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A new species of dustywings (Neuroptera: Coniopterygidae) from mid-Cretaceous Kachin amber

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The family Coniopterygidae, commonly known as dustywings, occupies a distinctive niche within the Neuroptera, as they are the smallest members of this order (Grimaldi & Engel, 2005; Engel *et al.*, 2018). Characterized by forewing lengths seldom surpassing 5 mm, with a few exceptions (Liu & Lu, 2017), this family has achieved a remarkable speciosity, with approximately 570 extant species scattered across diverse habitats globally (Oswald & Machado, 2018).

Recent advances in molecular phylogenies have reshaped our understanding of the position of the Coniopterygidae within the Neuroptera. Traditionally considered a derived group, recent studies proposed that Coniopterygidae are, in fact, the basalmost lineage of Neuroptera, challenging previously held assumptions (Winterton *et al.*, 2010, 2017; Wang *et al.*, 2017). This places the origin of these diminutive insects far earlier than indicated by their current fossil record, with the earliest coniopterygid species dating back to the Early Jurassic and Late Jurassic epochs (Meinander, 1975; Makarkin & Ansoerge, 2023). However, the scarcity of coniopterygid fossils, totaling only 48 species in 31 genera worldwide, underscores the need for a comprehensive exploration of historical and new fossil deposits (*e.g.*, Nel *et al.*, 2005; Engel & Grimaldi, 2007; Li *et al.*, 2019; Chen *et al.*, 2022).

Herein we delve into the Cretaceous, a pivotal period that witnessed a remarkable radiation of Coniopterygidae, particularly evident in the amber deposits of Myanmar. A total of 15 species in 11 genera have been described from Kachin amber (Myanmar), shedding light on the hitherto unknown diversity (Xiao *et al.*, 2023: tabl. 1). We further this diversity by describing a new species of Coniopterygidae lacking seta on the vein MP, a relatively rare characteristic among this paleofauna.

Material and methods

The piece of amber containing *Glaesoconis glaber* sp. nov. originated from the deposits of Noiye Bum in the Hukawng Valley (26°29'N, 96°35'E), Kachin State, northern Myanmar (*vide* Grimaldi & Ross, 2017: fig 2). Radiometric data established an early Cenomanian age (98.79 ± 0.62 Mya) for Kachin amber, based on zircons from volcanic clasts found within the amber-bearing sediments (Shi *et al.*, 2012). Some ammonites found in the amber-bearing bed and within amber corroborated a late Albian/early Cenomanian age (Cruickshank & Ko, 2003; Yu *et al.*, 2019).

The amber piece was polished to facilitate the observation of the specimen using a grinder polisher (Buehler EcoMet 30) with very thin silicon carbide sanding paper (grit size 7000). The specimen was examined and photographed with a Nikon SMZ 25 with an attached Nikon Z7II camera. All images are digitally stacked photomicrographic composites of several individual focal planes, which were obtained using Helicon Focus 6.7. The figures were enhanced with Nikon Capture NXD and composed with Adobe Illustrator CC2019 and Photoshop CC2019 software. The amber piece is housed in the Geological Department and Museum of the University of Rennes, France (IGR), under collection numbers IGR.BU-084. We follow the wing venation nomenclature of Li *et al.* (2019).

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Systematic paleontology

Order Neuroptera Linnaeus, 1758

Superfamily Coniopterygoidea Burmeister, 1839

Family Coniopterygidae Burmeister, 1839

Subfamily Aleuropteryginae Enderlein, 1905

Tribe Fontenelleini Carpentier & Leastage, 1928

Genus *Glaesoconis* Meinander, 1975

Type species. *Glaesoconis cretica* Meinander, 1975

Other species. *Glaesoconis baliapteryx* Engel, 2004; *Glaesoconis nearctica* Grimaldi, 2000; *Glaesoconis popovi* Makarkin & Perkovsky, 2017; *Glaesoconis glaber* **sp. nov.**

***Glaesoconis glaber* sp. nov.**

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(Figs. 1–2; Supplementary Figure 1)

Material. Holotype: imago, IGR.BU-084, preserved in a trapezoidal piece of amber measuring 5 × 4 × 2 mm, housed in the amber collection of the Geological Department and Museum (IGR), Rennes, France.

Etymology. The specific epithet derives from the Latin adjective ‘*glaber*’, meaning glabrous, without pilosity, and refers to the lack of setae on MP.

Diagnosis. Compound eyes occupying most of head lateral surface (*vs.* small in *G. popovi*). Maxillary palpus with distal palpomere short and swollen (resembling that of *G. nearctica*; different from the much more elongate, fusiform maxillary palpus of *G. popovi*). Antennae with 26 antennomeres (*vs.* 24 in *G. popovi*, the other species apparently more variable). Forewing with distinct spots (pigmented areas along some crossveins *vs.* absent in *G. cretica* and *G. popovi*); ma-mp long (distinctly longer than in *G. baliapteryx*); first fork of MP (= base of MP3) close to rp+ma-mp crossvein (distinctly distad crossvein in *G. baliapteryx* and *G. nearctica*; variable in *G. cretica*); branches of MP long (*vs.* comparatively shorter in the other species of *Glaesoconis*); three mp-cua crossveins present (*vs.* two in other species except *G. baliapteryx* with one? crossvein, but see Discussion). Hind wing with long RP branches (*vs.* comparatively shorter in *G. nearctica* and *G. popovi*); rp+ma-mp crossvein connecting MP between MP3 and MP2 (*vs.* connecting stem of MP in *G. cretica*, *G. nearctica*; but similar to *G. popovi*).

Locality and horizon. Noiye Bum Hill, Hukawng Valley, Kachin State, Myanmar; uppermost Albian to lowermost Cenomanian, mid-Cretaceous.

Description. Sex unknown. Head wider than long (about 0.45 mm wide and 0.25 mm long), with prominent compound eyes; eye about 0.22 mm long, occupying most of head lateral surface; frons depressed, probably poorly sclerotized; lower part of face apparently well sclerotized. Antenna with scape well-separated, larger than pedicel, longer than wide; flagellum moderately setose, each flagellomere subquadrate (note that the basal and second flagellomeres of the right antenna are nested in each other), terminal flagellomere bullet-shaped. Maxillary palpi elongate, palpomeres all longer than wide, with apical palpomere the longest, swollen medially, much longer and slightly broader than preceding palpomeres.

Prothorax much narrower and shorter than meso- and metathorax. Legs slender, with short setae; pro- and mesotibiae nearly equal in length to pro- and mesofemora; metatibia much longer than metafemur; tarsus 5-segmented; tarsomere 1 longest, nearly equal to combined length of remaining tarsomeres; tarsomere 4 apically expanded; pretarsal claws short, simple; arolium absent. Forewing length about 2.4 mm; membrane hyaline, with four ovoid, colored spots, respectively located at proximal section of MA, rp+ma-mp crossvein, 3mp-cua, and cua-cup; costal space proximally with two costal crossveins; ScP largely parallel to costal margin, distally feebly curved; ScP2 separating from ScP1 at about 0.8 of ScP length, distally slightly curved anteriorly toward ScP1; origin of RP+MA near wing midlength; RP simple, with ra-rp distinctly distad proximal section of ScP2 as well as branching point between RP and MA; MA simple, proximally strongly angled, with curving point connected with MP1 by a long crossvein (ma-mp); MP without stiff seta; MP trifurcate into MP1, MP2, and MP3; 2mp-cua slightly anterior to rp+ma-mp; separation between CuA and CuP located in wing basal quarter; cua-cup located at mid-length between 2mp-cua and cup-a1; two cup-a1 crossveins; A1 simple, A2 with a short proximal branch reaching wing margin; a1-a2 present.

Hind wing length about 2.2 mm, broader than forewing, immaculate; venation in general similar to that of forewing; RP + MA origin near proximal quarter of wing length; second rp+ma-mp present well before fork of RP+MA; MP (then MP3) and CuA subparallel, and distinctly separated; cua-cup, cup-a1, and a1-a2 present near wing base.

Discussion

Following the key to Cretaceous genera of Coniopterygidae proposed by Li *et al.* (2019) the new specimen keys out to *Glaesoconis* Meinander, 1975 because of the following couplets: forewing length ≤ 3.0 mm; at least origin of forewing RP+MA near wing midlength; forewing RA and RP separated, without any fusion, CuP proximally smooth; crossvenation sparse; forewing MP with three branches; forewing without stiff setae on stem of MP; forewing MA strongly angling at connection of ma-mp. Following the more recent key to the genera of Coniopterygidae from Myanmar amber of Xiao *et al.* (2023) the new specimen also keys out to *Glaesoconis* because of the following couplets: origin of RP+MA near wing midlength in forewing; forewing RA not connected with RP; CuP proximally smooth; crossvenation sparse; MP trifurcate; forewing without stiff setae on MP; MA separated from RP distally, MP branched anteriorly and entering outer margin; MA distant to MP branches, ma-mp crossvein long.

Currently, this genus encompasses four species, *G. baliopteryx*, *G. cretica*, *G. nearctica*, and *G. popovi*, which span from the mid-Cretaceous (Kachin amber) to the Santonian (Taimyr amber)

and display a relatively homogeneous wing venation (Engel, 2004; Makarkin & Perkovsky, 2017). However, one species, *G. baliopteryx*, has a wing venation that stands in stark contrast with the other species (our new species included) of the genus because of its extremely short ma-mp, and the reduced number of crossveins in the proximal part of the forewing (Engel, 2004: fig. 1). These characters are, in our point of view, sufficient to justify transferring the species into a new or already described genus (maybe *Achlyoconis*), but before that it is imperative to reexamine the type specimen of this species to ensure the absence of more proximal crossveins and that these were not overlooked owing to the preservation (Makarkin & Perkovsky, 2017). Regardless of the placement of *G. baliopteryx*, the new species enhances our knowledge of the considerable diversity of dustywings present in the Kachin amber forest and documents the considerable longevity and paleogeographical occurrence of *Glaesoconis* during the Late Cretaceous.

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Figure captions:

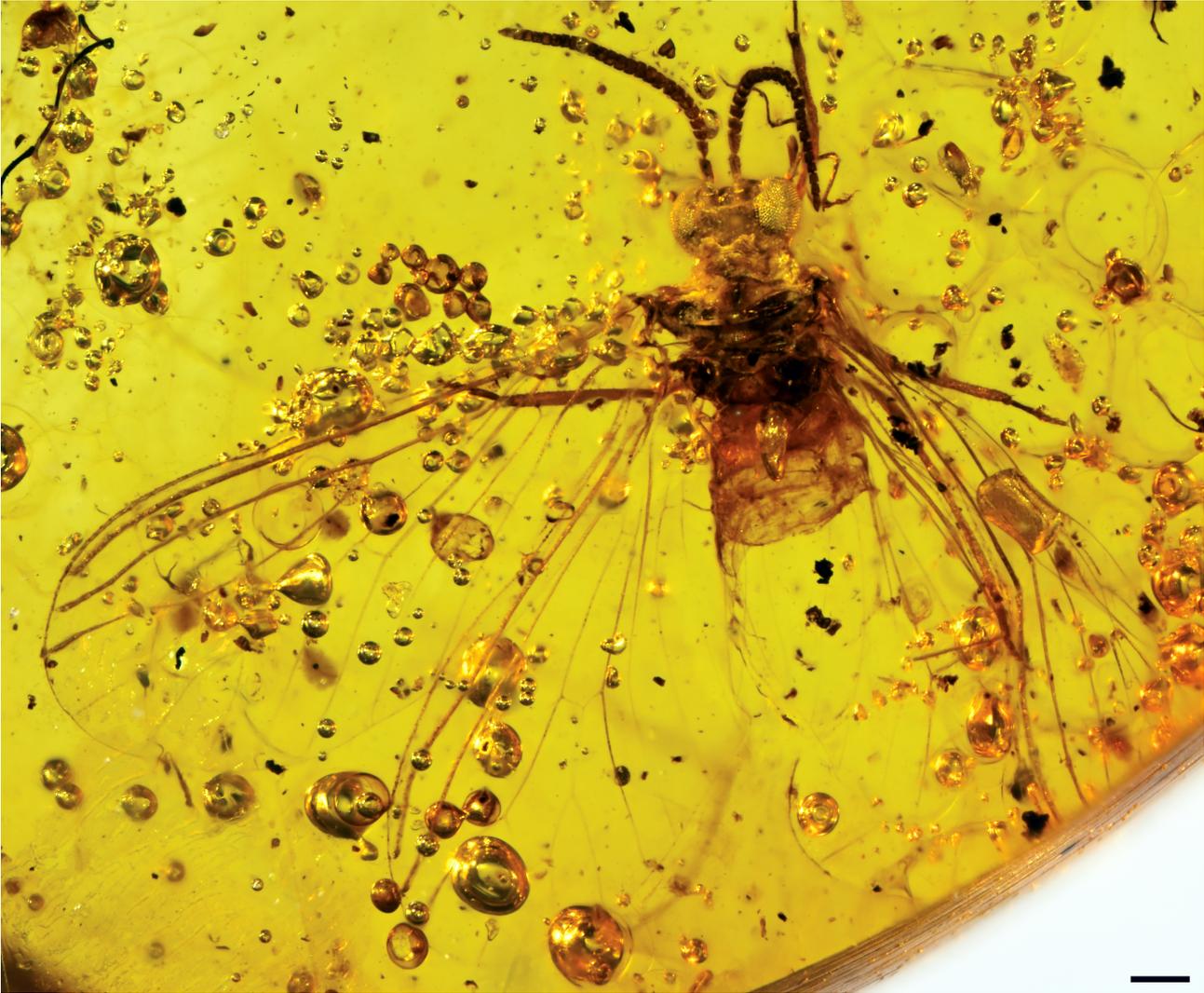


FIGURE 1. *Glaesoconis glaber* **sp. nov.**, holotype IGR.BU-084. Habitus in dorsal view. Scale bar = 1 mm.

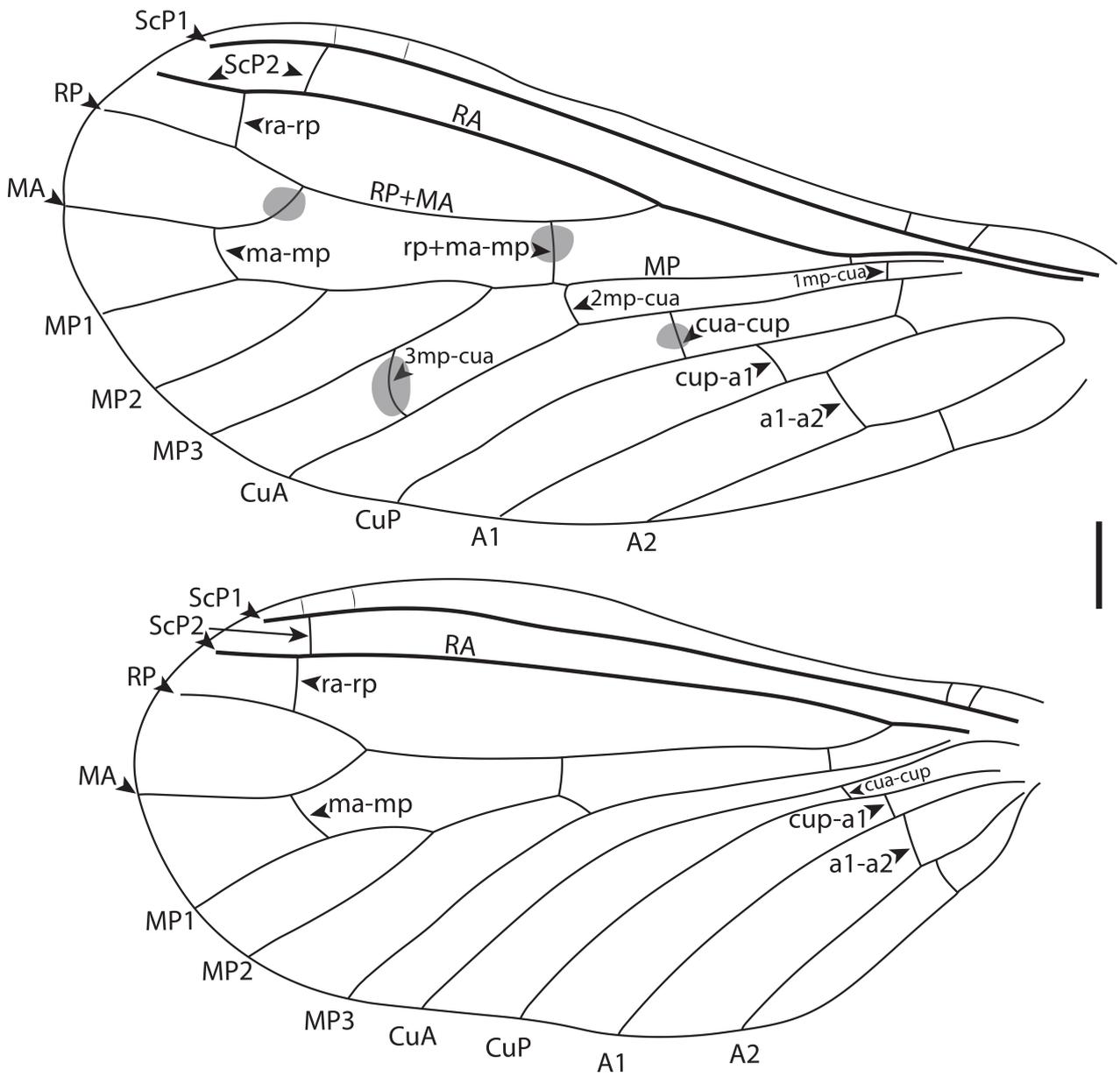
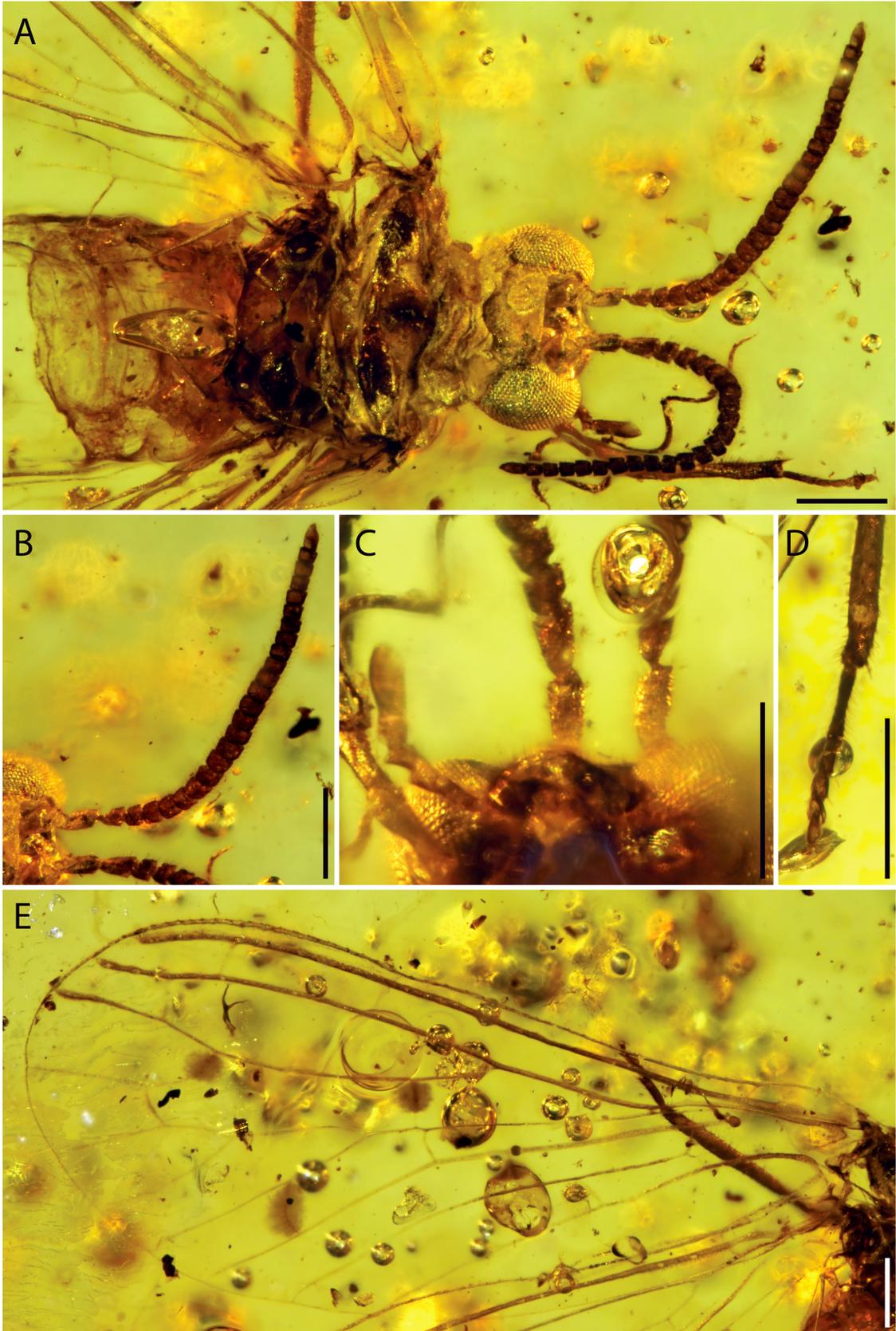


FIGURE 2: *Glaesoconis glaber* **sp. nov.**, holotype IGR.BU-084. Interpretative drawing of the fore- and hind-wing venation with the names of veins and crossveins labelled, and the location of colored spots indicated. Scale bar = 0.2 mm.



SUPPLEMENTARY FIGURE 1: *Glaesoconis glaber* sp. nov., holotype IGR.BU-084. **A**, Anterior part of the body in dorsal view. **B**, Detailed view of the left antenna. **C**, Detailed ventral view of the mandibles. **D**, Detailed view of right protarsus. **E**, Forewing. Scale bars = 0.2 mm.