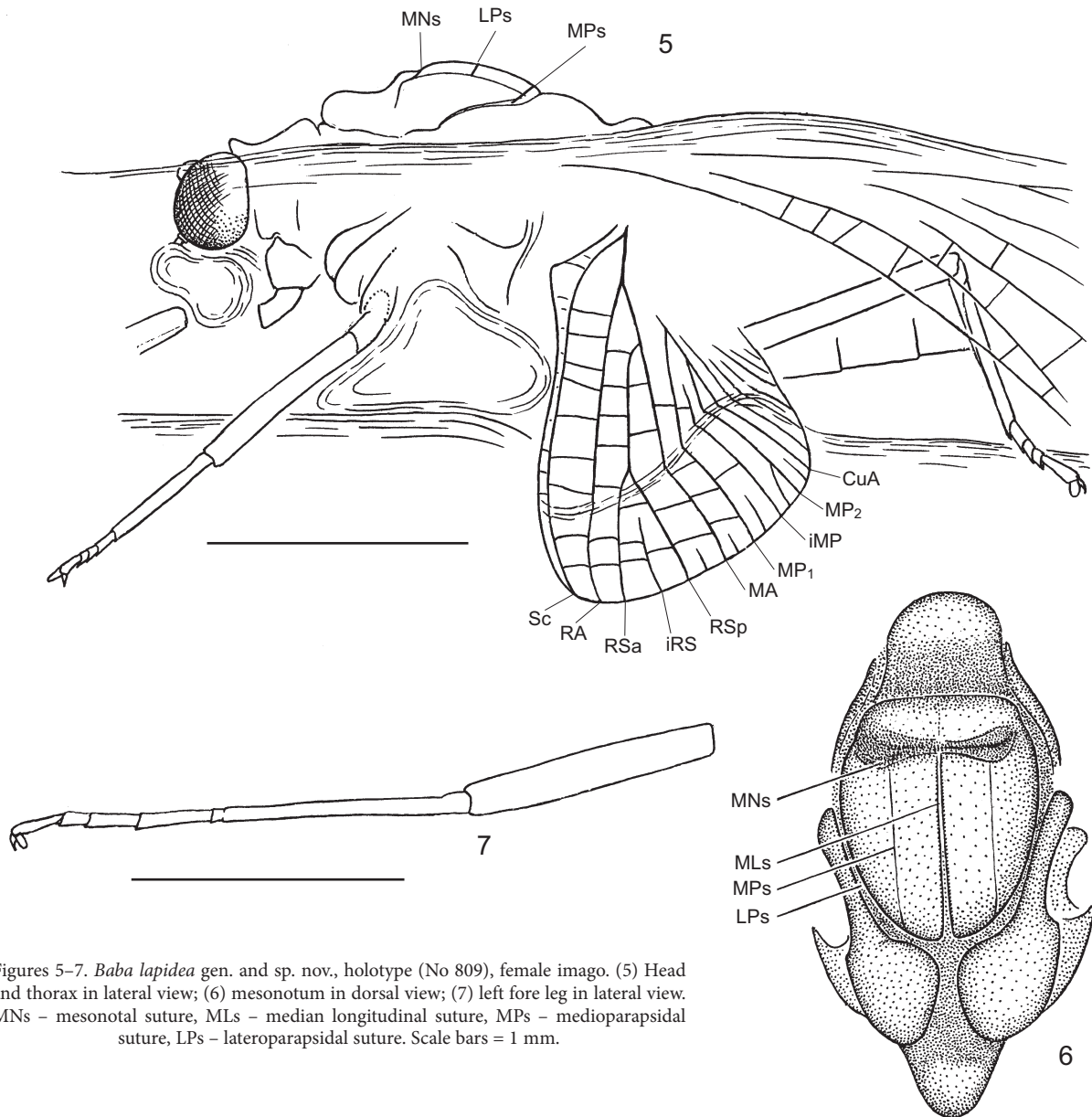
Fimbriatotergaliae described from the Baltic amber, namely *Denina dubiloca* McCafferty, 1989 (holotype was reexamined by N. J. Kluge in 2003 in the collection of Palaeontological Institute of Russian Academy of Sciences in Moscow), mesonotal suture has a shape typical for Fimbriatotergaliae, being just the same as in recent taxa *Hexagenia* Walsh, 1863, *Ephemera*/fg11 sensu Kluge, 2004 (i.e. genus or subgenus *Ephemera* Linnaeus, 1758 without *Afromera*) and *Sinephemera* Kluge, 2004 (Kluge 1997a, Fig.3:4, 2004, Fig. 71E).

We can assume that *Baba* is a sister taxon of Fimbriatotergaliae, because it has a synapomorphy with Fimbriatotergaliae in vein curvature, but lacks autapomorphy of Fimbriatotergaliae in the structure of mesonotal suture. In this case the taxon Fimbriatotergaliae s. str. (excluding *Baba*) has a single apomorphy known for certain: mesonotal suture sharply curved and stretched backward by sides of median line (sometimes smoothed or lost). The curvature of MP_2 and CuA is an autapomorphy of a higher taxon Fimbriatotergaliae s. l., which

should be established to unite Fimbriatotergaliae s. str. with *Baba*. Larval characters described as autapomorphies of Fimbriatotergaliae (Kluge 2004) are unknown for *Baba* and, thus, can not be attributed for certain neither to Fimbriatotergaliae s. str. (excluding *Baba*), nor to Fimbriatotergaliae s. l. (including *Baba*).

Another possible assumption is that *Baba* belongs to Fimbriatotergaliae s. str., but is not its sister taxon. The curvature of mesonotal suture is not a unique character. Besides Fimbriatotergaliae s. str., it exists in Leptophlebiidae Banks, 1900 and has evolved independently in some taxa not belonging to Furcatergaliae – in Baetidae Leach, 1815 s. l. (or Tetramerotarsata Kluge, 1997) and *Prosopistoma* Latreille, 1833 (Kluge 1997b, 2004). Thus, it is not excluded that this character either repeatedly appeared in different groups within Fimbriatotergaliae, or is reversible, and was secondarily lost in *Baba*.

The systematic position of *Baba* gen. nov. could be ascertained only if some other specimens were found, especially subimagoes with cuticular pigmentation on



Figures 5–7. *Baba lapidea* gen. and sp. nov., holotype (No 809), female imago. (5) Head and thorax in lateral view; (6) mesonotum in dorsal view; (7) left fore leg in lateral view. MNs – mesonotal suture, MLs – median longitudinal suture, MPs – medioparapsidal suture, LPs – lateroparapsidal suture. Scale bars = 1 mm.

mesothorax being preserved and with traces of tracheal gills joinings on abdomen.

Remarks. As it often happens in paleontology, one cannot be fully confident in the priority of a new generic and family group names *Baba* gen. nov. and Babidae fam. nov., since these names may appear the junior subjective synonyms of earlier described taxa.

The generic name *Palaeoanthus* Kluge, 1993 and the family name Palaeoanthidae Kluge, 1993 are based on the designation of the type species *P. orthostylus* Kluge, 1993 (inclusion in retinite, Upper Cretaceous of Siberia), which has been described by incomplete remains of male and female imagoes and subimagoes, none of them having mesonotum preserved. Thus, we do not know with

certainty if this species really had a mesonotal suture typical for Fimbriatotergaliae, or its mesonotal suture was plesiomorphic as in *Baba* gen. nov. Besides *P. orthostylus*, the species *P. minutus* Kluge, 1993 (the same age) has also been attributed to the genus *Palaeoanthus*. The latter species has a well preserved structure of mesonotal suture, typical for true Fimbriatotergaliae (Kluge 1993, Fig. 5m). But we don't know reliable synapomorphies, which would prove these two species to constitute a holophyletic taxon; their possible synapomorphy is that in the both species the common stem of RS+MA on the hind wing is relatively long, and non-branched part of RS is relatively short (as long as 0.25–0.5 triad RS), in contrast to *B. lapidea* sp. nov. and many other mayflies.

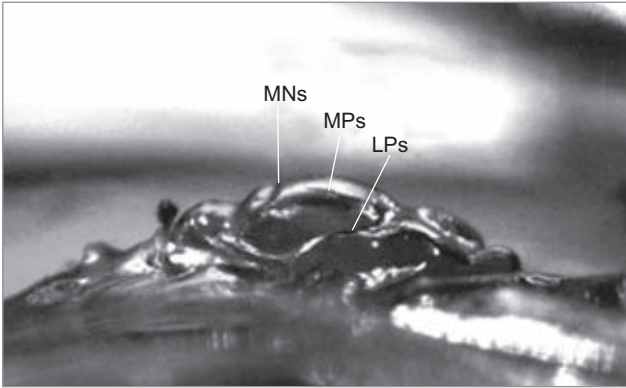


Figure 8. *Baba lapidea* gen. and sp. nov., holotype (No 809), female imago. (8) Mesonotum in lateral view. Without scale.

The structure of thorax of other extinct mayfly taxa with “fimbriatotergalian” wing venation has not been described yet. To those belong some taxa described from Cretaceous of South and North America: (1) Australiphemeridae McCafferty, 1991 (the genus *Australiphemera* McCafferty, 1990 and species *A. relevata* McCafferty, 1990); (2) *Microphemera* McCafferty, 1990 with single species *M. neotropica* McCafferty 1990; (3) *Pristiplocia* McCafferty, 1990 with single species *P. rupestris* McCafferty, 1990 and (4) *Borephemera* Sinitshenkova, 2000 with single species *B. goldmani* Sinitshenkova, 2000 (McCafferty 1990, Sinitshenkova 2000: 115–116, Figs 6–8). When analyzing the photographs of the genus *Pristiplocia* (McCafferty 1990, Fig. 29) one can affirm that this taxon lacks a transverse mesonotal suture, and apparently belongs to Fimbriatotergaliae s. str. Nothing is known about the structure of imaginal thorax of other fossil “fimbriatotergalian” taxa.

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