

Revision of fossil *Metretopodidae* (Insecta: Ephemeroptera) in Baltic amber – Part 2: Description of a new species of *Metretopus* Eaton, 1901

Arnold H. Staniczek^{a*} and Roman J. Godunko^{b,c}

^aDepartment of Entomology, Stuttgart State Museum of Natural History, Rosenstein 1, 70191 Stuttgart, Germany; ^bState Museum of Natural History, National Academy of Sciences of Ukraine, Teatralna 18, 79008 Lviv, Ukraine; ^cBiology Centre of the Academy of Sciences of the Czech Republic, Institute of Entomology, Branišovská 31, 37005 České Budějovice, Czech Republic

(Received 12 November 2012; accepted 20 March 2014)

In the second part of the revision of fossil *Metretopodidae*, a new species of the genus *Metretopus* Eaton, 1901 is described and illustrated based on a male imago. *Metretopus dividus* sp. nov. is the second fossil species of the genus. Distinguishing characters for its separation from other fossil and recent representatives of *Metretopus* are discussed.

<http://www.zoobank.org/urn:lsid:zoobank.org:act:BCC5CB69-8014-4DA1-A0DA-DCF714969081>

Keywords: fossil insects; mayflies; Ephemeroptera; Siphonuroidea; *Metretopodidae*; *Metretopus*; new species; Baltic amber; Eocene

Introduction

Demoulin (1965) formally described a single isolated forewing as first fossil representative of the mayfly family *Metretopodidae* Traver, 1935 from Baltic amber. By adding a question mark to the genus name in the description of *Metretopus? henningseni* Demoulin, 1965, he already then indicated that his attribution to the genus *Metretopus* was provisional. Later, Demoulin (1968) transferred the species to the family Heptageniidae Needham, 1901. In subsequent publications on fossil mayflies from Baltic amber, *Metretopus? henningseni* was rarely mentioned, but was usually placed in the genus *Metretopus* (see e.g. Hubbard 1987; Weitschat and Wichard 1998; Wichard et al. 2009). Kluge (2004) realised its uncertain placement and transferred *Metretopus? henningseni* to *Anteritorna* inc. sed. within mayflies. Staniczek and Godunko (2012) redescribed the type specimen, discussed its affinities and accordingly placed it as Ephemeroptera inc. sed.

Demoulin (1968) described with *Metretopus trinervis* another fossil species of the genus from poorly preserved male and female subimaginal specimens of the Stantien & Becker collection (deposited in the University of Göttingen, Germany). Kluge (2004) placed *M. trinervis* within *Anteritorna* inc. sed. without commenting. Our own reinvestigation and redescription of type specimens of hitherto described fossil species of *Metretopodidae* (Staniczek and Godunko 2012) resulted in new critical distinguishing characters of these fossils. The reinvestigation of the holotype of *M. trinervis*, however, confirmed

Demoulin's placement of this species within *Metretopus* (for details see Staniczek and Godunko 2012).

The objective of the present contribution was to describe a new fossil species of *Metretopus* and to discuss its affinities to *M. trinervis* and to extant species of *Metretopus* with emphasis on critical diagnostic characters.

Material and methods

Drawings were made with a camera lucida on a Olympus SZX7 or a Leica S8 APO stereo microscope. Photographs of fossils were taken through a Leica Z16 APO Macroscope, processed with Leica Application Suite™ Version 3.1.8 to obtain combined photographs with extended depth of field and subsequently enhanced with Adobe Photoshop™ CS3.

The acronym SMNS is used throughout the text to abbreviate the State Museum of Natural History, Stuttgart, Germany, where the holotype of *M. dividus* sp. nov. is deposited.

Systematic palaeontology

Order Ephemeroptera Hyatt and Arms, 1890

Family *Metretopodidae* Traver, 1935

Genus *Metretopus* Eaton, 1901

The genus *Metretopus* is characterised in the winged stages by the presence of one pair of intercalaries in the cubital field of forewing (Berner 1978; Kluge 2004).

*Corresponding author. Email: arnold.staniczek@smns-bw.de

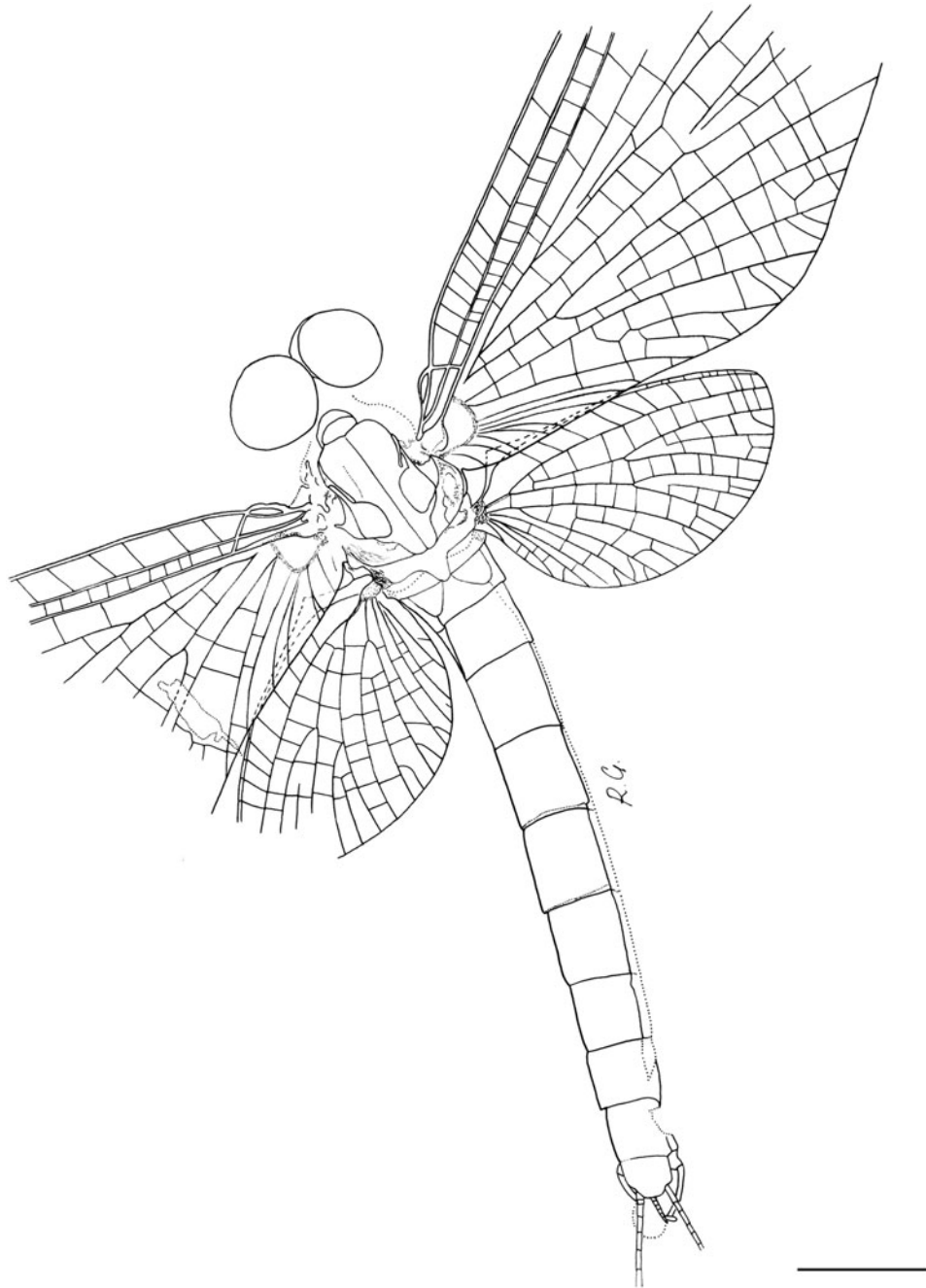


Figure 1. *M. dividus* sp. nov., holotype, male imago in dorsal view. Scale line 1 mm.

Recent representatives are characterised by the presence of male genitalia with elongate shape (see Berner 1978, fig. 11; Tiunova 1999, fig. 2).

There are two Recent species described from the Palaearctic region, namely, *M. alter* Bengtsson, 1930 and *M. tertius* Tiunova, 1999. A third species *M. borealis* Eaton, 1871 has Holarctic distribution.

Two fossil species were formally included with the genus *Metretopus*: *Metretopus? henningseni* Demoulin, 1965 and *M. trinervis* Demoulin, 1968. The former was transferred to

Ephemeroptera inc. sed. (Staniczek and Godunko 2012), leaving *M. trinervis* as the only fossil species that could so far be placed within the genus *Metretopus*.

***Metretopus dividus* sp. nov. (Figures 1–5; Table 1)**

Material examined

Holotype. Male imago, no. SMNS BB-2478 in the SMNS amber collection (ex coll. Wunderlich). Stratum typicum: Eocene, Baltic amber.

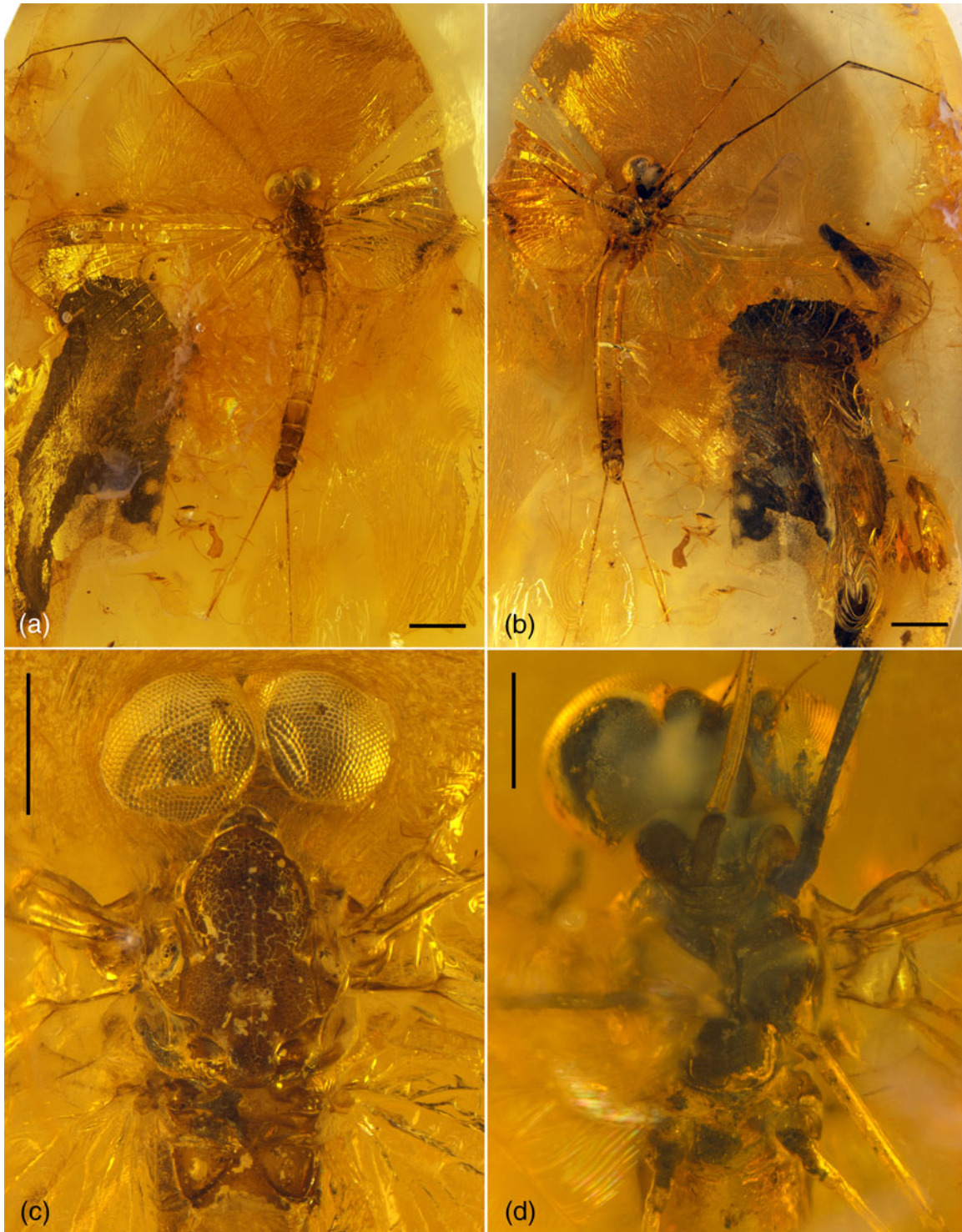


Figure 2. (Colour online) *M. dividus* sp. nov., holotype, male imago. (a) General dorsal view; (b) general ventral view; (c) head and thorax in dorsal view; (d) head and thorax in ventral view. Scales lines 1 mm (a, b); 0.5 mm (c, d).

Description of holotype

Generally well-preserved specimen, visible in dorsoventral aspect (Figures 1 and 2(a),(b)), embedded in resin. Apical part of right forewing, tarsus and pretarsus of left

foreleg, and apical parts of cerci lost. For measurements, see Table 1.

General colouration pale, yellowish-brown to brown. Colouration of dorsal side slightly darker than ventral side.

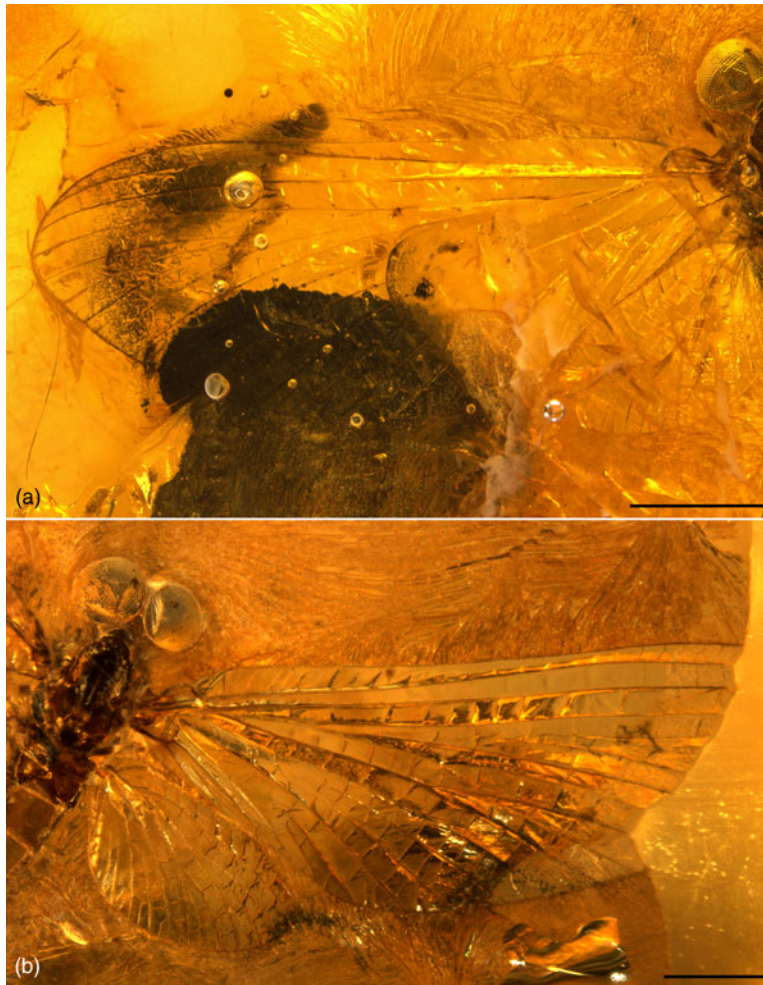


Figure 3. (Colour online) *M. dividus* sp. nov., holotype, male imago. (a) Left wing pair in dorsal view; (b) right wing pair in dorsal view. Scale lines 1 mm.

Dorsal head details, ocelli and details of pronotum invisible through influxes of resin. Eyes broad, medially contiguous, surface of ommatidia well preserved (Figure 2(a),(c)).

Thorax dorsally and ventrally uniformly brown to dark brown (pigmentation around lateroparapsidal suture not preserved); lateral sides of thorax hardly visible; lateroparapsidal suture elongate; mesonotal suture nearly transverse (Figures 1 and 2(c)); furcasternal protuberances of mesothorax contiguous (Figure 2(d)).

Wings translucent, hyaline, not pigmented. Left forewing and both hind wings completely preserved (Figure 3). Details of nervation of middle part of left forewing and tip of left hind wing invisible due to some distortions of amber and influxes of resin (Figure 3(a)). Longitudinal and transversal veins without darker colouration. Pterostigmatic area with several anastomosed veins. Cubital field of forewings each with two

intercalaries. Anterior intercalary vein longer, connected with CuA by several cross veins; posterior intercalary smaller, connected only with CuP and anterior intercalary (Figures 1, 3 and 4(a)). Cubital field hardly visible in left forewings. Hind wings with triadic RS, MA and MP. Costal process of hind wings relatively small, acute (Figures 1 and 4(a)).

Legs well preserved, except tarsus and pretarsus of left foreleg. Tarsi five-segmented (Figure 4(b)). First tarsal segment of middle and hind legs longest, fused with tibia. Tibia of foreleg without spines on outer margin. Tibia of middle and hind legs with traces of tibiopatellar suture. Tarsal claws dissimilar with one hooked and one blunt claw.

Abdominal segments well preserved. Tergum I about same colour as thorax, dark brown. Terga II, VIII–X and partly VII clearly darker than others, with brown tinge. Other segments light brown to yellowish-brown.

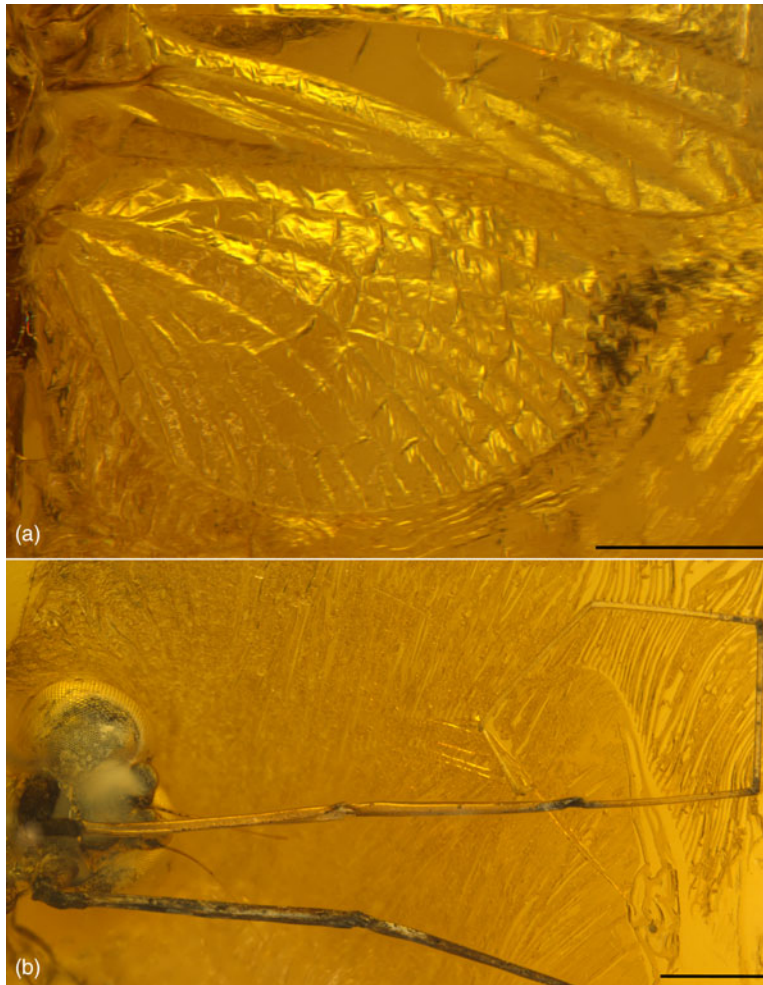


Figure 4. (Colour online) *M. dividus* sp. nov., holotype, male imago. (a) Right hind wing and cubital field of right forewing in dorsal view; (b) right foreleg. Scale lines 0.5 mm.

Some influx of resin on lateral sides of segments. Abdominal sterna pale.

Styliiger plate brown, two last segments of forceps paler, yellowish-brown (Figure 5(a)). Styliiger plate with distinct median projection (Figure 5(b)). Basal segment of forceps basally slightly narrower than adjoining apical part of styliiger plate; forceps four-segmented, segment 4 approximately 0.3 times longer than wide.

Structure of penis lobes hardly visible, partly covered by milky smear ('Verlumung'). Penis lobes elongated, medially widely separated from each other at least in their apical halves. Each penis lobe convex in distal half with bulging, rounded outer margin of lateral sclerite. Apical lobes rounded. Incision between lateral and medial penis sclerites hardly visible due to resin distortions but present (similar to the condition in *Siphloplecton*) (Figure 5(a),(b)).

Paracercus vestigial, at least six-segmented. Preserved part of cerci without darkened annulations.

Discussion

The systematic placement of *M. dividus* sp. nov. within the genus *Metretopus* is due to the combination of following diagnostic characters present in this species: furcasternal protuberances contiguous; tarsi of all legs five-segmented; tarsomere 1 of middle and hind legs fused to tibia; cubital field of forewing with one pair of intercalaries; paracercus vestigial.

M. dividus sp. nov. can be separated from Recent representatives of *Metretopus* by the following:

- (1) Its styliiger plate with distinct median projection (in contrast to medially incised styliiger plates in all Recent species) (Figures 5(a),(b)).
- (2) The shape of penis lobes that are elongated, medially widely separated from each other, convex in their distal halves with bulging, rounded outer margin of lateral sclerite, and with incision between lateral and medial penis sclerites. In contrast to *M. dividus* sp. nov.,

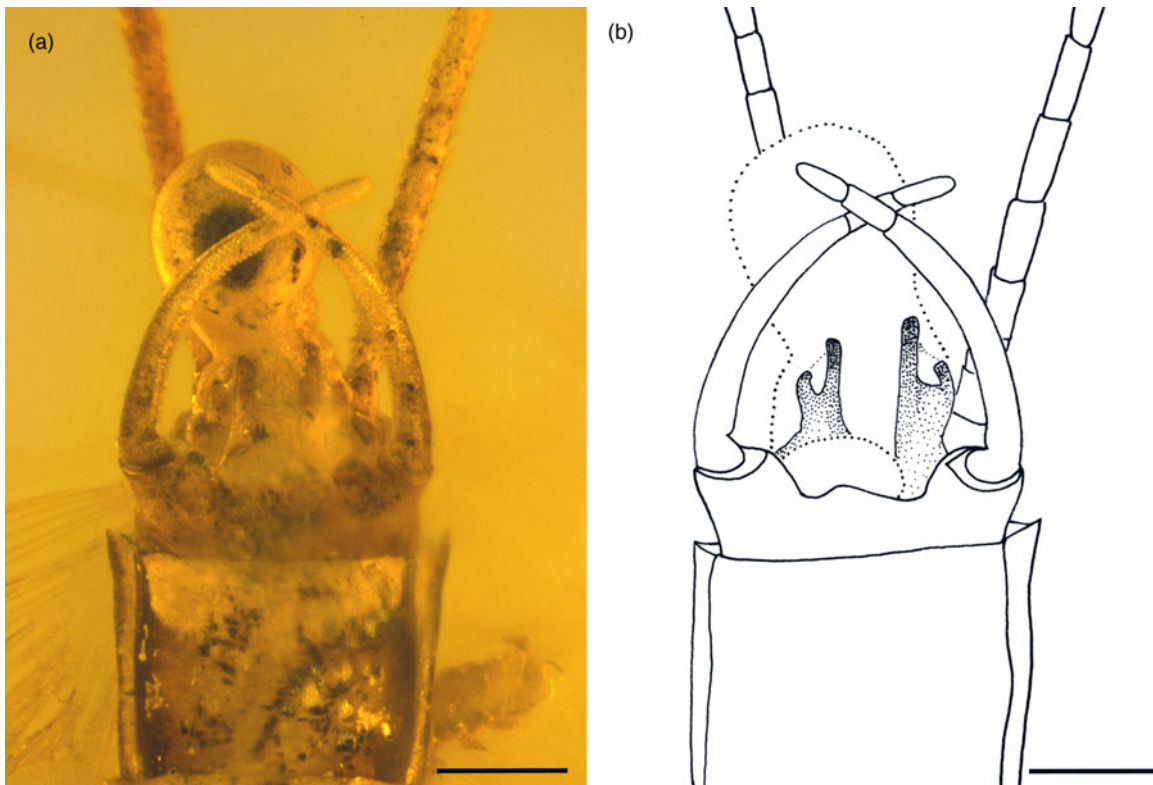


Figure 5. (Colour online) *M. dividus* sp. nov., holotype, male imago, genitalia in ventral view. (a) Photograph; (b) drawing. Scale lines 0.2 mm.

Table 1. Measurements of *M. dividus* sp. nov. (holotype, male imago).

Characters	mm	Characters	mm
Length of body	6.80	Length of tarsus	0.91
Length of right foreleg	7.28	Segment 1	0.30
Length of femur	1.53	Segment 2	0.26
Length of tibia	1.37	Segment 3	0.16
Length of tarsus	4.38	Segment 4	0.10
Segment 1	1.03	Segment 5	0.09
Segment 2	0.98	Length of right hind leg	2.79
Segment 3	0.99	Length of femur	1.21
Segment 4	0.95	Length of tibia	0.65
Segment 5	0.43	Length of tarsus	0.93
Length of left foreleg	7.62	Segment 1	0.29
Length of femur	1.64	Segment 2	0.24
Length of tibia	1.36	Segment 3	0.16
Length of tarsus	4.62	Segment 4	0.11
Segment 1	0.98	Segment 5	0.13
Segment 2	0.99	Length of left hind leg	2.62
Segment 3	1.06	Length of femur	1.07
Segment 4	1.20	Length of tibia	0.65
Segment 5	0.39	Length of tarsus	0.90
Length of right middle leg ^a	1.50	Segment 1	0.30
Length of femur	0.82	Segment 2	0.24
Length of tibia	0.68	Segment 3	0.17
Length of tarsus	–	Segment 4	0.10
Segment 1	–	Segment 5	0.09
Segment 2	–	Length of right forewing	7.0
Segment 3	–	Length of left forewing	–
Segment 4	–	Length of right hind wing	2.10
Segment 5	–	Length of left hind wing	2.25
Length of left middle leg	2.34	Hind/forewings length ratio	0.30
Length of femur	0.80	Length of right cercus ^a	3.87
Length of tibia	0.63	Length of left cercus ^a	3.64

^a Preserved part.

M. borealis is equipped with subparallel, tapering and apically emarginated penis lobes (Bengtsson 1930, fig. 10; Berner 1978, fig. 11; Engblom et al. 1993, fig. 4); *M. alter* has only apically separated penis lobes without any incision between medial and lateral sclerites (Bengtsson 1930, fig. 9; Engblom et al. 1993, fig. 6); and *M. tertius* presents small and conical penis lobes (Tiunova 1999, figs 1, 2).

- (3) In addition, *M. dividus* **sp. nov.** can be separated from *M. alter* and *M. tertius* by the colouration of preserved part of cerci without darkened annulations, while segments of cerci in *M. alter* and *M. tertius* are equipped with darkened annulations (Engblom et al. 1993; Tiunova 1999, fig. 5).

It appeared to be rather complicated to separate *M. dividus* **sp. nov.** from the second fossil species *M. trinervis*, as the latter was only described from three subimaginal specimens, among which the single male specimen was designated as holotype (see Demoulin 1968; Staniczek and Godunko 2012). Moreover, the genitalia of the holotype of *M. trinervis* are almost entirely covered by ‘Verlumung’ (except of the outermost margin of left forceps), which makes a comparison of important distinguishing characters to other fossil and Recent species of *Metretopus* difficult. However, *M. dividus* **sp. nov.** can be clearly separated from *M. trinervis* in the forewings by its pterostigmatic area with several anastomosed veins, while *M. trinervis* has a pterostigmatic area with simple cross-veins that are not anastomosed (Demoulin 1968, fig. 12; Staniczek and Godunko 2012, fig. 17).

Acknowledgements

We are indebted to Milan Pallmann (SMNS) for his assistance in taking photographs and to Dr Karin Wolf-Schwenninger (SMNS) for embedding and preserving the holotype of *M. dividus* **sp. nov.**

Funding

This study was financially supported by DFG [grant STA 1098/1-1] and by institutional support [grant RVO:60077344].

References

- Bengtsson S. 1930. Beitrag zur Kenntnis der Ephemeropteren des nördlichen Norwegen. Tromsø Museums Årshefter, Naturhistorisk Avd Nr 1. 51(2):1–19.
- Berner L. 1978. A review of the mayfly family Metretopodidae. Trans Am Entomol Soc. 104(2):91–137.
- Demoulin G. 1965. Contribution à la connaissance des Éphéméroptères de l’ambre oligocène de la Baltique. Entomol Med. 34:143–153.
- Demoulin G. 1968. Deuxième contribution à la connaissance des Éphéméroptères de l’ambre oligocène de la Baltique. Deutsche Entomol Z NF. 15:233–276.
- Engblom E, Lingdell P-E, Nilsson AN, Savolainen E. 1993. The genus *Metretopus* (Ephemeroptera, Siphonuridae) in Fennoscandia. Identification, faunistics and natural history. Entomol Fennica. 4:213–222.
- Hubbard MD. 1987. Ephemeroptera. In: Westphal F, editor. Fossilium catalogus. I: Animalia. Amsterdam: Kugler Publications. Pars 129, iii +99 pp.
- Kluge NJ. 2004. The phylogenetic system of Ephemeroptera. Dordrecht: Kluwer, 442 pp.
- Staniczek AH, Godunko RJ. 2012. Revision of fossil Metretopodidae (Insecta: Ephemeroptera) in Baltic amber. Part 1: Type specimens of hitherto described fossil species of *Siphloplecton* Clemens, 1915 and *Metretopus* Eaton, 1901, with description of four new fossil species of *Siphloplecton*. Palaeodiversity. 5:57–87.
- Tiunova TM. 1999. A new species of *Metretopus* Eaton, 1901 (Ephemeroptera: Metretopodidae) from the Far East of Russia. Aquatic Insects. 21(4):273–279.
- Weitschat W, Wichard W. 1998. Atlas der Tiere und Pflanzen im Baltischen Bernstein. München: Friedrich Pfeil.
- Wichard W, Gröhn C, Seredusz F. 2009. Wasserinsekten im Baltischen Bernstein. Aquatic insects in Baltic amber. Remagen: Kessel.