

# A NEW GENUS OF RICANIIDAE (HEMIPTERA: FULGOROMORPHA) FROM THE LATE EOCENE BEMBRIDGE MARLS, ISLE OF WIGHT, UNITED KINGDOM

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**Abstract.**— A new monospecific fossil genus of ricaniid planthoppers (Hemiptera: Fulgoromorpha: Ricaniidae), *Worako gen. nov.*, is described with *Worako yulei sp. nov.* The fossil is reported from the Late Eocene Insect Bed of the Bembridge Marls, Isle of Wight, UK. It is the second record of Ricaniidae from these strata and third fossil record of Ricaniidae from the United Kingdom. The morphological characters and biogeographical importance of the fossils are briefly discussed.



**Key words.**— Fulgoroidea, morphology, taxonomy, fossil material, Europe

## INTRODUCTION

The Hemiptera is an ancient insect order, known since the Carboniferous (Nel *et al.* 2013, Szwedo 2018). It is divided into six suborders, of which one is the Fulgoromorpha Evans, 1946. According to the most recent interpretation and classification proposals, the Fulgoromorpha are known since the Moscovian with

*Aviorrhyncha magnifica* Nel, Bourgoin, Engel et Szwedo, 2013 recently interpreted as the oldest member of the suborder (Bourgoin and Szwedo 2022, 2023). The classification was recently revised with extinct lineages comprising Carboniferous Aviorrhynchidae Nel, Bourgoin, Engel et Szwedo, 2013, Permian Coleoscytoidea Martynov, 1935, Permian-Triassic Surijokocixioidea Shcherbakov, 2000, Jurassic-Eocene

Fulgoridioidea Handlirsch, 1939, recent Delphacoidea Leach, 1815 and recent Fulgoroidea Latreille, 1807 (Bourgoin and Szwedo 2022, 2023). The family Ricaniidae Amyot et Audinet-Serville, 1843, is currently placed in the Fulgoroidea; previously placed in so called 'higher Fulgoroidea' (Bartlett *et al.* 2018, Brysz and Szwedo 2019). Its fossil record starts in the Paleocene (Piton 1940, Szwedo *et al.* 2004 and unpublished data), but numerous taxa once placed in Ricaniidae were transferred to other groups (e.g. Shcherbakov 2006). The internal classification of the family is the subject of discussion, with subfamilies Ricaniinae Amyot et Audinet-Serville, 1843 and Pharsalinae Gnezdilov, 2009 proposed (Gnezdilov 2009, 2019). The family comprises 70 genera and 443 described species, of which three monospecific genera are placed in Pharsalinae, while the remaining are placed in Ricaniinae (Bourgoin 2023). The Ricaniidae are found in almost all the zoogeographic realms of Holt *et al.* (2013): mainly in Afrotropical, Madagascar, Oriental, Oceanian regions with less representation in Sino-Japanese, Saharo-Arabian, Palaeartic, Australian, Neotropical and Panamanian regions.

Fossil Ricaniidae are known since the Paleocene: Selandian of Menat in France and Fur Formation in Denmark (Szwedo *et al.* 2004), but older fossils of Danian age from Tsagayan Formation of the Amur Region, Russian Far East are also known (Stroiński, unpublished).

The Insect Limestone of the Isle of Wight, United Kingdom, is remarkable for the exquisite preservation of insects and spiders (Konservat-Lagerstätte), preserving the fossils in fine detail. The limestone is of late Eocene: Priabonian age and forms concretions or tabular bands of very fine-grained micrite. The unit where these concretions/bands occur is known as the Insect Bed, which lies towards the base of the Bembridge Marls Member (Solent Group: Bouldnor Formation) (Ross and Self 2014). King's (2016) suggestion of changing the name of the Bembridge Marls Member to the Gurnard Member has not yet gained wide acceptance. The Bembridge Marls were deposited in fresh-brackish water lakes and lagoons (Daley 1973, 1999). The insects of the Bembridge Marls are remarkable in preserving cuticle and mineralized internal tissues in a largely uncompact state, the taphonomic features were discussed by McCobb *et al.* (1998).

The family Ricaniidae was previously reported from the Bembridge Marls (Szwedo *et al.* 2019), rerepresented by *Ankwlanno bluga* Szwedo, 2019. The new fossil described below represents another new genus and species, belonging to the *Pochazoides* generic group of Ricaniinae, of unclear relationships, as all recent genera placed in this group require revision and redescription, and includes many as yet undescribed species.

## MATERIAL AND METHODS

The specimen came from Saltmead Ledge, Thorne Bay, on the north-west coast of the Isle of Wight and was collected by Andy Yule. It is an adpression of an upside down left fore wing (tegmen) with coloration of veins partly preserved. The specimen is housed in the Dinosaur Isle Museum, Sandown, Isle of Wight, United Kingdom. The specimen was examined using direct light from different angles and photographed using a Nikon D700 digital SLR camera. Drawings were prepared with use of CorelDrawX7 package.

## Terminology

The nomenclature of the forewing (tegmen) follows the interpretation proposed by Bourgoin *et al.* (2015) and Stroiński (2020).

## Measurements and abbreviations

Institutional abbreviation: IWCMS – Isle of Wight County Museum Service.

I/J – length of tegmen measured from the base to the apical margin in median portion / width of tegmen measured at the widest part / tip of clavus (Stroiński 2020).

## TAXONOMY

Order **Hemiptera** Linnaeus, 1758

Suborder **Fulgoromorpha** Evans, 1946

Superfamily **Fulgoroidea** Latreille, 1807

Family **Ricaniidae** Amyot et Audinet-Serville, 1843

Subfamily **Ricaniinae** Amyot et Audinet-Serville, 1843

***Worako*** gen. nov.

**Type species.** *Worako yulei* sp. nov., by present designation and monotypy.

**Etymology.** Generic name from Proto-Celtic stem “\*worāko-” meaning curve and refers to the curved veins. Gender: neuter.

**Diagnosis.** *Worako* gen. nov. is similar to *Abraracourcix* Stroiński et Szwedo, 2011a by the general shape of the tegmen, wave-shape longitudinal veins; costal area as wide as costal cell; all first forks of longitudinal veins in basal part; costal cell with transverse veinlets, present of double apical lines of transverse veinlets; absent of transverse veinlets on basal part. *Worako* gen. nov. differs from *Abraracourcix* Stroiński et Szwedo, 2011a in the following characters: forking sequence of longitudinal veins MP→ScP+R→CuA

(in *Abraracourcix* – ScP+R→CuA→MP); the dominant vein is MP with terminals covering  $\frac{3}{4}$  of apical margin of tegmen (in *Abraracourcix* the dominant vein is ScP+R with terminals covering  $\frac{3}{4}$  of apical margin of tegmen); longitudinal vein MP forming short common section with RP vein (in *Abraracourcix* such fusion is absent); clavus with transverse veinlets (in *Abraracourcix* clavus without transverse veinlets).

**Description.** (based on a left tegmen which is preserved upside down). Tegmen flattened, membranous, distinctly longer than wide, with well-developed longitudinal veins. Costal margin weakly curved at base, slightly arcuate to anteroapical angle; anteroapical and posteroapical angle widely arcuate, posterior margin distinctly arcuate, tornus absent, apex of clavus reaching  $\frac{2}{3}$  of tegmen length. Costal area present, about as wide as costal cell width, with transverse veinlets; ending a bit before level of the apex of clavus. Costal cell with transverse veinlets. Basal cell narrow, distinctly longer than wide. Stems of longitudinal veins ScP+R, MP and CuA leaving basal cell separately, with all first forks on corium, in its basal part, in sequence MP→ScP+R→CuA. All first forks before claval veins connection. Stem ScP+R about as long as basal cell; stem MP shorter than basal cell; stem CuA distinctly longer than basal cell. ScP+R long, forked at apex, branch RP forked twice on corium, with a short common part of terminal  $RP_3$  and terminal of  $MP_{1a}$ . Terminals of MP covering  $\frac{3}{4}$  of apical margin of tegmen. Clavus long, exceeding  $\frac{3}{4}$  of tegmen length. Claval veins  $Pcu$  and  $A_1$  fused in basal half of clavus length, joined vein  $Pcu+A_1$  reaching apex of clavus; postero-cubital cell (basal and posterior part) and postcubital cell with transverse veinlets. Tegmen with double lines of transverse veinlets, nodal line absent, posterior part of tegmen (apical section of corium, apicad of claval veins junction and membrane) with net of transverse veinlets, basal part of corium without transverse veinlets. Apical cells distinctly longer than wide subapical cells distinctly shorter than apical).

*Worako yulei* sp. nov.  
(Figs 1–7)

**Etymology.** Specific epithet is dedicated to Andy Yule, who collected the specimen.

**Diagnosis.** As for genus, as it is the only included species. In addition cell C1 shorter than cells C3 and C5, Cell C3 the longest, cell C5 subequally wide along to the end; ScP+R with two terminals, RP with 3 terminals; MP with 11 terminals, common section  $RP_3$  and  $MP_{1a}$  short, shorter than width of adjacent cells.

**Description.** Total length ca. 7.0 mm, width ca. 2.8 mm. Ratio I/J = about 2.5. Tegmen with 17 terminals of longitudinal veins in total. ScP+RA with 2 terminals

(ScP – 1, RA – 1); RP with 3 terminals;  $MP_{1+2}$  multi-branched with 7 terminals, covering the apical margin to the tegmen apex; first fork of  $MP_{1+2}$  before first fork  $MP_{3+4}$ ;  $MP_1$  forked distinctly basad of  $MP_2$  fork;  $MP_{1a}$  and  $MP_{1b}$  forked slightly apicad of  $MP_{2a}$  and  $MP_{2b}$  fork;  $MP_{3+4}$  with 4 terminals;  $MP_{3a}$  and  $MP_{3b}$  forked more apicad than  $MP_{4a}$  and  $MP_{4b}$  fork; CuA parallel to claval suture, with 2 terminals. Apical cells about 3 times longer than wide.

**Type material.** Holotype, IWCMS: 2023.124, deposited in Dinosaur Isle Museum, Sandown, Isle of Wight, UK.

**Age and occurrence.** Late Eocene, Priabonian, ca. 34 Ma; Saltmead Ledge, Thorness Bay, north-west coast of the Isle of Wight; Insect Bed, Bembridge Marls Member, Bouldnor Formation.

## DISCUSSION

The family Ricaniidae is revealed as a monophyletic lineage from molecular analyses (Bucher *et al.* 2023, Wang *et al.* 2023), but there is not a single morphological autapomorphy easily defining the lineage; Ricaniidae remains defined by a complex of variable characters of body morphology, venation patterns of fore and hind wings, leg structures and genital structures of males and females.

The new genus *Worako* can be placed in the generic group of *Pochazoides*, comprising recent genera *Pochazoides* Signoret, 1860 (with 17 species), *Janssensia* Lallemand, 1950, *Keiserana* Synave, 1966, (sub?) fossil genus *Yuripopoverus* Stroiński et Szwed, 2011b and fossil genus *Abraracourcix* Stroiński et Szwed, 2011a (these are monospecific). Taxa of the *Pochazoides* group taxa are also characteristic in having a costal area about as wide as costal cell or narrower in various degree, to very narrow, but in all cases the apical portion remain more or less widened. Recent distribution of this generic group covers Madagascar and East Africa, while its fossil record is known from Zanzibar copal (*Yuripopoverus* and *Pochazoides*), aged down to 1 Ma (Schlüter and von Gnielinski 1987, but see Solórzano-Kraemer *et al.* 2020 for discussions on ages of copal); current record from Late Eocene of the Isle of Wight (*Worako*) and Lowermost Eocene amber of Oise (*Abraracourcix*). All these genera are characterized by S-curved terminal sections of longitudinal veins (Stroiński and Szwed 2011a: figs 8–10). The genera *Pochazoides*, *Janssensia*, *Keiserana* and *Yuripopoverus* have a wide median field, the same pattern is present in *Worako*, while in *Abraracourcix* the radial field is prevailing over the median field (Figs 8–10). The radial field in the genera *Pochazoides*, *Janssensia*, *Keiserana* and *Yuripopoverus*, even if widened, is distinctly narrower than the median

field. It is interesting than in the unrelated family Weiwoboidae Lin, Huang, Szwedo et Stroiński, 2010 from the Eocene of Yunnan, the family presents a 'ricanoid' appearance in its cubital field which covers half of the tegmen, while the median area is attenuated.

The chronological and distributional pattern of fossils of the *Pochazoides* generic group are worth noting. The oldest fossils so far are known from European deposits - the oldest known from Oise amber (*Abraracourcix*), aged 53 Ma, the youngest (*Worako*) from the Late Eocene Bembridge Marls of the Isle of Wight, aged 34 Ma. Subfossil taxa (*Yuripopoverus africanus* and *Pochazoides szwedoi* Stroiński, 2007) are reported from East African copal (<1 Ma), and are in the range of modern distributions of species from the *Pochazoides* generic group, covering East Africa: Eritrea, Somalia, Ethiopia, Kenya and Tanzania, Madagascar and the Seychelles (Bourgoin 2023). Such a pattern suggests that the group was once much more widely distributed and the recent range is rather a result of migrations and shifting of biogeographic distributions, due to environmental and climatic changes.

The other fossil ricaniid from the Bembridge Marls - *Ankwilanno bluga* Szwedo, 2019, represents the other 'subgroup' within the Ricaniinae, belonging to the *Privesa* Stål, 1862 generic-group. In this group several taxa of generic level should be established and numerous new species, especially from Madagascar should be described. However, the distributional pattern of these taxa is similar, covering Eastern Africa, Madagascar, Comoros, Mauritius and the Seychelles (Bourgoin 2023, Stroiński, unpublished). Another Ricaniidae from the Eocene: Lutetian, Poole Formation, Bournemouth, U.K. described as *Hammapteryx anglica* Cockerell, 1920 should probably be placed in the '*Privesa*' group, but the material must be re-examined; the genus name '*Hammapteryx*' is a collective unit for various taxa and the genus and its characters remain weakly defined.

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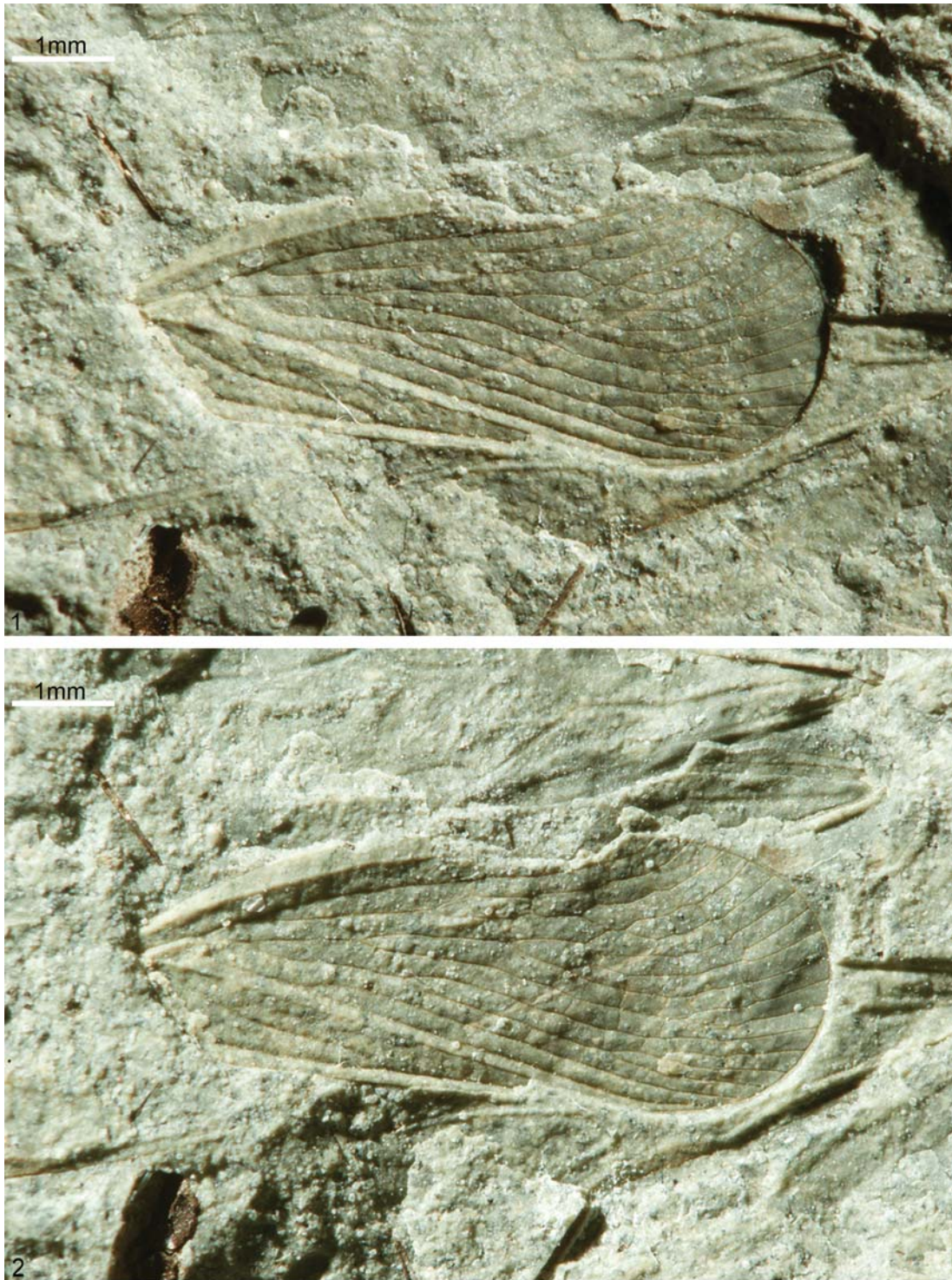
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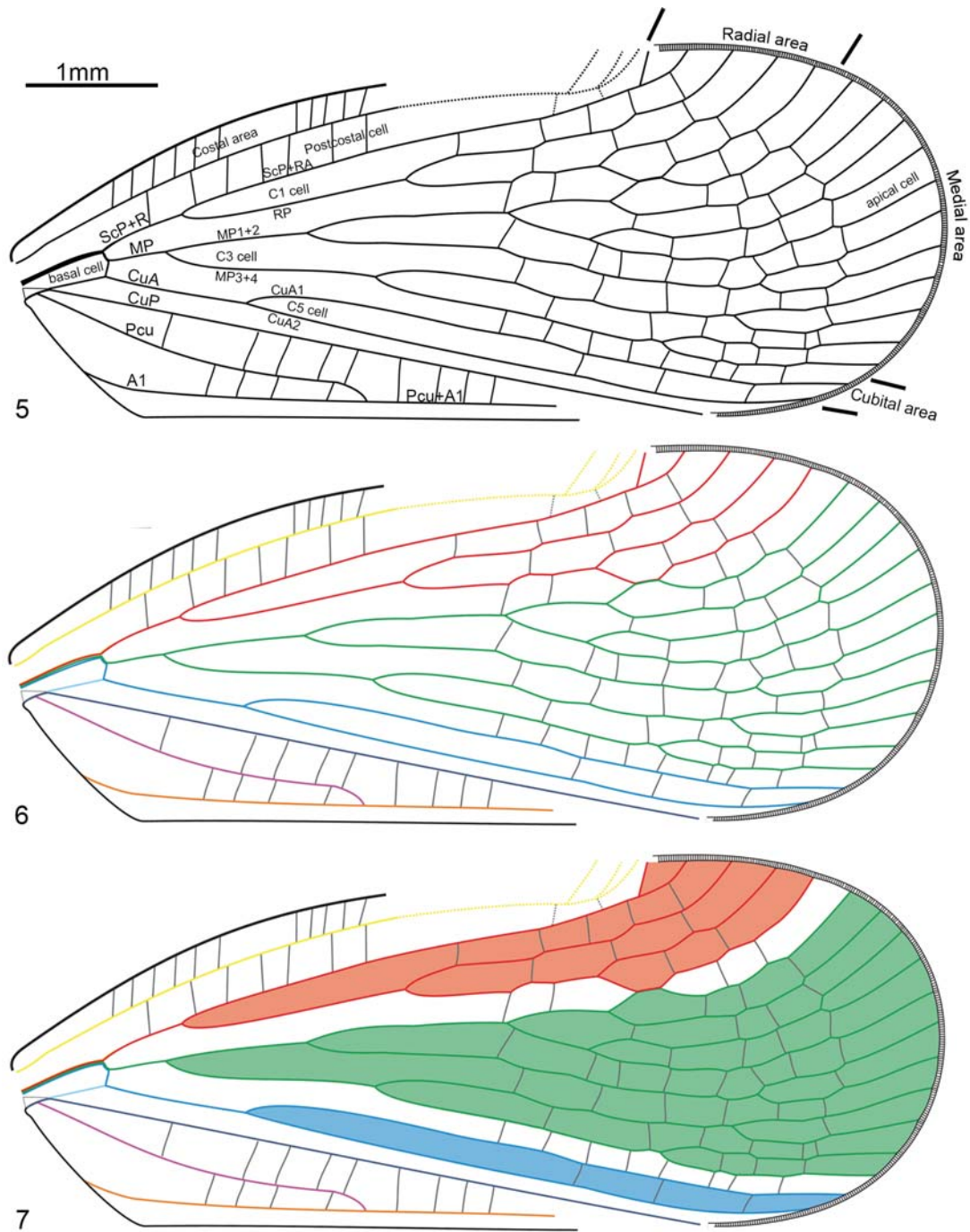
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Figures 1–2. *Worako yulei* gen. et sp. nov. Holotype (left tegmen which is preserved upside down): (1) Top right light; (2) top left light.

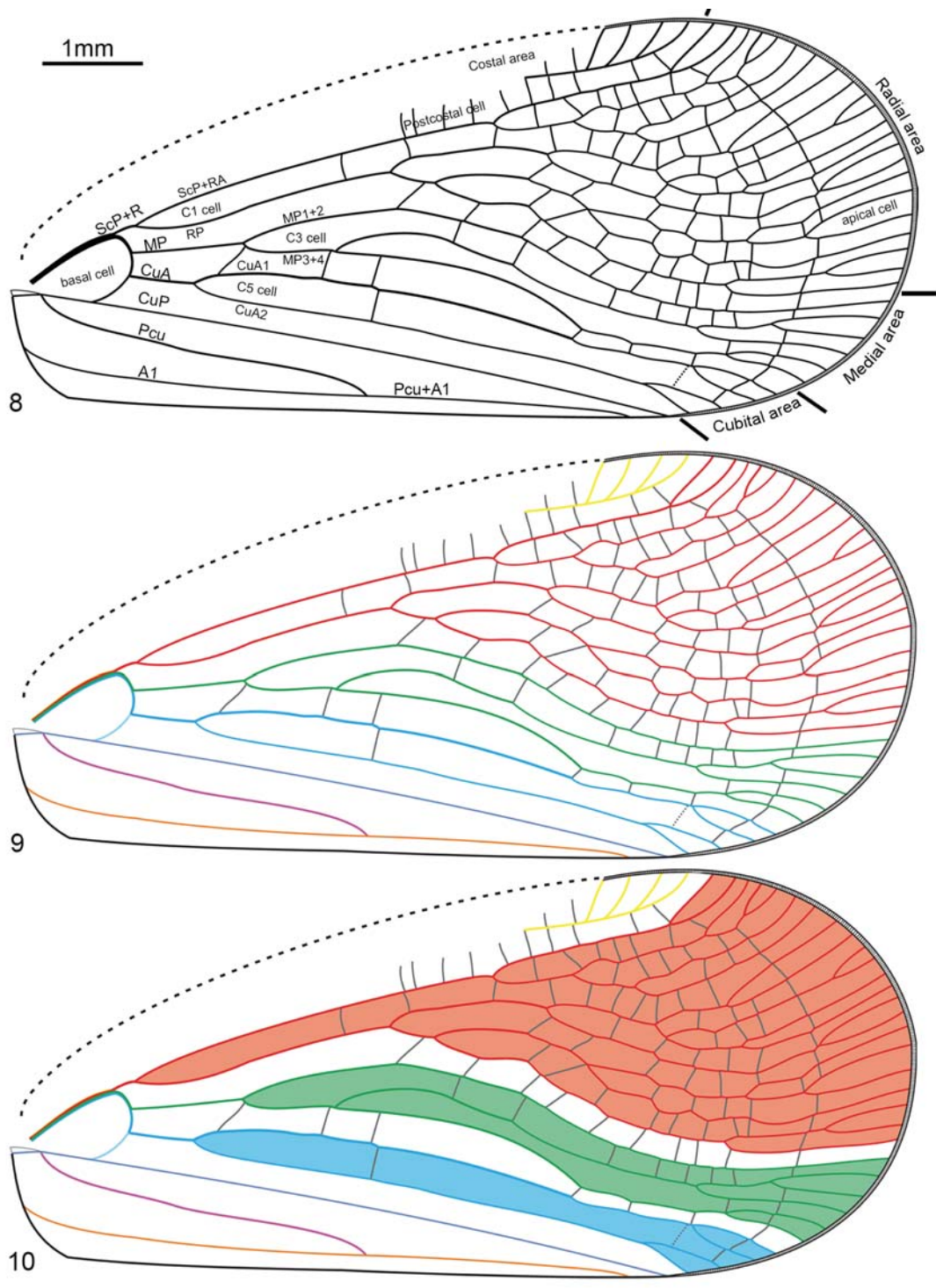


Figures 3–4. *Worako yulei* gen. et sp. nov. Holotype (left tegmen which is preserved upside down): (3) Bottom left light; (4) bottom right light which have created false relief.



Figures 5–7. *Worako yulei* gen. et sp. nov. Holotype (left tegmen which is preserved upside down): (5–6) tegmen venation pattern; (7) tegmen with areas marked.





Figures 8–10. *Abraracourcix curvivenatus* Stroiński et Szvedo, 2011. Holotype, left tegmen, mirrored (after Stroiński and Szvedo 2011a); (8–9) tegmen venation pattern; (10) tegmen with areas marked.