Zootaxa 5739 (1): 060–068
https://www.mapress.com/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)
https://doi.org/10.11646/zootaxa.5739.1.10
http://zoobank.org/urn:lsid:zoobank.org:pub:3D0DD36C-9BD8-400D-BDC4-4FA3A80C8178

Synchrotron X-ray tomography reveals a new genus of tropiduchid planthopper (Hemiptera: Fulgoromorpha) from Eocene Baltic amber

MATHIEU BODERAU[1*], ANCHENG PENG[1], CORENTIN JOUAULT[2] & ANDRÉ NEL[1]
[1]Institut de Systématique, Évolution, Biodiversité (UMR 7205) Muséum national d'Histoire naturelle, CNRS, Sorbonne Université, EPHE-PSL, Université des Antilles, F-75005 Paris, France
[2]Oxford University Museum of Natural History, University of Oxford, Parks Road, Oxford OX1 3PW, United Kingdom
mathieuboderau@gmail.com; https://orcid.org/0000-0001-7088-9560
ancheng.peng@edu.mnhn.fr; https://orcid.org/0000-0002-3813-1802
jouaultc0@gmail.com; https://orcid.org/0000-0002-3680-5172
anel@mnhn.fr; https://orcid.org/0000-0002-4241-7651
**Corresponding author*

Abstract

We describe a new genus and species of the small planthopper family Tropiduchidae Stål, 1866, *Discotropiduchus junoi* **gen. et sp. nov.** This new taxon highlights the remarkable diversity of tropiduchid planthoppers preserved in Eocene Baltic amber. Moreover, its morphological characters are incompatible with any currently recognized tropiduchid tribe. We therefore discuss the affinities of the new genus with the tribes previously established within Tropiduchidae.

Key words: Auchenorrhyncha, CT-scan, Eocene, Fulgoroidea, new taxon, Tropiduchidae

Introduction

Planthoppers, or Fulgoromorpha originated in the Early Carboniferous–Late Permian and diversified throughout the Mesozoic (Boderau *et al*., 2025a, b; Bucher *et al*., 2023; Deng *et al*., 2024). By the Cenozoic, modern planthopper family-level diversity was already established (Boderau *et al*., 2025b). This group is highly diverse in the Cenozoic (Szwedo, 2018), especially in Eocene Baltic amber. The historical Baltic amber collection of the Muséum national d'Histoire naturelle, Paris (MNHN), still contains numerous undescribed fossil Fulgoromorpha specimens (Lefebvre *et al*., 2007).

Here, we describe a new genus and species, *Discotropiduchus junoi* gen. et sp. nov., attributed to the small planthopper family Tropiduchidae, which currently encompasses about 680 extant species classified into 197 genera (Bourgoin, 2025). Tropiduchidae are subdivided into two subfamilies: Elicinae Melichar, 1915 and Tropiduchinae Stål, 1866, and comprise 25 tribes, five of which are extinct (Stroiński *et al*., 2022). In Eocene Baltic amber, seven species attributed to six genera have been described for tropiduchid planthoppers with: *Austris raffelis* Szwedo and Stroiński, 2010 (Elicinae: Austrini); *Gedanotropis sontagae* Szwedo and Stroiński, 2017 (Elicinae: Gedanotropidini); *Jantaritambia loculata* (Germar & Berendt, 1856), *J. serafini* Szwedo, 2000 (Tropiduchinae: Jantaritambiini); *Tritophania patruelis* Jacobi, 1937 (Elicinae: Elicini); *Patollo aestiorum* and *P. natangorum* Szwedo and Stroinski, 2013 (Elicinae: Patollini). However, no comprehensive phylogenetic analysis integrating morphological and molecular data has yet tested the monophyly and relationships of these tribes, leaving the family's systematic framework weakly supported. The new genus cannot be assigned to any described tropiduchid tribe, underscoring the need for a revised phylogenetic and systematic assessment of the family integrating extant and extinct taxa.

Accepted by C.-Y. Cai: 29 Dec. 2025; published: 31 Dec. 2025

Material and methods

Baltic amber deposits originate from a broad geographical area along the shores of the Baltic Sea and, in their broadest definition, may even include the coasts of eastern England and Scotland (Weitschat & Wichard, 2010). The principal deposits occur on or near the eastern Baltic coast, particularly on the Samland Peninsula. Baltic amber is predominantly associated with the Blue Earth Formation (or the Blue Earth Member of the Prussian Formation), which has been dated to the late Bartonian–Priabonian (Upper Eocene, *ca*. 38–34 Ma) based on palynological evidence (Aleksandrova & Zaporozhets, 2008; Kosmowska-Ceranowicz *et al*., 1997). A more comprehensive review of the dating and alternative age hypotheses for Baltic amber is provided by Jouault *et al*. (2021). Here, we follow a Priabonian age assignment, while acknowledging that a slightly older Lutetian age cannot be excluded for some amber pieces.

The specimen originated from the historical collection of the Muséum national d'Histoire naturelle (Paris, France); the exact provenance of the specimen is unknown.

The photographs were taken with an AxioCam 705 color camera attached to a Zeiss Zoom V16 stereomicroscope. All the photographs were digitally stacked using Helicon Focus 8 software and processed with Adobe Photoshop CC 2019. All the drawings were digitally vectorized with Pixelmator Pro 3.3.6 Mosaic software.

The specimen was scanned at the ANATOMIX beamline of Synchrotron SOLEIL (Saint-Aubin, France) (Weitkamp et al., 2017, 2022). Projections were acquired using a CMOS ORCA Flash 4.0 V2 camera (Hamamatsu City, Japan) operated in full-frame, non-binning mode (2048 × 2048 pixels; physical pixel size: 6.5 µm) with a 5× objective lens, yielding an effective pixel size of 1.3 µm. The optical setup included transmission filters with total thicknesses of 26 µm Au and 100 µm Cu, providing an effective mean photon energy of approximately 35 keV. The sample-to-detector distance was 1 m. Each tomographic scan consisted of 4000 projection angles over a 360° rotation, with an exposure time of 100 ms per projection. Volume reconstruction was carried out using PyHST2 (Version 2021c) with Paganin phase-retrieval correction (Mirone *et al.*, 2014). Segmentation and 3D rendering of the reconstructed data were performed in ORS Dragonfly (Version 2025.1), from which scene views were exported as screenshots. Final image post-processing was completed in Pixelmator Pro 3.3.6 Mosaic.

The systematic framework follows Szwedo (2018) and Bourgoin and Szwedo (2023), genital morphology follows Bourgoin (1993), wing venation terminology follows Nel *et al*. (2012), Bourgoin *et al*. (2015), adapted by Schubnel *et al*. (2019) for the postcubitus vein. Venation abbreviations are as follows: CA costa anterior, CP costa posterior; ScP subcostal posterior; RA radius anterior, RP radius posterior; M media; CuA_1, first branch of cubitus anterior; CuA_2, second branch of cubitus anterior; CuP cubitus posterior; PC praecosta; PCu postcubitus; A_1 first anal vein. Crossveins are written in italics and lower-case, *e.g*., *cua*-*cup* is the crossvein between CuA and CuP.

This published work and its included nomenclatural acts are registered in ZooBank (https://www.zoobank.org), with the following LSID (reference):

urn:lsid: zoobank.org:pub:3D0DD36C-9BD8-400D-BDC4-4FA3A80C8178

Systematic palaeontology

Order Hemiptera Linnaeus, 1758
Suborder Fulgoromorpha Evans, 1946
Superfamily Fulgoroidea Latreille, 1807
Family Tropiduchidae Stål, 1866
Subfamily Tropiduchinae?
Tribe *incertae sedis*

Discotropiduchus gen. nov.

(Figs 1–3)

Type species. *Discotropiduchus junoi* **sp. nov.**; by present designation and monotypy.

Etymology. The generic name is a combination of *'Disco-'* referring to the shape of the new fossil's forewings and '-*Tropiduchus*', the type genus of the family.

Diagnosis. The new genus can be separated from any other tropiduchid genus based on the following combination of features: head with vertex three times wider than longer, with anterior margin arcuate, transverse carina between frons and vertex well-developed; metathoracic tibiae with three lateral spines; forewing with developed costal cell, CuA meeting M basally.

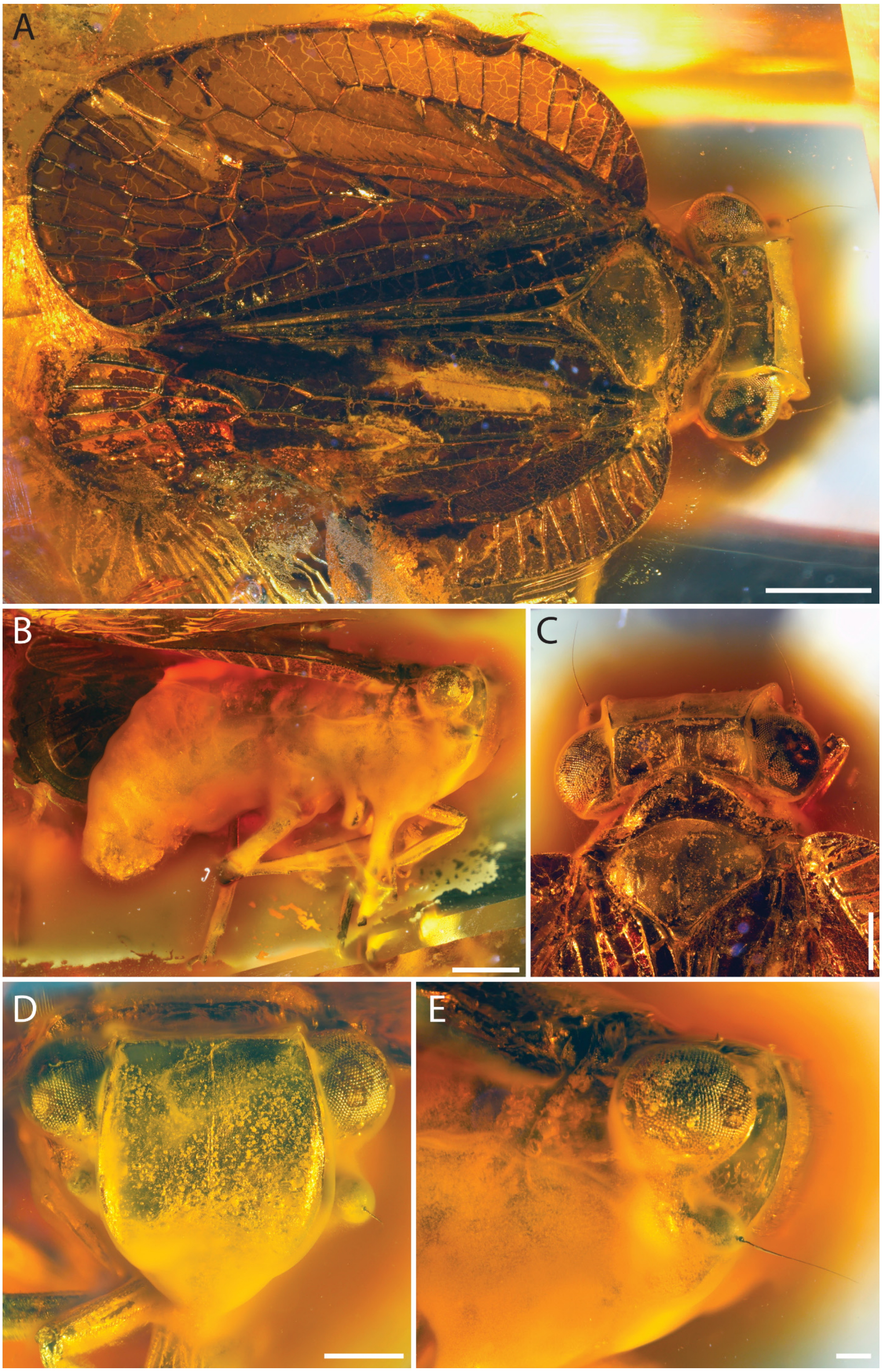

FIGURE 1. *Discotropiduchus junoi* **gen. et sp. nov.** (Fulgoromorpha: Tropiduchidae) holotype MNHN.F.C03012. **A**, Habitus dorsal view. **B**, Habitus lateral view. **C**, Head and thorax dorsal view. **D**, Head anterior view. **E**, Head dorsal view. Scale bars: **A**, **B** = 1 mm; **C**, **D** = 0.5 mm; **E**, **F** = 0.2 mm.

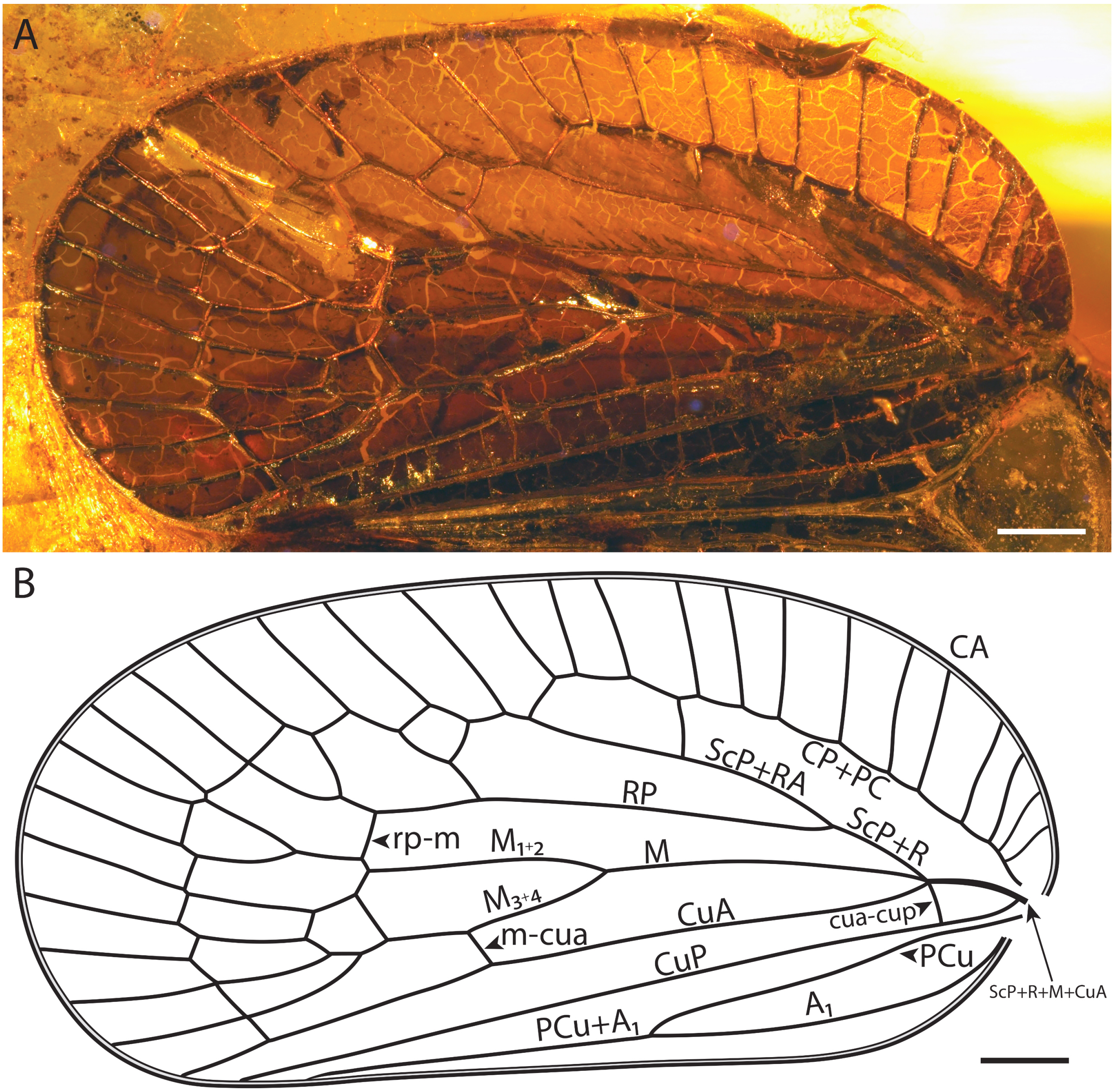

FIGURE 2. *Discotropiduchus junoi* **gen. et sp. nov.** (Fulgoromorpha: Tropiduchidae) holotype MNHN.F.C03012. **A**, Forewing photograph reconstruction. **B**, Forewing venation reconstruction. Scale bars = 0.5 mm.

***Discotropiduchus junoi* sp. nov.**
(Figs 1–3)

Material. The holotype is housed in the Palaeontology Collection of the Muséum national d'Histoire naturelle (Paris, France) under the collection number MNHN.F.C03012.

Etymology. Named after Miss Juno Narozny, niece of the first author; and is to be treated as a noun in the genitive case.

Diagnosis. As for the genus (*vide supra*).

Type locality and horizon. Eocene Baltic amber, exact country of origin unknown (historical collection of the MNHN).

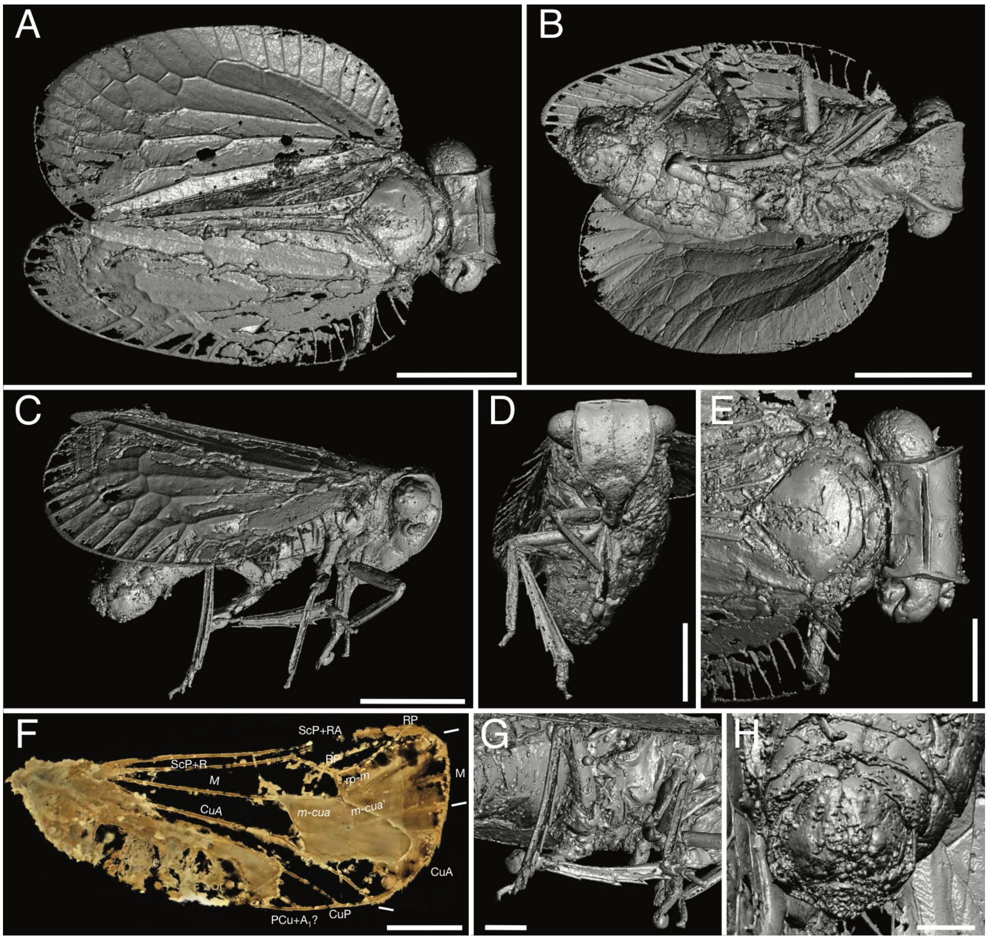

FIGURE 3. *Discotropiduchus junoi* **gen. et sp. nov.** (Fulgoromorpha: Tropiduchidae) holotype MNHN.F.C03012. µCT-scan reconstructions. **A**, Habitus, dorsal view. **B**, Habitus, ventral view. **C**, Habitus, lateral view. **D**, Habitus, anterior view. **E**, Head and thorax, dorsal view. **F**, Left hind wing extracted from the volume. **G**, Legs. **H**, Female terminalia, ventral view. Scale bars: **A**–**D** = 2 mm; **E**–**G** = 1 mm; **H** = 0.5 mm.

Description. Female, macropterous, total length 6.61 mm (without the tegmina), maximum width across abdomen 0.80 mm.

Head. Head with large compound eyes, ≈1.30 times larger than pronotum. Vertex 2.58 times wider than long in midline (1.29 mm and 0.50 mm respectively); anterior margin slightly arcuate, lateral margins straight, posterior margin weak and concave, disc of vertex depressed, transverse carina present between frons and vertex. Frons quadrangular, convex in lateral view, with a median carina reaching dorsal margin but not frontoclypeal suture. Antennae 0.94 mm long; pedicel ring-shaped and scape globose, longer than broad. Clypeus wider at base than frons apical part; clypeal suture concave. Rostrum long, reaching the base of the metacoxae.

Thorax. Pronotum 1.55 times wider than vertex in midline; anterior margin angulate, reaching first third of the compound eye's length; without median carina, but with two lateral carinae. Mesonotum narrower across midline than pronotum and head vertex; with a weak median carina in posterior part; lateral margins incurved, metanotum distinctly wider anteriorly than posteriorly, diamond-shaped.

Legs. Prothoracic tibia quadrangular, longer than prothoracic femur and mesothoracic tibiae. Mesothoracic tarsi distinctly shorter than prothoracic and metathoracic tarsi. Metathoracic legs 1.82 mm long, metathoracic femur slightly flattened, with strong lateral margins; metatibia distinctly longer than prothoracic and mesothoracic tibiae, depressed ventrally, quadrangular, with strong lateral margins, with three lateral spines, first one smaller than others.

Forewings. Tegmina 5.89 mm long, maximum width across tegmina 2.80 mm, costal and apical margin strongly curved, anal margin nearly straight. Costal area present, with numerous simple and straight veinlets, basad to clavus apex. ScP+R short, forking into ScP+RA and RP at 1.29 mm from forewing base, well distad M fork. ScP+RA stem

0.87 mm long. RP long, almost half of wing total length, with numerous branches, *rp-m* located distad *m-cua*. M stem long, about a third of wing total length, forking into M_{1+2} and M_{3+4} at 1.83 from wing base, distad $PCu+A_1$ fusion. CuA simple and straight, subparallel to CuP, *cua-cup* slightly incurved, meeting CuA at point of separation between CuA and M. CuP straight and reaching wing margin at 4.59 mm from wing base. PCu sinuous, distally fusing with A_1 at 2.06 mm from wing base, clavus closed and $^3/_4$ of total length of tegmina. All apical crossveins gathered in a row, subparallel to apical margin of wing.

Hind wings. Wings membranous, 2.80 mm long. ScP+R stem long reaching almost apex of costal margin, at 1.82 mm from wing base. RP with two branches emerging from a short stalk, *rp-m* distad *m-cua* and neither basad nor distad *m-cua*. M stem long, forking into two main branches at 2.21 mm from the hind wing base. CuA with five terminals, first level of forking distad forking of both ScP+R and M. CuP straight reaching anal margin at 1.79 mm from wing base. Claval veins obscured.

Abdomen. Female terminalia poorly preserved. No internal genital structures preserved (as revealed with CT scan construction).

Discussion

The specimen can be assigned to Fulgoromorpha based on the very short *cua-cup*, the presence of rather small cells restricted to the apical part of the forewing and delimited by crossveins, and the large media sector (Shcherbakov, 1984; Bucher *et al*., 2024). It is attributable to Fulgoroidea by the transversely wrinkled ambient vein, A_1 passing into PCu with PCu bent at the point of entry of A_1 (Shcherbakov, 1981).

The fossil can be placed within Tropiduchidae based on the following combination of forewing characters: macropterous; broad tegmina; longitudinal and transverse veins without setae; evenly convex costal margin; precostal field broad, developed and intersected by branches of CP+PC; RA with many long branches, passing into basal half of costal margin while M is branched more distally than CuA, M not forming a common trunk with RP; RP diverging from ScP+RA more basally than CuA branching; CuA not branching before level of clavus apex; clavus closed; CuP at apex straight, passing into anal margin at an acute angle; claval plica not extending beyond apex of clavus; PCu_2+A_1 passing into anal margin close to the apex of clavus and supplementary crossveins gathered into inner and outer gradate rows (Shcherbakov, 1981; see definitions of rows in Boderau *et al*., 2025c).

Tropiduchidae are currently divided into in two subfamilies, Elicinae and Tropiduchinae, encompassing 25 tribes, five of them being extinct (Stroiński *et al*., 2022). These subfamilies are primarily distinguished by female ovipositor shape and morphology (Gnezdilov, 2013). The new fossil presents an ovipositor consistent with Tropiduchinae, characterized by elongated gonoplacs; however, preservation is insufficient to allow further anatomical assessment, so we tentatively assign the genus to this subfamily.

Following the *Identification key of tropiduchid tribes* proposed by Fennah (1982), the new fossil cannot be placed in any extant tribe, because of the following couplets: post-tibia with three lateral spines and CuA meeting M basally. It shares several features with Alcestini: frons broadly unicarinate, post-tibia with three spines laterally, posterior margin of the mesoscutellum angulate, ScP+R forking near the tegmina base, M with more branches than ScP+R, presence of a subapical line near apical margin, and supernumerary transverse veinlets present. However, it differs markedly in having a much broader costal area and M meeting CuA basally.

Seven additional tribes have been described since Fennah's (1982) work, five of which are extinct and contemporaneous with the new fossil. *Discotropiduchus* **gen. nov.** differs from Austrini Szwedo & Stroiński, 2010 by its developed costal cell, more than two RP terminals, four MP terminals, aligned apical crossveins, and a long $PCu+A_1$ stem exceeding half the claval length (Szwedo & Stroiński, 2010). An attribution in Gedanotropidini Szwedo & Stroiński, 2017 is unlikely due to the relatively small size of our specimen, the less complex venation pattern, and the numerous crossveins in postcubital areas (Szwedo & Stroiński, 2017). The wing venation pattern of *Discotropiduchus* **gen. nov.** resembles that of Patollini Szwedo & Stroiński, 2013, but our new taxon is macropterous with a costal area that is half shorter than the clavus (*vs.* almost the same length in Patollini) (Szwedo & Stroiński, 2013). The new fossil cannot be placed within Jantaritambiini Szwedo, 2000 because it bears three spines on its post-tibia, and its different wing venation (most notably the absence of costal cell) (Szwedo, 2000). Emilianini Shcherbakov, 2006, known only from a single tegmen attributed to *Emiliana alexandri* Shcherbakov, 2006, strongly differs in having a poorly developed costal field (*vs.* well-developed in the new fossil), CuA branched (*vs.* simple), *cup-pcu* crossvein present (*vs*. absent), reduced number of nodal and apical crossveins (*vs*. numerous and arranged in series) (Shcherbakov, 2006). Among the recently described extant tribes, our new fossil differs from Bucini Gnezdilov *et al*., 2016 because of its developed costal area with numerous branches, the non-pectinate RP, and A_1 free portion not adpressed to the anal margin (Gnezdilov *et al*., 2016). Our fossil differs from Chrysopuchini Gnezdilov, 2013, due to its *cua-cup* meeting CuA at its common base with M, costal field with numerous crossveins, RP multi-branched, the medial vein's branching pattern, apical crossveins gathered in rows, and CuA vein simple. Lastly, affinities with Parathisciini Gnezdilov, 2013 are excluded based on the shape of their forewing, which is less rounded than in the new fossil, almost quadrangular, and with a reticulate pattern (Gnezdilov, 2013).

The new tropiduchid fossil is characterized by a unique combination of venation traits within the family: a very broad costal area with numerous veinlets; a rather short ScP+R stem; a very long RP stem (*i.e*., more than half the forewing length); ScP+R, M and CuA diverging from the same point; and an unbranched CuA running nearly parallel to CuP.

The systematics of Tropiduchidae remain to be tested by a comprehensive phylogenetic analysis assessing the validity of its subfamilies and tribes. In the absence of such a framework, and given that the new taxon is known from a single specimen, we establish a new genus within Tropiduchidae but leave it unassigned to any tribe.

Conclusion

Our study expands the known past diversity of Tropiduchidae by describing a new extinct genus and species, representing the eighth tropiduchid species recorded from Baltic amber. The fossil cannot be assigned to any currently recognized tribe within Tropiduchidae, underscoring the need for a clearer and more robust systematic framework upon which future phylogenetic analyses can be built. The historical collection of MNHN still contains around 30 specimens of undescribed planthoppers that will be crucial to better understand the past diversity of the lineage.

Acknowledgments

We thank the two anonymous reviewers for their constructive comments, which greatly improved the manuscript. We acknowledge SOLEIL for the provision of synchrotron radiation facilities, and we are grateful to Dr Jonathan Perrin for assistance in using beamline ANATOMIX under proposal n°20242207. ANATOMIX is an Equipment of Excellence (EQUIPEX) funded by the Investments for the Future program of the French National Research Agency (ANR), project NanoimagesX, grant no. ANR-11-EQPX-0031. Computational resources for CT rendering were provided through equipment funded by the French National Research Agency under grant no. ANR-19-CE02-0023 (SocioGenomics project). This study was conducted by MB and AP during their PhD theses.

References

Aleksandrova, G.N. & Zaporozhets, N.I. (2008) Palynological characteristics of Upper Cretaceous and Paleogene deposits on the west of the Sambian Peninsula (Kaliningrad region), Part 2. *Stratigraphical and Geological Correlations*, 16, 528–539. https://doi.org/10.1134/S0869593808050067

Boderau, M., Nel, A. & Jouault, C. (2025a) Diversification and extinction of Hemiptera in deep time. *Communications Biology*, 8, 352. https://doi.org/10.1038/s42003-025-07773-x

Boderau, M., Fu Y., Jiang, H., Guan, S., Peng, A., Nel, A. & Jouault, C. (2025b) Bayesian modelling of the fossil record enlightens the evolutionary history of Hemiptera. *Proceedings of the Royal Society B*, 292, 20251133. https://doi.org/10.1098/rspb.2025.1133

Boderau, M., Nam, G.S., Jouault, C. & Nel, A. (2025c) The first cixiid planthopper (Fulgoromorpha: Cixiidae) from Lower Cretaceous Jinju Formation (Republic of Korea). *Journal of Asia-Pacific Entomology*, 28, 102472. https://doi.org/10.1016/j.aspen.2025.102472

Bourgoin, T. (1993) Female genitalia in Hemiptera Fulgoromorpha, morphological and phylogenetic data. *Annales de la Société Entomologique de France, (N.S.)*, 29 (3), 225–244. https://doi.org/10.1080/21686351.1993.12277686

Bourgoin, T. (2025) FLOW (Fulgoromorpha Lists on The Web): a world knowledge base dedicated to Fulgoromorpha. Retrieved 2025-09-22. [https://flow.hemiptera-databases.org/flow/?&lang=en]

Bourgoin, T. & Szwedo, J. (2023) Toward a new classification of planthoppers Hemiptera Fulgoromorpha: 2. Higher taxa, their names and their composition. *Zootaxa*, 5297, 562–568.
https://doi.org/10.11646/zootaxa.5297.4.5

Bourgoin, T., Wang, R., Asche, M., Hoch, H., Soulier-Perkins, A., Stroinski, A., Yap, S. & Szwedo, J. (2015) From micropterism to hyperpterism: recognition strategy and standardized homology-driven terminology of the forewing venation patterns in planthoppers (Hemiptera: Fulgoromorpha). *Zoomorphology*, 134 (1), 63–77.
https://doi.org/10.1007/s00435-014-0243-6

Bucher, M., Condamine, F.L., Luo, Y., Wang, M. & Bourgoin, T. (2023) Phylogeny and diversification of planthoppers (Hemiptera: Fulgoromorpha) based on a comprehensive molecular dataset and large taxon sampling. *Molecular Phylogenetics and Evolution*, 186, 107862.
https://doi.org/10.1016/j.ympev.2023.107862

Bucher, M., Gignoux, G., Szwedo, J. & Bourgoin, T. (2024) Time-traveling through fossil planthopper tegmina in the Paleozoic and Mesozoic eras (Insecta: Hemiptera: Fulgoromorpha). *Palaeoentomology*, 7 (1), 1–67.
https://doi.org/10.11646/palaeoentomology.7.1.1

Deng, J., Stroiński, A., Szwedo, J., Ghanavi, H.R., Yapar, E., Franco, D.C., Prus-Frankowska, M., Michalik, A., Wahlberg, N. & Łukasik, P. (2024) Phylogenomic insights into the relationship and the evolutionary history of planthoppers (Insecta: Hemiptera: Fulgoromorpha). *Systematic Entomology*, 50, 495–518.
https://doi.org/10.1111/syen.12666

Evans, J.W. (1946) A natural classification of the leaf-hoppers (Jassoidea, Homoptera). Part 1. External morphology and systematic position. *Transactions of the Royal Entomological Society*, 96, 47–60.
https://doi.org/10.1111/j.1365-2311.1946.tb00442.x

Fennah, R.G. (1982) A tribal classification of the Tropiduchidae (Homoptera: Fulgoroidea), with the description of a new species on tea in Malaysia. *Bulletin of Entomological Research*, 72, 631–643.
https://doi.org/10.1017/S0007485300008658

Gnezdilov, V.M. (2013) Contribution to the taxonomy of the family Tropiduchidae Stål (Hemiptera, Fulgoroidea) with description of two new tribes from Afrotropical region. *Deutsche Entomologische Zeitschrift*, 60 (2), 179–191.
https://doi.org/10.1002/mmnd.201300024

Gnezdilov, V.M., Bartlett, C.R. & Bourgoin, T. (2016) A new tribe of Tropiduchidae (Hemiptera: Fulgoroidea) with revision of the genus *Buca* and description of asymmetric hind leg spinulation. *Florida Entomologist*, 99 (3), 406–416.

Jouault, C., Legendre, F., Condamine, F.L. & Nel, A. (2021) A new stonefly species (Plecoptera: Perlodidae) from Eocene Baltic amber and questions on the wing venation potential for species diagnostic of fossil Plecoptera. *Palaeoentomology*, 4 (3), 243–256.
https://doi.org/10.11646/palaeoentomology.4.3.12

Kosmowska-Ceranowicz, B., Kohlman-Adamska, A. & Grabowska, I. (1997) Erste Ergebnisse zur Lithologie und Palynologie der bernsteinführenden Sedimente im Tagebau Primorskoje. *Metalla*, 66, 5–17.

Latreille, P.A. (1807) Genera crustaceorum et insectorum, secundum ordinem naturalem et familias disposita, tomus tertius. *Parisiis et Argentorati*, 1–258.

Lefebvre, F., Bourgoin, T., & Nel, A. (2007) New Cixiidae and Achilidae fossils from Middle Eocene Baltic amber (Hemiptera: Fulgoromorpha). *Annales de La Société Entomologique de France (N.S.)*, 43 (1), 37–43.
https://doi.org/10.1080/00379271.2007.10697491

Linnaeus, C. von (1758) Systema Naturae per regna tria naturae secundum classes, ordines, genera, species cum characteribus, differentiis, synonymis, locis. Ed. decima reformata. Holmiae, Laur. Salvii, Typis Ioannis Thomae nob. *De Trattnern, Vindobonae*, 1, 1–823.

Melichar, L. (1915) Monographie der Tropiduchinen (Homoptera). *Verhandlungen des Naturforschenden Vereines in Brünn*, 53, 82–226.

Mirone, A., Brun, E., Gouillart, E., Tafforeau, P. & Kieffer, J. (2014) The PyHST2 hybrid distributed code for high speed tomographic reconstruction with iterative reconstruction and a priori knowledge capabilities. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, 324, 41–48.
https://doi.org/10.1016/j.nimb.2013.09.030.

Nel, A., Prokop, J., Nel, P., Grandcolas, P., Huang, D., Roques, P., Guilbert, E., Dostál, O., Szwedo, J. (2012) Traits and evolution of wing venation pattern in paraneopteran insects. *Journal of Morphology*, 273, 480–506.
https://doi.org/10.1002/jmor.11036

Schubnel, T., Desutter-Grandcolas, L., Legendre, F., Prokop, J., Mazurier, A., Garrouste, R., Grandcolas, P. & Nel, A. (2019) To be or not to be: postcubital vein in insects revealed by microtomography. *Systematic Entomology*, 45, 327–336.
https://doi.org/10.1111/syen.12399

Shcherbakov, D.Ye. (1981) Diagnostics of the families of the Auchenorrhyncha (Homoptera) on the basis of the wings. 1. Fore wing. *Entomological Review*, 60 (4), 64–81.

Shcherbakov, D.Ye. (1984) Systematics and phylogeny of Permian Cicadomorpha (Cimicida and Cicadina). *Paleontological Journal*, 18 (2), 87–97.

Shcherbakov, D.E. (2006) The earliest find of Tropiduchidae (Homoptera: Auchenorrhyncha), representing a new tribe, from the Eocene of Green River, USA, with notes on the fossil record of higher Fulgoroidea. *Russian Entomological Journal*, 15 (3), 315–322.

Stål, C. (1866) Hemiptera Africana. *Stockholm, Norstedtiana*, 4, 1–275.

Stroiński, A., Bourgoin, T. & Szwedo, J. (2022) Laberiini, a new tribe of Tropiduchidae planthoppers from Madagascar (Hemiptera: Fulgoroidea). *European Journal of Taxonomy*, 836 (1), 23–54. https://doi.org/10.5852/ejt.2022.836.1913

Szwedo, J. (2000) First fossil Tropiduchidae with a description of a new tribe Jantaritambiini from Eocene Baltic amber (Hemiptera: Fulgoromorpha). *Annales de la Société Entomologique de France (N.S.)*, 36 (3), 279–286.

Szwedo, J. (2018) The unity, diversity and conformity of bugs (Hemiptera) through time. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*, 107, 109–128. https://doi.org/10.1017/S175569101700038X

Szwedo, J. & Stroiński, A. (2010) Austrini—a new tribe of Tropiduchidae planthoppers from the Eocene Baltic amber (Hemiptera: Fulgoromorpha). *Annales de la Société Entomologique de France (N.S.)*, 46 (1–2), 132–137. https://doi.org/10.1080/00379271.2010.10697648

Szwedo, J. & Stroiński, A. (2013) An extraordinary tribe of Tropiduchidae from the Eocene Baltic amber (Hemiptera: Fulgoromorpha: Fulgoroidea). *Zootaxa*, 3647 (2), 371–381. https://doi.org/10.11646/zootaxa.3647.2.8

Szwedo, J. & Stroiński, A. (2017) Who's that girl? A singular Tropiduchidae planthopper from the Eocene Baltic amber (Hemiptera: Fulgoromorpha). *Palaeontologia Electronica*, 20.3.60A, 1–20. https://doi.org/10.26879/784

Weitkamp, T., Scheel, M., Giorgetta, J.L., Joyet, V., Le Roux, V., Cauchon, G., Moreno, T., Polack, F., Thompson, A. & Samama, J.P. (2017) The tomography beamline ANATOMIX at Synchrotron SOLEIL. *Journal of Physics Conference Series*, 849 (1), 012037.

Weitkamp, T., Scheel, M., Perrin, J., Daniel, G., King, A., Le Roux V., Giorgetta, J.L., Carcy, A., Langlois, F., Desjardins, K. & Menneglier, C. (2022) Microtomography on the ANATOMIX beamline at Synchrotron SOLEIL. *Journal of Physics Conference Series*, 2380 (1), 012122.

Weitschat, W. & Wichard, W. (2010) Baltic amber. *In*: Penney, D. (Ed.), *Biodiversity of fossils in amber from the major world deposits*. Siri Scientific Press, Manchester, pp. 80–115.