



New genera and species of the lacewing family Babinskaiidae (Insecta: Neuroptera) from the mid-Cretaceous Kachin amber

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Abstract

The family Babinskaiidae is one of the major lineages of the superfamily Myrmeleontoidea from the Cretaceous. It is exceptionally diverse in species and morphology from the mid-Cretaceous of northern Myanmar. Here, we describe three new species belonging to two new genera of Babinskaiidae, namely *Pseudelectrobabinskaia suae* **gen. et sp. nov.**, *Pseudelectrobabinskaia confusa* **gen. et sp. nov.**, and *Microbabinskaia delicatula* **gen. et sp. nov.** *Pseudelectrobabinskaia* **gen. nov.** appears to be similar to *Electrobabinskaia* Lu, Zhang & Liu, 2017, and *Parababinskaia* Makarkin, Heads & Wedmann, 2017, in the number of presectoral crossveins and the origin of RP+MA. *Microbabinskaia* **gen. nov.** resembles *Pseudobabinskaia* Makarkin, Heads & Wedmann, 2017, in its simplified wing venation. *Electrobabinskaia neli* Jouault, 2022, is transferred to *Pseudelectrobabinskaia* **gen. nov.**

Keywords: Neuropterida, Babinskaiidae, Kachin amber, taxonomy, Cretaceous

Introduction

Babinskaiidae is an extinct family of the neuropteran superfamily Myrmeleontoidea, only known from the Cretaceous so far. This family represents one of the major lineages of Myrmeleontoidea from the Cretaceous, currently with 19 species in 14 genera (Martins-Neto & Vulcano, 1989a, b; Ponomarenko, 1992; Martins-Neto, 1997; Lu *et al.*, 2017, 2021, 2022; Makarkin *et al.*,

2017; Hu *et al.*, 2018; Huang *et al.*, 2019; Makarkin & Staniczek, 2019; Ngô-Muller *et al.*, 2020; Jouault & Nel, 2021; Jouault, 2022). The adults of Babinskaiidae are characterized by the long filiform antenna, the elongated wings with a distally shifted origin of RP+MA and presectoral crossveins in both fore- and hindwings, and the reduced hindwing A2 and A3 veins. While Babinskaiidae appears to be an intermediate lineage between Nymphidae and Myrmeleontidae, phylogenetic analyses suggest that it forms a monophyletic clade with Cratosmylidae, and that this clade is sister to the one containing Nemopteridae, Palaeoleontidae, and Myrmeleontidae (Lu *et al.*, 2021, 2022).

The palaeofauna of Babinskaiidae from the mid-Cretaceous of northern Myanmar, preserved in Kachin amber, is particularly rich, including 12 species in 10 genera (Lu *et al.*, 2017; Hu *et al.*, 2018; Makarkin & Staniczek, 2019; Huang *et al.*, 2019; Ngô-Muller *et al.*, 2020; Lu *et al.*, 2021; Lu *et al.*, 2022). Here, we describe three new species belonging to two new genera of Babinskaiidae from Kachin amber. These new findings further document the species diversity of this family from the Cretaceous and provide new data for understanding the early evolution of Myrmeleontoidea.

Material and methods

The amber samples studied herein were obtained from the amber mines in the Hukawng Valley (26°20' N, 96°36' E), Kachin State, northern Myanmar (see Cruickshank & Ko,

2003, figs 1, 3, 4; Kania *et al.*, 2015, fig. 1; Yu *et al.*, 2019, fig. 1). According to the coordinates provided by Cruickshank & Ko (2003), the amber mines are situated on the West Burma Block as depicted by Metcalfe (2017). Cruickshank & Ko (2003) proposed that amber-bearing horizon is upper Albian to lower Cenomanian in age. The deposit has been dated to 98.8 ± 0.6 Ma (earliest Cenomanian) by U-Pb dating of zircons from the volcanoclastic matrix of the amber (Shi *et al.*, 2012).

The type specimens are deposited in the Beijing Xiachong Amber Museum (BXAM), Beijing, and Nanjing Institute of Geology and Palaeontology (NIGP), Chinese Academy of Sciences, Nanjing.

Photographs and drawings were taken using a Leica TL5000 Ergo stereomicroscope system. The figures were prepared with Adobe Photoshop 2021. Terminology of wing venation generally follows Aspöck *et al.* (1980) and Martins-Neto (2000). Terminology of genitalia follows Aspöck and Aspöck (2008).

Abbreviations used for wing veins are: A, anal vein; C, costa; Cu, cubitus; CuA, cubitus anterior; CuP, cubitus posterior; M, media; MA, media anterior; MP, media posterior; R, radius; RA, radius anterior; RP, radius posterior; ScA, subcosta anterior; ScP, subcostal posterior; ps, presectoral crossveins (*i.e.*, r-mp crossveins).

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Systematic palaeontology

Order Neuroptera Linnaeus, 1758

Superfamily Myrmeleontoidea Latreille, 1802

Family Babinskaiidae Martins-Neto & Vulcano, 1989a

Type genus. *Babinskaia* Martins-Neto & Vulcano, 1989a

Type species. *Babinskaia pulchra* Martins-Neto & Vulcano, 1989a.

Pseudelectrobabinskaia gen. nov.

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(Figs 1–4)

Type species. *Pseudelectrobabinskaia suae* sp. nov.

Etymology. From “*pseud-*” and *Electrobabinskaia* (a genus name of the family Babinskaiidae), in reference to the high similarity between the new genus and *Electrobabinskaia*. Gender: feminine.

Diagnosis. Medium-sized, forewing length about 10 mm. Wings slenderly elongated, transparent, and immaculate; forewing *ca.* 3.5 times as long as wide,

costal space nearly 2.0–3.0 times as wide as subcostal space; RP+MA originating from R near proximal 1/3 of wing; RP; four presectoral crossveins present; MP stem long and nearly straight, pectinately branched at distal 1/5, with most branches bifurcated; CuA pectinately branched, with most branches marginally forked; CuP distally zig-zagged; A1 distally bifurcated, with anterior branch partially fused with CuP; hindwing with three presectoral crossveins; CuA short, termination of which slightly proximad origin of RP+MA; CuP and A1 possibly fused. Legs with tarsomeres 2–4 moderately expanded, semilune.

Remarks. The new genus shares similar wing venation with *Electrobabinskaia* and *Parababinskaia*, such as the presence of 4–6 forewing presectoral crossveins, the presence of 3 hindwing presectoral crossveins, and the origin of RP+MA proximad to the termination of forewing CuP (Lu *et al.*, 2017; Hu *et al.*, 2018). However, the new genus differs from *Electrobabinskaia* by the bifurcated forewing A1 [in *Electrobabinskaia*, the forewing A1 is simple], and it further differs from *Parababinskaia* in that the anterior branch of forewing A1 is partially fused with CuP [in *Parababinskaia*, the forewing A1 is bifurcated but completely separated from CuP].

Pseudelectrobabinskaia suae sp. nov.

urn:lsid:zoobank.org:act:12A3447D-4E91-483F-B032-032D8F2930AE

(Figs 1, 2)

Type material. Holotype: BXAM-BAB-25001: an amber piece measuring approximately 25.9×12.9 mm in length and width, and 8.3 mm in height, preserving a nearly complete *Pseudelectrobabinskaia suae* gen. et sp. nov., gender unknown, together with a beetle; the piece is polished flat and transparent, in the form of an oval cabochon.

Etymology. The specific epithet *suae* is in honours Ms Yiyu Su, the respected elder sister of one of the authors (De Zhuo) of this study.

Diagnosis. Forewing RP with seven branches; hindwing RP with six branches; hindwing incomplete inner gradate series of crossveins present in both fore- and hindwings, with four and two crossveins, respectively; outer gradate series of crossveins absent in both fore- and hindwings.

Description. Body length 7.83 mm; head 0.75 mm long and 1.45 mm wide; antenna length 6.21 mm; forewing 10.64 mm long and 2.75 mm wide; hindwing 10.03 mm long and 2.28 mm wide; abdomen length 4.42 mm.

Head orthognathous, subtriangular, much wider than prothorax. Compound eyes semi-globular and relatively large; ocellus absent. Antenna long and filiform, with

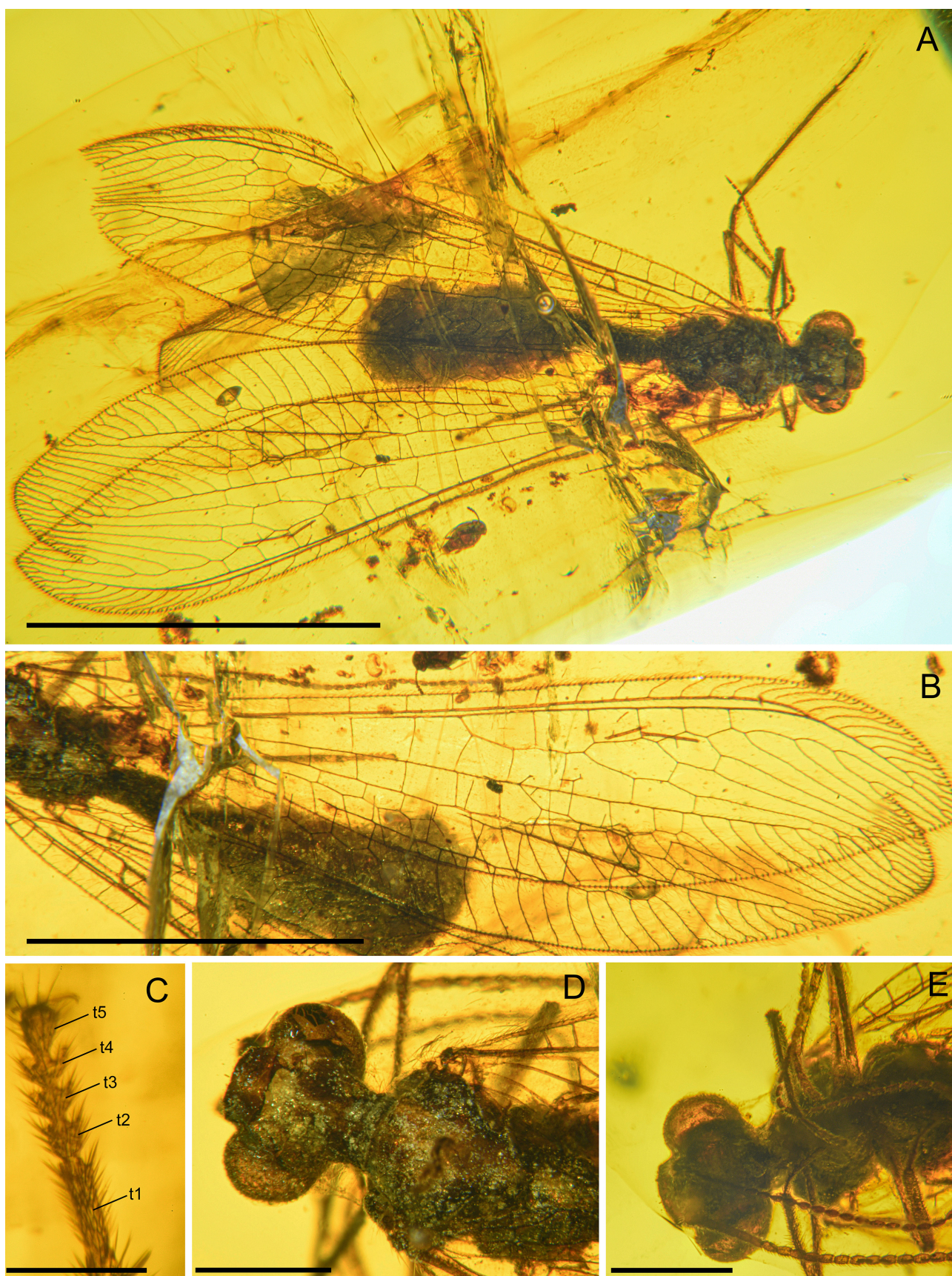


FIGURE 1. *Pseudelectrobabinskaia suae* **gen. et sp. nov.**, holotype BXAM-BAB-25001. **A**, Dorsal viewed photograph of the whole specimen. **B**, Photograph of right wings. **C**, Detailed photograph of hind tarsus. **D**, Detailed dorsal view of head and prothorax. **E**, Detailed ventral view of head and prothorax. t: tarsomere. Scale bars: 5.0 mm (**A**); 4.0 mm (**B**); 0.25 mm (**C**); 1.0 mm (**D**, **E**).

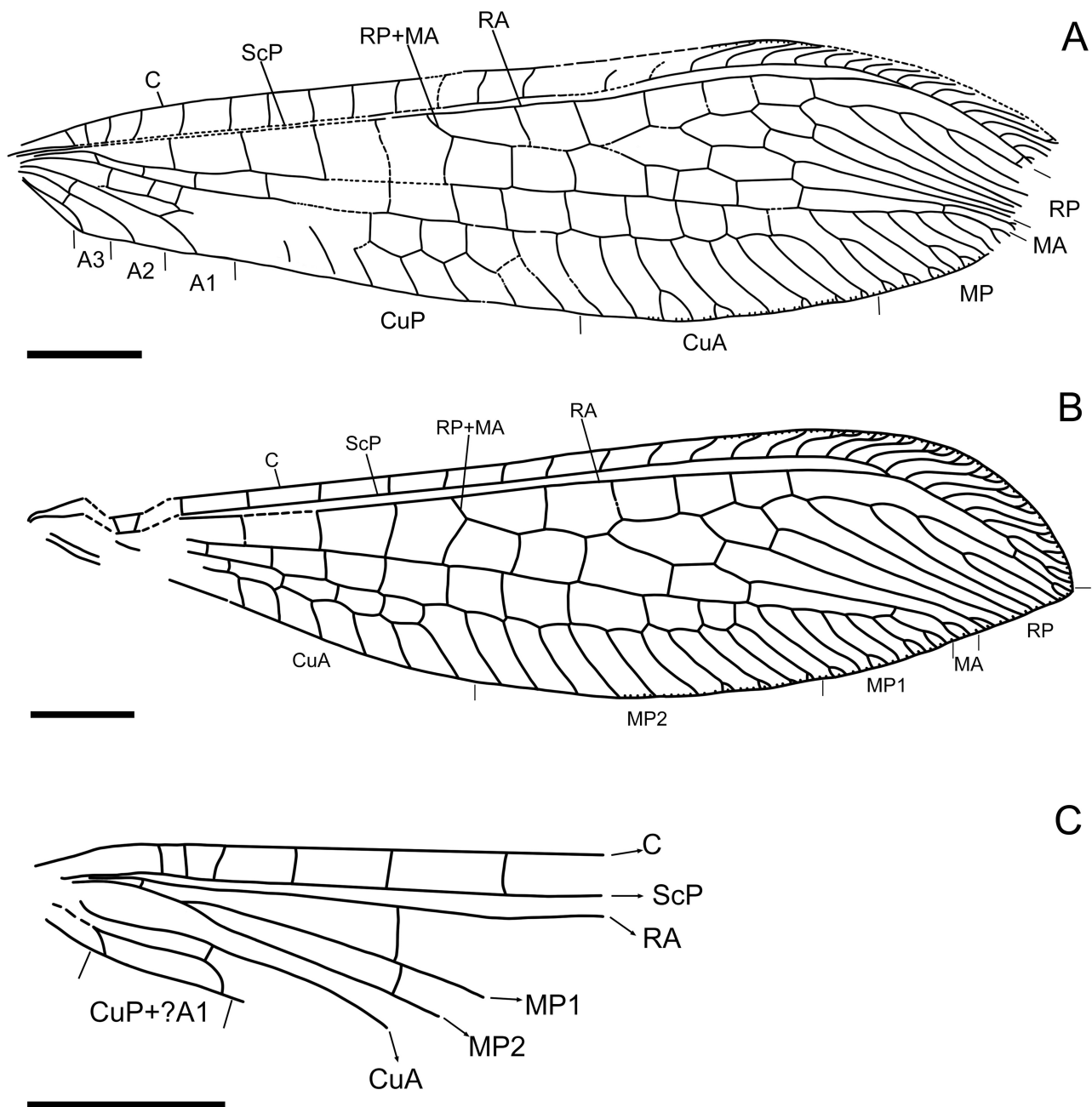


FIGURE 2. *Pseudelectrobabinskaia suae* gen. et sp. nov., holotype BXAM-BAB-25001. **A**, Drawing of left forewing. **B**, Drawing of right hindwing. **C**, Drawing of the wing base of left hindwing. Scale bars: 1.0 mm.

about 60 flagellomeres, all covered with dense short setae; scape much wider and longer than pedicel; flagellomere longer but narrower than pedicel.

Prothorax covered laterally with long hairs; meso- and metathorax robust. Wings slightly narrowed, elongated, transparent and immaculate. Forewing: Single trichosors present between veins along distal margin; multiple trichosors (up to six) between veins along costal and posterior margins. Costal space about three times as wide as subcostal space, but much narrower than radial space, with 15 simple crossveins on proximal 3/4 and at least 17 more inclined, marginally forked crossveins on

distal 1/4; four presectoral crossveins present; RP+MA originated from R near proximal 1/3 of wing; MA diverging from RP far distad of separating point of RP+MA from RA; RP with seven branches; MA with a shallow marginal fork; MP long and nearly straight, pectinately branched at distal 1/5 with six branches, most of which are bifurcated; 12 crossveins present between MP and CuA, no oblique vein; CuA and CuP diverging near wing base; CuA slightly zig-zagged distally along its stem and pectinately branched, with five forked branches and three simple branches; CuP pectinately branched, with at least seven short and simple branches; at least seven cua-cup

crossveins present; A1 distally bifurcated, with anterior branch partially fused with CuP; one cup-a1 crossvein present near wing base; A2 and A3 simple. Hindwing: Trichosors as in forewing. Costal space nearly as wide as subcostal space, with 11 simple crossveins visible on proximal 2/3 and 15 marginally forked crossveins on distal 1/3; RP+MA originating from R slightly proximad of wing midpoint; three presectoral crossveins present; MP1 and MP2 diverging near wing base; MP1 long and almost straight, with six branches, four bearing a small marginal fork; MP2 long, distally feebly zig-zagged, with 10 branches, four bearing a small marginal fork; at least 10 mp1-mp2 crossveins present; CuA short, feebly zig-zagged, with at least seven simple branches; at least five mp2-cua crossveins present; CuP and A1 possibly fused, short; one crossvein present between CuA and CuP+?A1.

Legs slender, with dense short setae; no specialized setae present; tarsus 5-segmented; tarsomere 1 longest and slender; tarsomeres 2–4 slightly prominent on distal-lateral corners; tarsomere 5 oval; pretarsal claws equal in length and shape, shorter than tarsomere 5, simple; arolium present, narrow, and slightly shorter than pretarsal claw. Abdomen long, densely covered with short setae, proximal half slenderly elongate, distal half apparently widened. Genitalia hardly visible.

***Pseudelectrobabinskaia confusa* sp. nov.**

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(Figs 3, 4)

Type material. Holotype: NIGP209779: an amber piece measuring approximately 33.3 × 17.8 mm in length and width, and 8.8 mm in height, preserving a complete male *Pseudelectrobabinskaia confusa* **gen. et sp. nov.**, with wings in a distorted condition and the body covered with dense trichomes, together with a cockroach moult; the piece is polished flat and transparent, in the form of a trapezoid cabochon.

Etymology. The specific epithet “*confusa*” refers to the inconspicuous characteristics of the new species in comparison to the congeners and the species of closely related genera.

Diagnosis. Forewing RP with five branches; hindwing RP with at least four branches; incomplete inner gradate series of crossveins absent in both fore- and hindwings; incomplete outer gradate series of crossveins present in both fore- and hindwings, with two crossveins.

Description. Male. Body length 10.08 mm; head 0.82 mm long and 1.61 mm wide; antenna length 10.08 mm; forewing at least 9.12 mm long and 2.42 mm wide; preserved part of right hindwing 8.72 mm long

(estimated length up to 9.0 mm), hindwing width 1.92 mm; abdomen length 6.99 mm.

Head orthognathous, subtriangular, much wider than prothorax. Compound eyes semi-globular, relatively large; ocellus absent. Antenna long, filiform, with *ca.* 65 flagellomeres, densely setose; scape much wider and longer than pedicel; flagellomeres longer but narrower than pedicel.

Prothorax covered by long hairs laterally; meso- and metathorax robust. Wings narrowed, elongated, transparent and immaculate. Forewing: Single trichosor present between veins along distal margin; multiple trichosors (at least six) between veins along costal and posterior margins. Costal space about twice as wide as subcostal space, but much narrower than radial space, with 17 simple crossveins on proximal 3/4 and at least 17 more inclined marginally forked crossveins on distal 1/4; four presectoral crossveins present; RP+MA originated from R near proximal 1/3 of wing; MA diverging from RP far distad separating point of RA and RP+MA; RP with five branches; MA with a small marginal fork; MP long and nearly straight, pectinately branched at distal 1/5 with five branches, most of which are bifurcated; 10 crossveins present between MP and CuA, no oblique vein (*i.e.*, stem of MP2); CuA and CuP diverging near wing base; CuA slightly zig-zagged distally along its stem and pectinately branched, with five forked branches and five simple branches; CuP pectinately branched, with seven short and simple branches; seven cua-cup crossveins present; A1 distally bifurcated, with anterior branch partially fused with CuP; A2 and A3 simple. Hindwing: Trichosors as in forewing, but up to 10 trichosors visible between veins along posterior margins. Costal space nearly as wide as subcostal space, with 12 simple crossveins on proximal 2/3 and at least 14 marginally forked crossveins on distal 1/3; subcostal crossveins absent; RP+MA originated from R slightly proximad midpoint of wing; three presectoral crossveins present; MP1 and MP2 diverging near wing base; MP1 largely simple, almost straight, with five branches; MP2 long, distally feebly zig-zagged, with 10 branches, only the most anterior branch bearing a small marginal fork; eight mp1-mp2 crossveins present; CuA short, with only four simple branches, four mp2-cua crossveins present; CuP and A1 possibly fused as CuP+?A1, short; two crossveins present between CuA and CuP+?A1.

Legs slender, with dense short setae; no specialized setae present; tarsus 5-segmented; tarsomere 1 longest, tarsomeres 2–4 slightly wider than tarsomere 1, distinctly prominent on distal-lateral corners; tarsomere 5 slender; pretarsal claws equal in length and shape, shorter than tarsomere 5, simple; arolium present, narrow, and slightly shorter than pretarsal claw.

Abdomen long, densely covered with long setae, proximal half slenderly elongate, distal half slightly

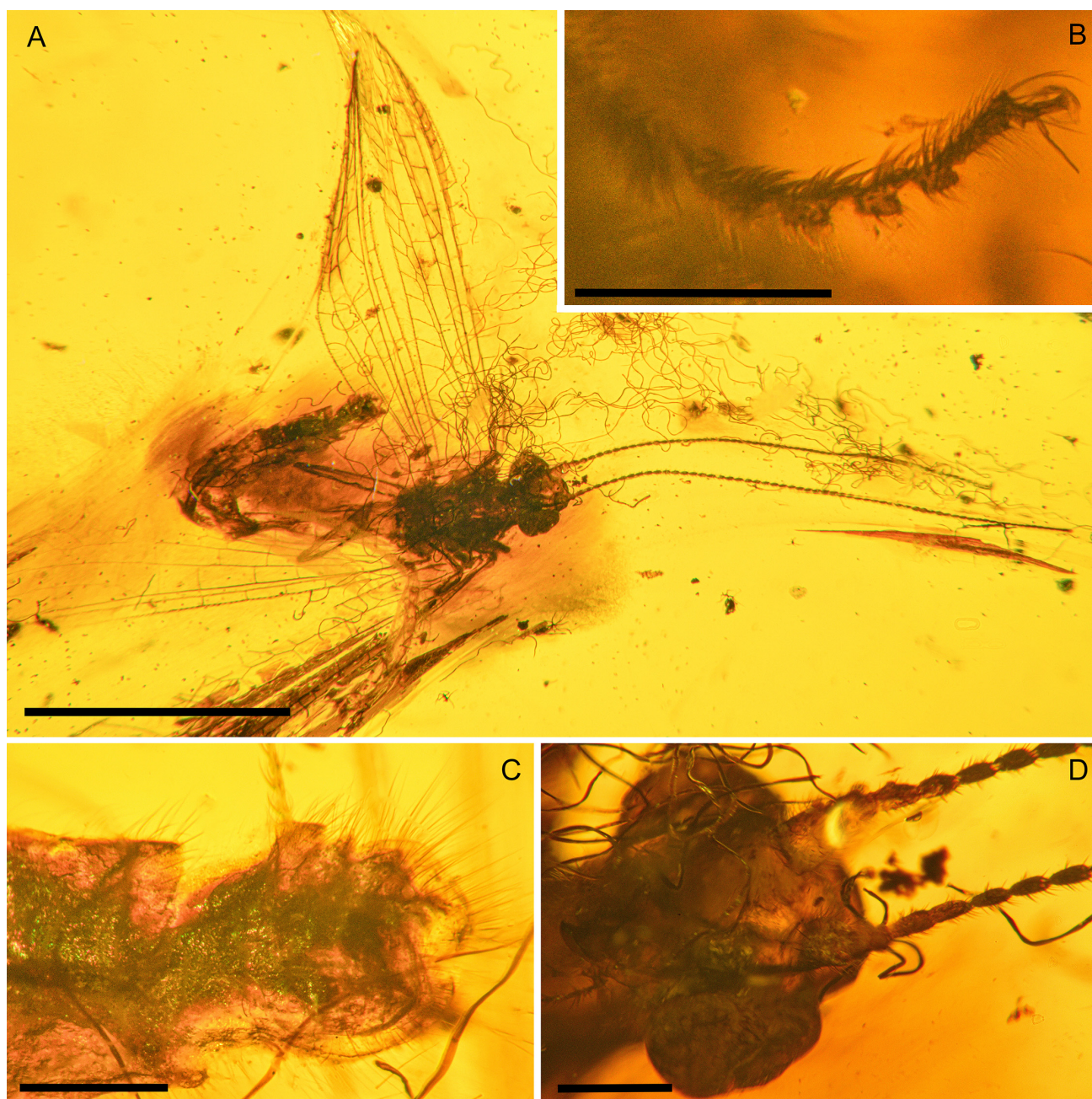


FIGURE 3. *Pseudelectrobabinskaia confusa* **gen. et sp. nov.**, holotype NIGP209779. **A**, Ventral viewed photograph of the whole specimen. **B**, Detailed photograph of fore tarsus. **C**, Detailed lateral view of male genitalia. **D**, Detailed ventral view of head. Scale bars: 5.0 mm (**A**); 0.5 mm (**B–D**).

widened. Male genitalia: Tergum 9 short, nearly half length of tergum 8, slightly narrowed ventrad; sternum 9 long, nearly bowl-shaped; ectoprocts paired, broad, with rounded apex and ovoid callus cerci; a large arcuate structure present in the genital chamber, but detailed characters not visible.

Remarks. The two new species of *Pseudelectrobabinskaia* **gen. nov.** described above can be distinguished from each other by the number of forewing RP branches and the gradate series of crossveins. Both two species differ from *E. burmana* and

P. neli by the absence of the inclined veinlet between the distal-most presectoral crossvein and the stem of RP+MA in the forewing.

Pseudelectrobabinskaia neli (Jouault, 2022) **comb. nov.**

Electrobabinskaia neli Jouault, 2022: 216.

Diagnosis. Forewing RP with six branches; an inclined veinlet present on forewing between distal-most presectoral crossvein and stem of RP+MA; hindwing in

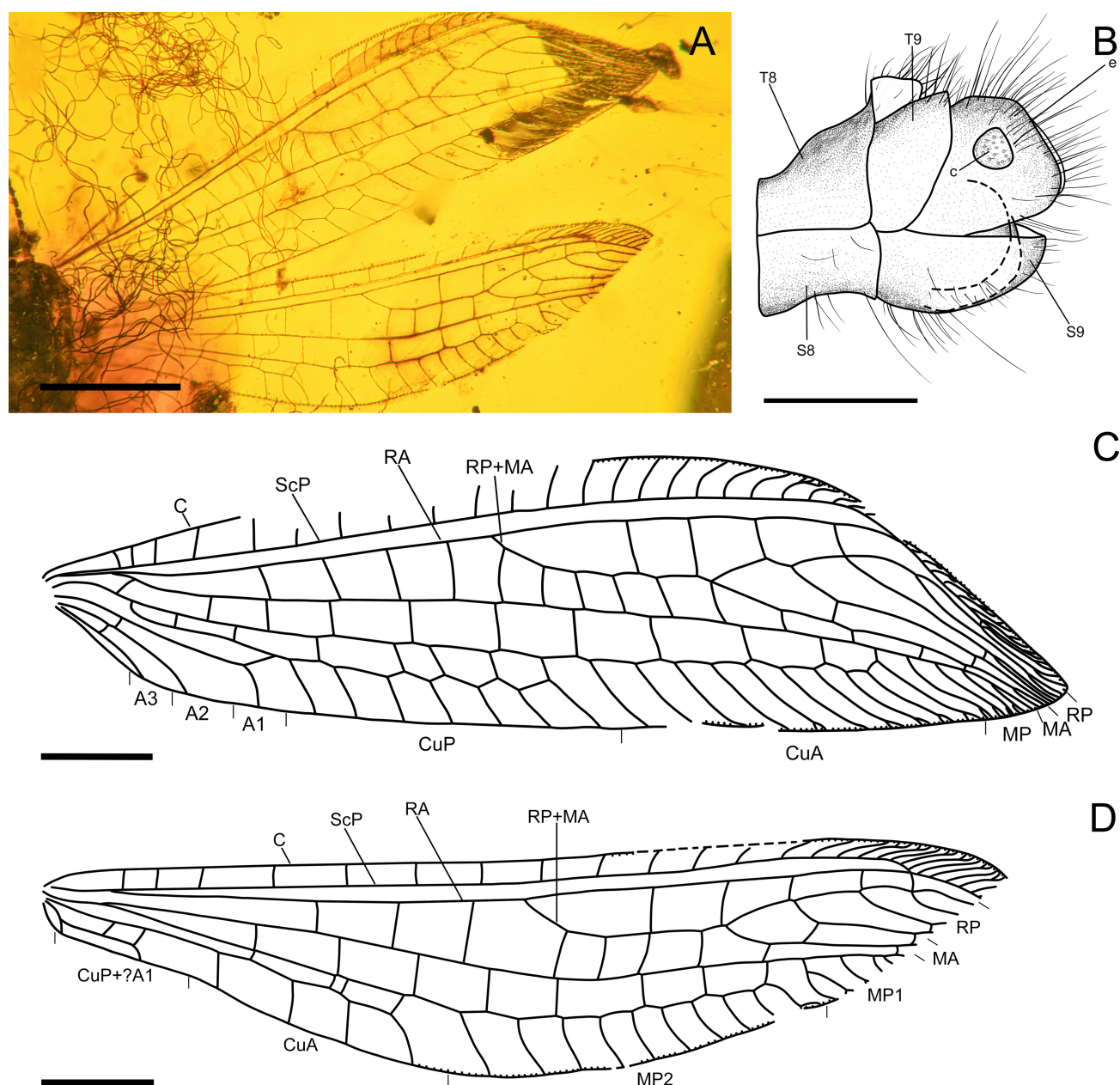


FIGURE 4. *Pseudelectrobabinskaia confusa* **gen. et sp. nov.**, holotype NIGP209779. **A**, Photograph of left wings. **B**, Drawing of male genitalia. **C**, Drawing of left forewing. **D**, Drawing of left hindwing. T: tergum; S: sternum; e: ectoproct; c: callus cercus. Scale bars: 2.0 mm (**A**); 0.5 mm (**B**); 1.0 mm (**C**, **D**).

complete inner gradate series of crossveins present in both fore- and hindwings, respectively with three crossveins; outer gradate series of crossveins absent in both fore- and hindwings.

Remarks. This species was originally placed in *Electrobabinskaia* based on the forewing with five presectoral crossveins and the strongly narrowed hindwing with an acutely produced apex (Jouault, 2022). However, these characters are not convincing evidence for generic affiliation, because slight variation in the number of presectoral crossvein cannot be used as a reliable character for distinguishing babinskaiid genera, as it varies only

within a limited range, and wing shape may also differ among conspecific species in Myrmeleontoidea. In addition, the configuration of the forewing A1 in this species—which is the same in the two new species described above for the new genus—was overlooked in Jouault (2022). Therefore, based on this important generic diagnostic character, *Electrobabinskaia neli* should be transferred to *Pseudelectrobabinskaia* **gen. nov.**

***Microbabinskaia* gen. nov.**

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Type species. *Microbabinskaia delicatula* sp. nov.

Etymology. From “Micron-” and *Babinskaia* (the type genus name of the family Babinskaiidae), in reference to the relatively small size of the new genus. Gender: feminine.

Diagnosis. Small-sized, forewing length less than 10 mm. Wings slenderly elongated, transparent, and immaculate; forewing costal space about 2.0 times as wide as subcostal space; subcostal space with at least one scp-r crossvein; CuP feebly zig-zagged; A1 deeply forked; hindwing with two scp-r crossveins present on subcostal space; three presectoral crossveins present; RP with only three branches; CuA short and simple; CuP and A1 possibly fused. Legs with tarsomere 2–4 slightly expanded.

Remarks. The new genus appears to be similar to *Babinskaia*, *Neliana*, and *Parababinskaia* in having deeply forked forewing A1, while it differs from the latter three genera by the fusion of A2 and A3 in the forewing and the hindwing RP with only three branches (Martins-Neto & Vulcano, 1989a; Martins-Neto & Vulcano, 1989b; Martins-Neto, 1992; Makarkin *et al.*, 2017). Considering the fused forewing A2 and A3, and the very short branches of hindwing MP2, the new genus appears to be closely related to *Pseudobabinskaia*, but it can be distinguished by the bifurcated forewing A1 and the extremely short and simple hindwing CuA. Moreover, the female of the new genus lacks the paired digitiform processes on the abdominal sternum 6, which, however, is present in *Pseudobabinskaia* (Lu *et al.*, 2017; Hu *et al.*, 2018).

***Microbabinskaia delicatula* sp. nov.**

urn:lsid:zoobank.org:act:4011319D-B228-461C-A109-AF53BE9FB59F

(Figs 5, 6)

Type material. Holotype: NIGP209780: an amber piece measuring approximately 19.1 × 11.0 mm in length and width, and 4.8 mm in height, preserving a female *Microbabinskaia delicatula* **gen. et sp. nov.** with most part of forewings not preserved; the piece is polished clear and transparent, in the form of an oval cabochon with a flat section.

Etymology. The specific epithet “*delicatula*” refers to the small size and simple venation of the new species. Gender: feminine.

Diagnosis. As for the genus.

Description. Female. Body length 6.58 mm; head 0.52 mm long and 1.23 mm wide; antenna length 3.54 mm; preserved part of left forewing 2.95 mm long and 2.42 mm wide, length about 8.8 mm by estimation; hindwing 8.58 mm long and 1.81 mm wide; abdomen length 4.01 mm.

Head orthognathous, subtriangular, much wider than prothorax. Compound eyes semi-globular and relatively large; ocellus absent. Antenna filiform, with about only 30 flagellomeres, all covered with dense short setae; scape much wider and longer than pedicel; flagellomere longer than pedicel but approximately equal in width.

Prothorax covered by long hairs laterally; meso- and metathorax robust, metathorax much smaller than mesothorax. Wings narrowed, elongated, transparent, immaculate. Forewing: Costal space about twice as wide as subcostal space, but narrower than radial space, preserved part with 5 simple crossveins; one subcostal crossvein visible; one presectoral crossvein visible; MP straight, with at least four crossveins between MP and CuA, no oblique vein (*i.e.*, stem of MP2) present; CuA and CuP diverging near wing base; visible part of CuA nearly straight; CuP feebly zig-zagged and pectinately branched, three short and simple branches visible; at least four cua-cup crossveins present; A1 deeply forked; one cup-a1 crossveins present; A2 and A3 fused on distal half. Hindwing: Apex acutely produced; single trichosors present between veins along distal margin; multiple trichosors (up to 10) between veins along costal and posterior margins; costal space nearly as wide as subcostal space, with 11 simple crossveins on proximal 3/4 and 10 marginally forked crossveins on distal 1/4; two scp-r crossveins present on subcostal space, with one near wing base and one on proximal 1/3; RP+MA originated from R slightly proximad midpoint of wing; three presectoral crossveins present; MP1 and MP2 diverging near wing base; MP1 largely simple, almost straight, with seven branches; MP2 long, distally feebly zig-zagged, with eight simple branches; eight mp1-mp2 crossveins present; CuA short, with only one simple branch, only one mp2-cua crossvein present; CuP and A1 possible fused as CuP+?A1, short and simple.

Legs slender, with dense short setae; no specialized setae present; tarsus 5-segmented; tarsomere 1 longest, total length of tarsomeres 2–5 slightly longer than tarsomere 1, tarsomere 2–4 slightly prominent on distal-lateral corners; tarsomere 5 oval; pretarsal claws equal in length and shape, much shorter than tarsomere 5, simple; arolium present, narrow, and slightly shorter than pretarsal claw.

Abdomen long, densely covered with long setae, distal half slightly widened; Female genitalia: Tergum 8 subtriangular in lateral view; tergum 9 much shorter and nearly rectangular in lateral view; gonocoxites 9 partly visible, valvate; ectoprocts paired, ovoid, with rounded apex and large callus cerci on the middle.

Discussion

The present finding of new genera and species from the

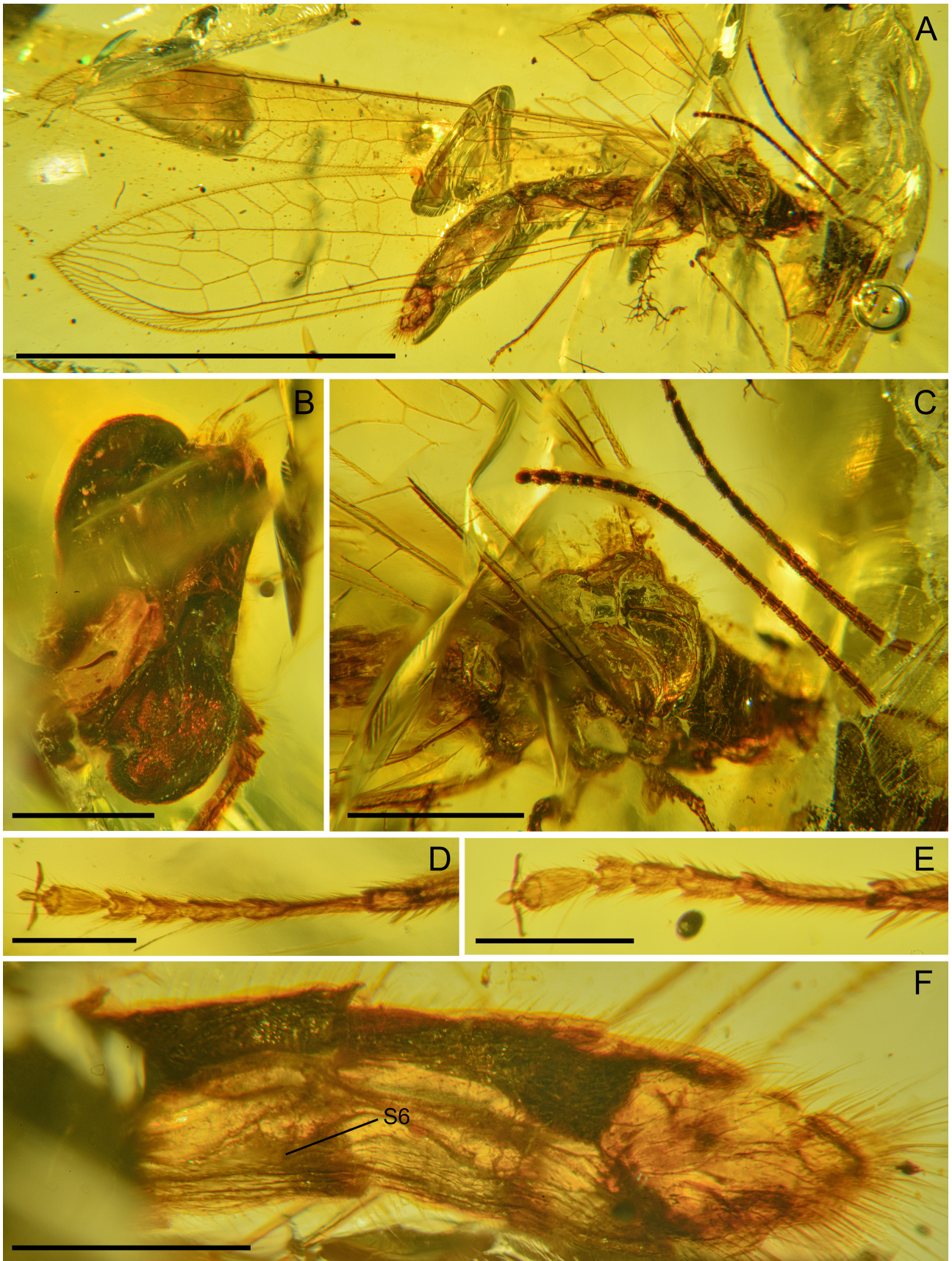


FIGURE 5. *Microbabinskaia delicatula* **gen. et sp. nov.**, holotype NIGP209780. **A**, Photograph of the whole specimen, lateral view. **B**, Detailed photograph of head, ventral view. **C**, Detailed photograph of antenna and thorax. **D**, Detailed photograph of mid tarsus. **E**, Detailed photograph of hind tarsus. **F**, Detailed photograph of abdomen. Scale bars: 5.0 mm (**A**); 0.5 mm (**B**); 1.0 mm (**C**); 0.25 mm (**D–E**, **F**).

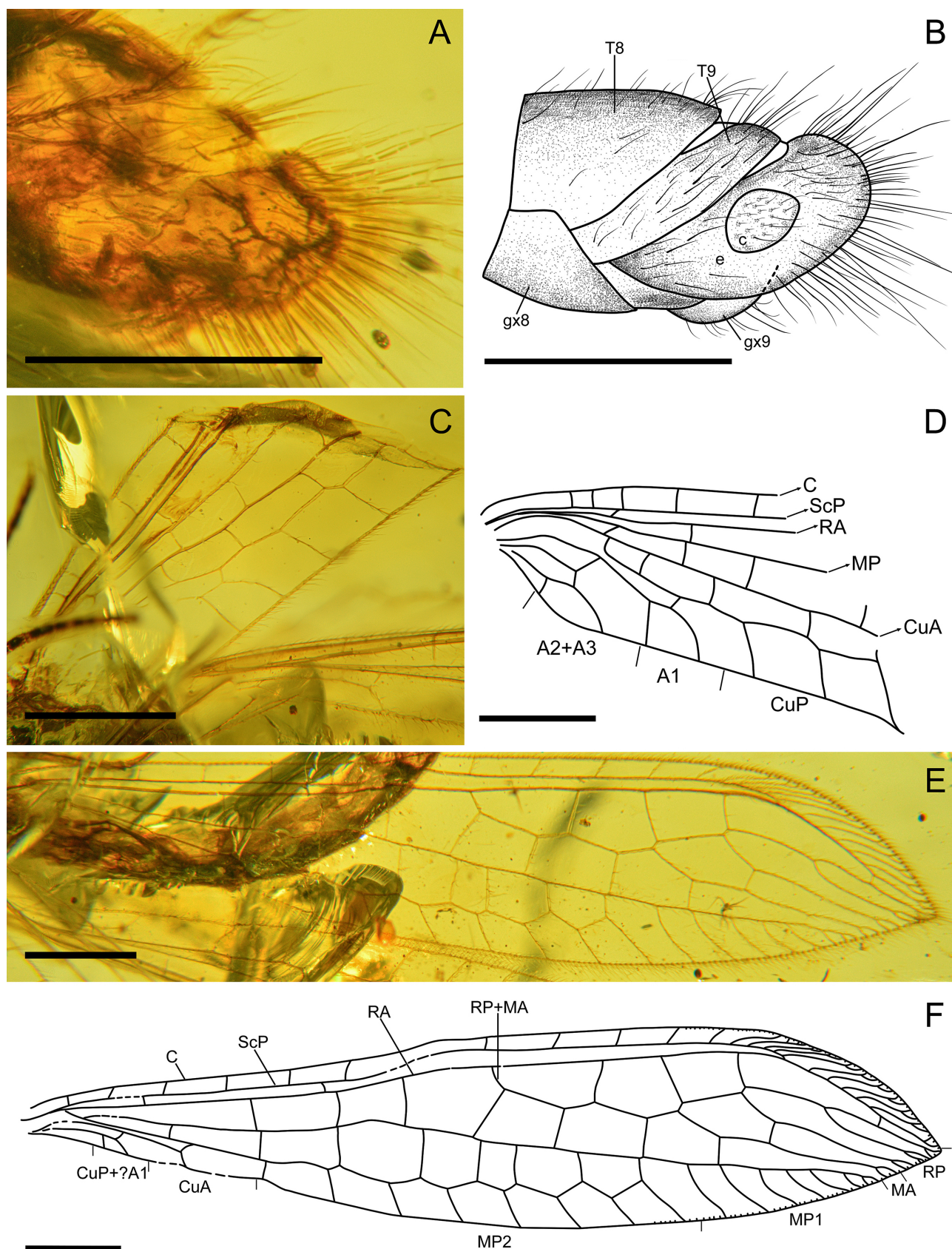


FIGURE 6. *Microbabinskaia delicatula* **gen. et sp. nov.**, holotype NIGP209780. **A**, Detailed lateral view of female genitalia. **B**, Drawing of female genitalia. **C**, Detailed photograph of preserving left forewing. **D**, Drawing of left forewing. **E**, Photograph of right hindwing. **F**, Drawing of right hindwing. T: tergum; S: sternum; e: ectoproct; c: callus cercus; gx: gonocoxite. Scale bars: 0.5 mm (**A**, **B**); 1.0 mm (**C**–**F**).

mid-Cretaceous of northern Myanmar further enriches the documented species diversity of Babinskaiidae from the Kachin amber biota. In morphology-based phylogenies of Babinskaiidae (Lu *et al.*, 2021, 2022), this family is divided into two major clades. Clade 1 comprises two Kachin amber genera—*Stenobabinskaia* Lu, Wang & Liu, 2021 and *Calobabinskaia* Lu, Wang & Liu, 2021—which are characterized by strongly elongated wings and numerous crossveins. The remaining Kachin amber genera, together with *Babinskaia* Martins-Neto & Vulcano, 1989 and *Neliana* Martins-Neto, 1992 from the Early Cretaceous of Brazil, constitute the clade 2.

The two new genera appear to be closely related to the contemporary Kachin amber genera *Electrobabinskaia*, *Parababinskaia*, and *Pseudobabinskaia*. They are therefore likely to belong to clade 2, specifically the subclade comprising *Electrobabinskaia*, *Parababinskaia*, and *Pseudobabinskaia*, whose monophyly is supported by the forewing A1 being distally unfused with CuP (Lu *et al.*, 2017). Notably, however, *Pseudelectrobabinskaia* **gen. nov.** exhibits a partial fusion between the anterior branch of A1 and the distal section of CuP in the forewing. Although this condition is unique within Babinskaiidae, it may represent a derived state from the completely separated, bifurcated forewing A1 seen in *Parababinskaia* (Hu *et al.*, 2018). Indeed, *Pseudelectrobabinskaia* **gen. nov.** may have a particularly close relationship with *Parababinskaia*, as these two genera share most wing characters—apart from the configuration of forewing A1—as well as a similar morphology of tarsomeres 2–4.

The taxonomic significance of presectoral crossveins in Babinskaiidae requires careful evaluation, as it has been used for distinguishing either genera or species. Notably, it should be cautious when using the number of presectoral crossveins to distinguish genera. Besides, the veinlet linking the distal-most presectoral crossvein to the RP+MA stem is another noteworthy character for distinguishing genera. For instance, this character is present in *Burmobabinskaia* and *Electrobabinskaia*, but it is absent in *Parababinskaia*. Nonetheless, it may be also variable in certain genus, *e.g.*, absent in the two new species of *Pseudelectrobabinskaia* **gen. nov.** but present in *Pseudelectrobabinskaia neli* (Jouault, 2022). Thus, the configuration of forewing A1 may be a more reliable wing character for distinguishing babinskaiid genera.

The simplification of venation in *Microbabinskaia* **gen. nov.** is remarkable. This feature might be related to the small body-size. Thus, the venational similarity between *Microbabinskaia* **gen. nov.** and *Pseudobabinskaia* (*e.g.*, the simplified venation, the fusion of forewing A2 and A3, and the shorter branches of hindwing MP) may suggest either close relationship between both genera or convergent evolution due to small body-size. However, the female genitalia of these two genera are dissimilar.

In *Pseudobabinskaia*, the gonocoxites 8 is separated into a pair of digitiform processes (Hu *et al.*, 2018), while in *Microbabinskaia* **gen. nov.** the gonocoxites 8 is present as a broad subgenital plate. Moreover, the paired digitiform processes on the abdominal sternum 6 in *Pseudobabinskaia* is absent in *Microbabinskaia* **gen. nov.** Considering the greatly differed female genitalia between these two genera, it is more likely that these two genera are distantly related with convergently simplified venation.

In conclusion, the new Kachin amber babinskaiids highlight the mosaic evolution of morphological characters in this extinct family. The rich species diversity of Babinskaiidae from the mid-Cretaceous of northern Myanmar might have been formed by a complex process of diversification, possibly in a mode of radiation. Future exploration on the Kachin amber Babinskaiidae is still necessary for understanding of the evolution of this enigmatic extinct lineage prior to the rise of Myrmeleontidae.

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