

On two rare wasps (Hymenoptera: Ohlhoffiidae; Panguidae) from mid-Cretaceous Kachin amber

CORENTIN JOUAULT^{1, 2, *}

¹State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing 210008, China

²Oxford University Museum of Natural History, University of Oxford, Parks Road, Oxford OX1 3PW, UK

 jouaultc0@gmail.com;  <https://orcid.org/0000-0002-3680-5172>

*Corresponding author

Abstract

The Kachin amber biota is one of the most extensively studied and well-documented ecosystems of the Cretaceous, with over 2,000 arthropod species described to date. Among these are the Ohlhoffiidae, a family of stephanoid wasps currently known from four species, two from Kachin amber and two from the La Pedrera de Rúbies Formation in Spain. Despite their distinctiveness, little is known about their true diversity, biology, or intraspecific morphological variation. Here, we describe a new species of *Ohlhoffia* Jouault *et al.* 2020, as *Ohlhoffia minuta* **sp. nov.** which offers new insights into morphological variability within the family. We also report and illustrate a panguid wasp specimen identified as *Pangu yuangu* Li *et al.* 2019. Members of the Panguidae are known from both Wealden and Kachin ambers, yet like the Ohlhoffiidae, they remain poorly understood, with limited data available on their diversity and morphological variation at the species level.

Keywords: Apocrita, Burmese amber, morphological variability, Pangoidea, Stephanoidea

Introduction

Apocritan wasps are among the most diverse insect groups in modern ecosystems, comprising over 140,000 described extant species, and many more have yet to be named (Branstetter *et al.*, 2018). This clade includes both parasitoid and predatory wasps, exhibiting a remarkable range of ecological roles, behaviours, and morphological traits (Grimaldi & Engel, 2005). Their fossil record is rich, including extinct families that either display combinations of features found in modern groups or possess entirely unique morphologies (*e.g.*, Ephialtitidae, Sirenobethylidae). Apocritans diversified

during the Mesozoic and Cenozoic, likely in response to environmental changes that directly affected them or their hosts, as well as through the evolution of novel morphological traits (*e.g.*, Blaimer *et al.*, 2023; Jouault *et al.*, 2025).

Kachin (Burmese) amber preserves a diverse Apocritan fauna, with over 400 species described to date (PBDB, accessed 22/06/2025). Several families appear to be unique to this deposit (*e.g.*, Myanmarinidae), leading to the hypothesis that part of the fauna is endemic (Zhang *et al.*, 2018). It should be noted, however, that this pattern may be biased by the exceptionally intense research focus on Burmese amber and the large quantity of available material, which far exceeds that of other Cretaceous deposits (Ross, 2025). This disparity increases the likelihood of discovering lineages that appear to be exclusive to this deposit. Further studies have suggested that the Kachin amber biota exhibits a combination of endemic taxa and species with affinities to both Gondwanan and Laurasian lineages (*e.g.*, de Sena Oliveira *et al.*, 2016; Jouault, 2021). Despite this diversity, some families remain extremely rare as amber inclusions. For example, the Ohlhoffiidae are currently known from only two specimens, each representing a different species: *Ohlhoffia robusta* Jouault *et al.*, 2020 and *Myanmephialtites bashkuevi* Jouault *et al.*, 2020. This family was recently established based on Kachin amber material and also includes two compression fossils: *Cretephialtites pedrerae* Rasnitsyn & Ansoerge, 2000, originally assigned to Ephialtitidae and later transferred to Ohlhoffiidae, and *Cretephialtites hispanicus* Rasnitsyn & Martínez-Delclòs, 2000 tentatively attributed to *Cretephialtites* (Rasnitsyn & Ansoerge, 2000; Rasnitsyn & Martínez-Delclòs, 2000; Jouault *et al.*, 2020). The family Panguidae is slightly better represented, with four described species: *Protopangu valdensis* Zhuang *et al.*,

2024; *ProspheX anthophilos* Grimaldi & Engel, 2019; *Pangu antiquum* Li *et al.*, 2020; and *Pangu yuangu* Li *et al.*, 2019 (Grimaldi *et al.*, 2019; Li *et al.*, 2019, 2020; Zhuang *et al.*, 2024).

Here, we report additional specimens belonging to these two rare families, contributing new data on the intraspecific variability of *Ohlhoffia* Jouault *et al.*, 2020 by describing a new species. We also report a new specimen of *Pangu yuangu*, thereby enhancing our understanding of their morphology.

Material and methods

Origin and preparation of amber pieces

The pieces of amber containing the specimens derive from the deposits of Noiye Bum in the Hukawng Valley (26°29' N, 96°35' E), Kachin State, northern Myanmar (see detailed map in Grimaldi & Ross, 2017, fig. 2). Radiometric data established an early Cenomanian age (98.79 ± 0.62 Ma) for Kachin amber, based on zircons from volcanic clasts found within the amber-bearing rock (Shi *et al.*, 2012). Some ammonites, found in the amber-bearing bed, and within amber, corroborate a late Albian–early Cenomanian age for these sediments (Cruickshank & Ko, 2003). The specimens are housed in the collections of the Nanjing Institute of Geology and Palaeontology of the Chinese Academy of Sciences (NIGPAS), under collection numbers NIGP207494 and NIGP207495.

The pieces of amber were polished with a grinding polisher (Ameritool), with thin silicon carbide sanding paper. The specimens were examined with a Zeiss Axio Zoom V16 stereomicroscope and photographed with a Zeiss AxioCam 512 colour camera. All images are digitally stacked photomicrographic composites of several individual focal planes, obtained using Helicon Focus 6.7. The figures were composed with Adobe Illustrator CC2018 and Photoshop CC2018.

The morphological terminology used in description generally follows that of Huber & Sharkey (1993), except for the wing cell nomenclature that is adapted from van Achterberg (1993) or Quicke (2015). Published work and nomenclatural acts are registered in ZooBank (<http://www.zoobank.org/>, accessed 27/06/2025), with the following LSID (reference): urn:lsid:zoobank.org:pub:844014E9-E959-4848-A846-F75F041206A9.

Systematic palaeontology

Order Hymenoptera Linnaeus, 1758

Superfamily Stephanoidea Leach, 1815

Family Ohlhoffiidae Jouault *et al.*, 2020

Remarks. The placement of *Karataus kourios* Sharkey, 1990 (in Darling & Sharkey, 1990) considered as a *Cratephialtites* species by Osten (2007), but not Jouault *et al.* (2020), remains to be clarified. In the present work, we follow Jouault *et al.* (2020) and consider *Karataus kourios* Sharkey, 1990.

Genus *Ohlhoffia* Jouault *et al.*, 2020

Included species. *Ohlhoffia robusta* Jouault *et al.*, 2020 (type species); *Ohlhoffia minuta* sp. nov.

Ohlhoffia minuta sp. nov.

urn:lsid:zoobank.org:act:23ED7F5C-609C-42B5-8456-06489E755EF4
(Figs 1–3)

Material. Holotype NIGP207494 (in a rectangular piece of amber measuring $29 \times 18 \times 4$ mm; with an Arachnida, two Coleoptera, one undetermined insect, and some organic debris).

Etymology. The species name refers to the species' small size and is from the Latin masculine adjective *minuto*, meaning small; it is to be treated as an adjective.

Diagnosis. Small species, body about 3.7 mm long (vs. 6.3 mm in *O. robusta*). Antennae long, with at least 25 flagellomeres (vs. 21). Forewing with pterostigma slightly elongate, about five times as long as wide (vs. about eight times); 2r-rs originating before pterostigma midlength, shorter than Rs+M (vs. about as long as Rs+M); second submarginal cell about 3.1 times longer than wide (vs. more than 4 times); 2m-cu reaching M very close to 2rs-m (vs. far anterior 2rs-m); Hindwing with six distal hamuli (vs. eight). Gaster shorter than combined length of petiolar segments.

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

Description. Female. Total body length about 3.7 mm, without distinctive coloration pattern.

Head globose, about 0.9 mm high; compound eye large, 0.59 mm high, 0.37 mm wide, occupying much of lateral surface of the head. In lateral view, vertex strongly rounded above compound eye, with distinct ocelli, ocellar diameter about as large as pedicel width. Frons with median-anterior tubercle (tbA) followed by slightly larger, second median-anterior tubercle (tbB); and row of two large tubercles (tbC–tbC') located right in front and at either side of median ocellus. Vertex with one row of two large tubercles (tbD–D') located just behind median ocellus and in front of lateral ocelli, at about the same position and size as tbC–C'; one single, large, median

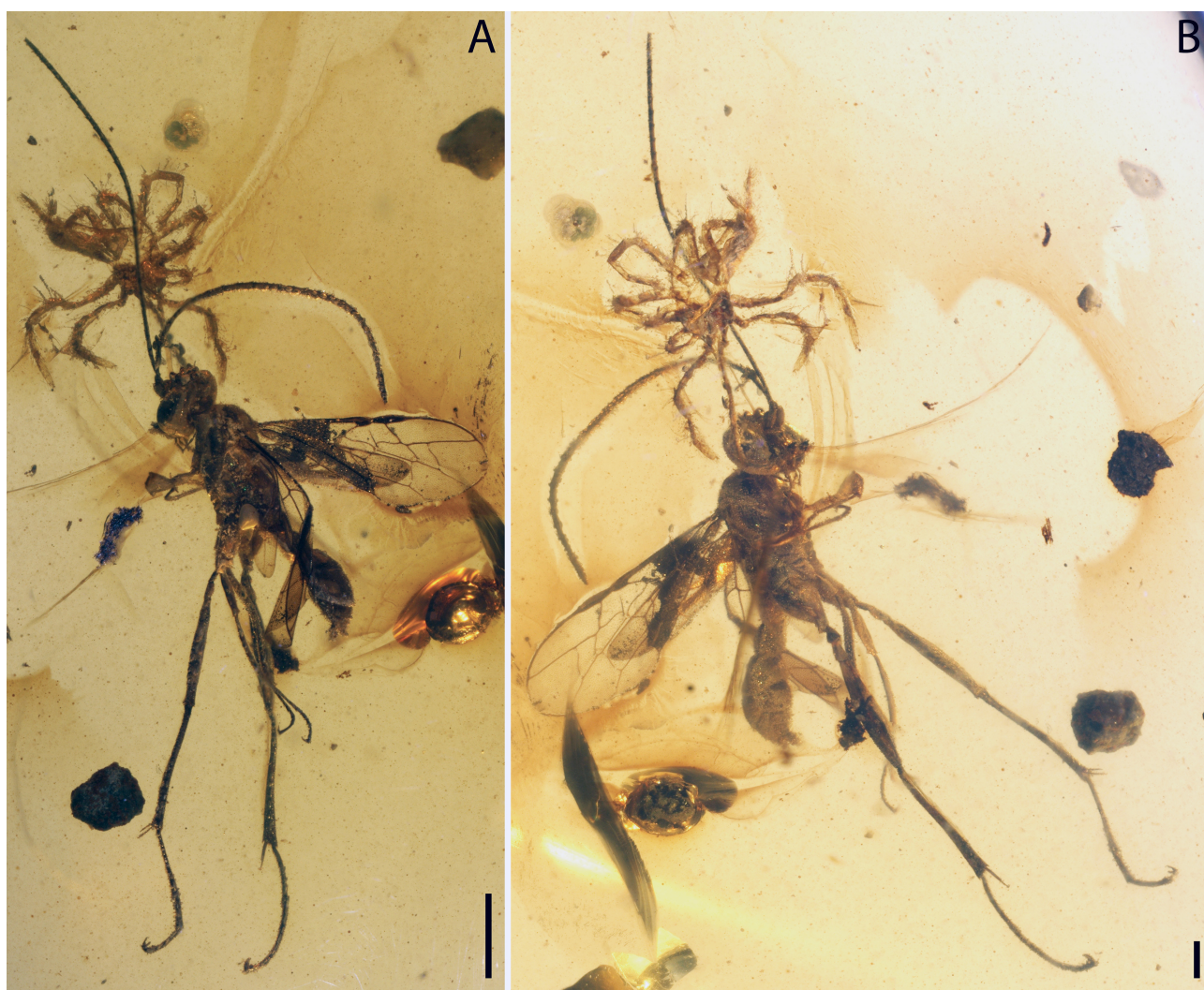


FIGURE 1. *Ohlhoffia minuta* sp. nov., holotype NIGP207494. **A**, Habitus in left lateral view. **B**, Habitus in right lateral view. Scale bars: 1 mm (A), 0.4 mm (B).

tubercle (tbE) located between lateral ocelli; and one single, median tubercle (tbF) smaller than tbE and located posterior to lateral ocelli. Each row of tubercles extending laterally into transverse ridges reaching margin of compound eyes. Occiput slightly concave and roughened; malar space slightly longer than first flagellomere (about 0.18 mm long). Antenna longer than body (about 4.63 mm long), filiform, with at least 25(?) flagellomeres (limits of distal ones obscured by bubbles); scape robust, pedicel short, longer than wide, and slightly narrower than scape; individual flagellomeres longer than wide, each about 0.05 mm wide; length of first flagellomere 0.12 mm; flagellomeres decreasing in length after antennal mid-length; mandibles short, stout, projecting forward, outer surface strongly convex and with apical half densely covered by long, fine, decumbent setae; masticatory margin of mandible with three blunt teeth, apical tooth large, others progressively decreasing in size toward base. Maxillary palps with four(?) long palpomeres,

labial palps much shorter, with apical palpomere the only visible segment, which barely surpasses first maxillary palpomere.

Mesosoma about 1.5 mm long, about 0.75 mm high. Pronotum slightly elongate into a neck, reaching tegula, pronotal fold reduced; anterior declivity of pronotum smooth; neck without distinctive sculpture; dorsal mesonotal area convex, with weak median longitudinal sulcus not reaching to posterior mesonotal margin, and distinct notauli converging but not touching posteriorly; mesoscutellum short; mesopleuron with a depression for reception of leg delimited above with furrow running from mesopleural pit (entrance of mesopleural apodeme) to small triangular external part of prepectus; metanotum and mesoscutellum subequal in length, slightly costulate; metapostnotum foveate; metapleuron fused immovably with propodeum, posteriorly with transverse, foveate groove; propodeum at to slightly convex, anteriorly with a transverse row of shallow foveae, with long, slit-like

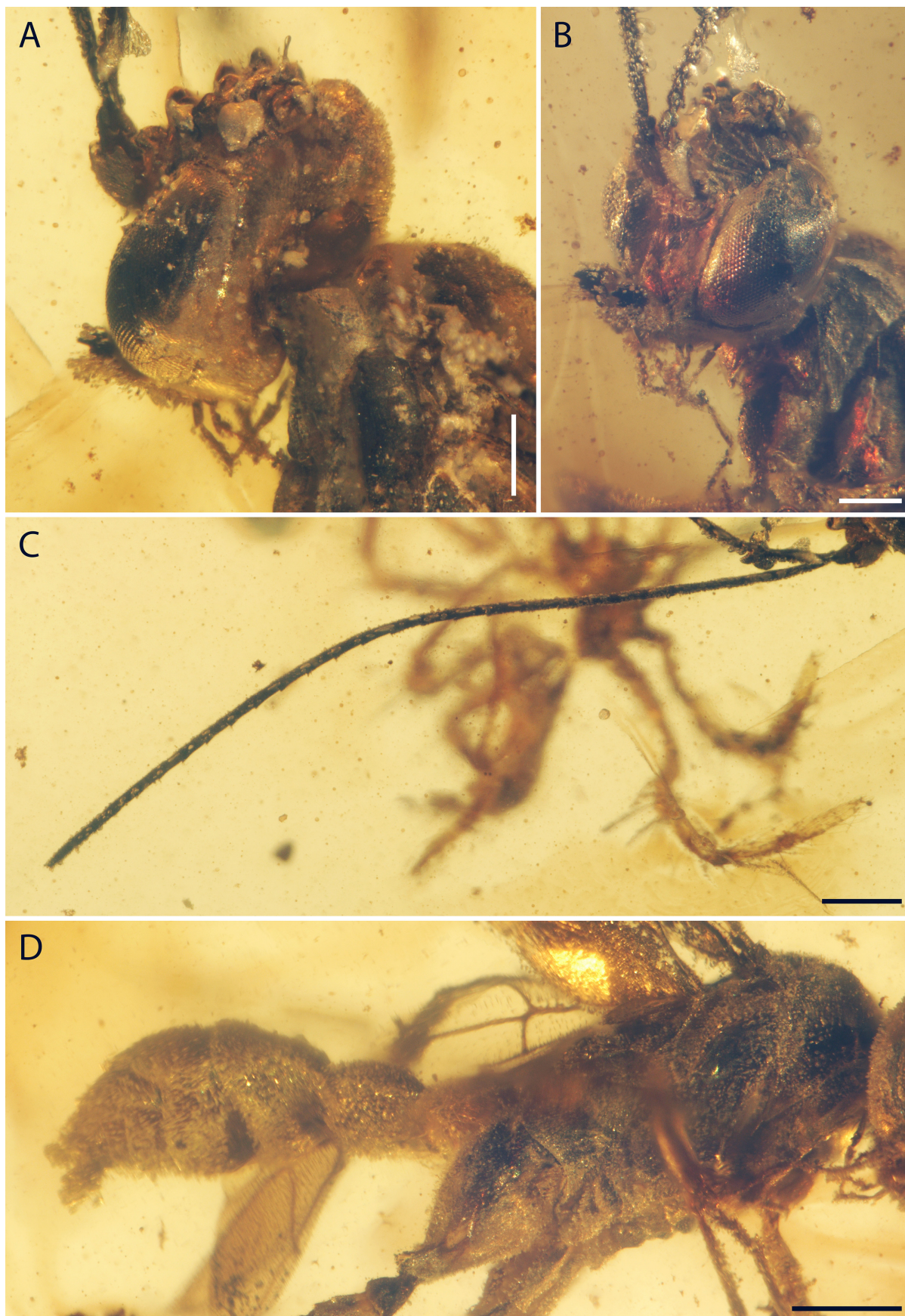


FIGURE 2. *Ohlhoffia minuta* sp. nov., holotype NIGP207494. **A**, Head in left posterior view. **B**, Head in left anterior view. **C**, Detailed view of right antenna. **D**, Detailed view of meso- and metasoma in right lateral view. Scale bars: 0.2 mm (**A**, **B**), 0.4 mm (**C**, **D**).

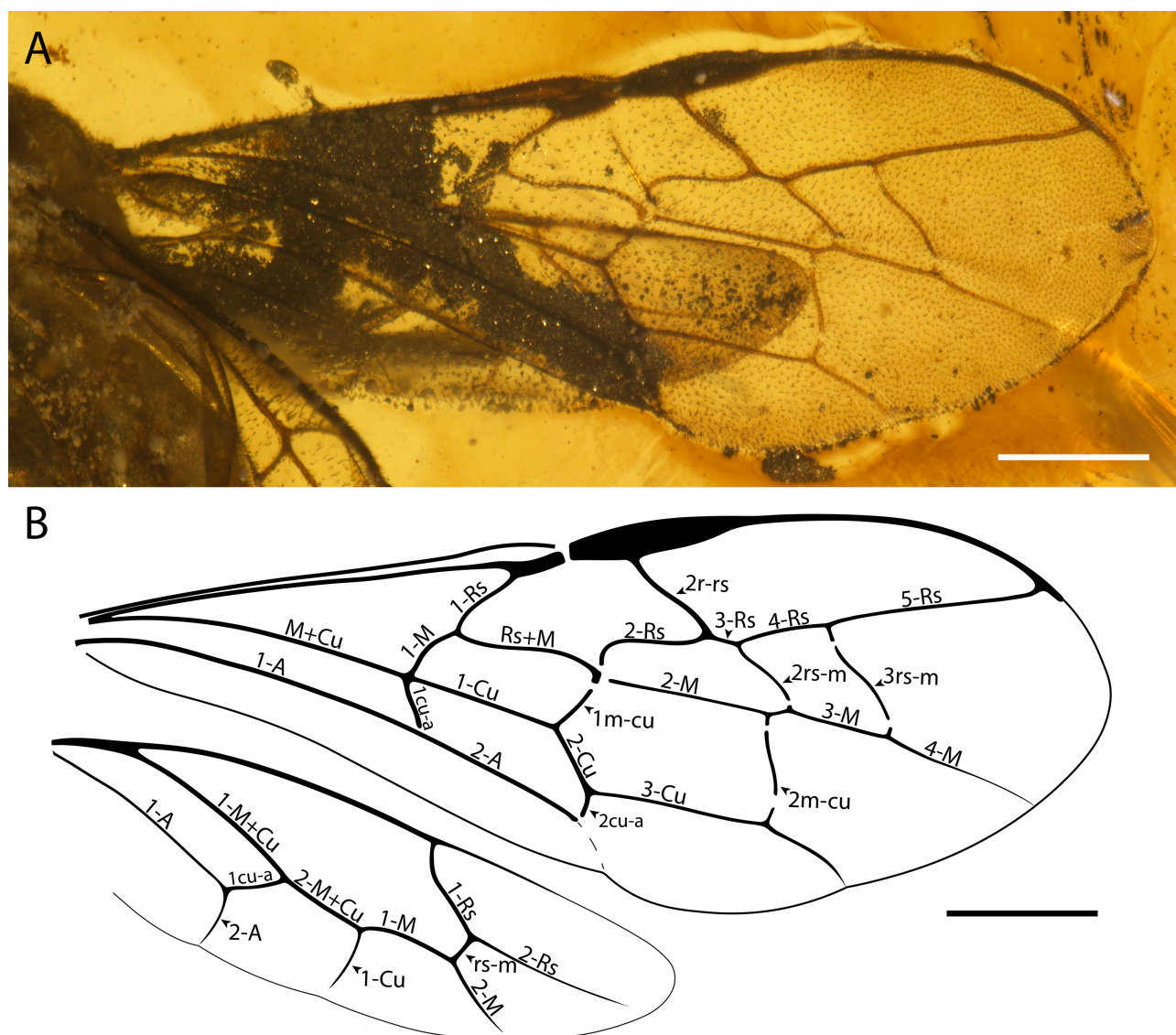


FIGURE 3. *Ohlhoffia minuta* sp. nov., holotype NIGP207494. **A**, Photograph of right wings. **B**, Interpretative line drawings of fore- and hind wing venation with names of veins labelled. Scale bars: 0.4 mm.

spiracle. Legs elongate, without distinct sculpturing; tibial spur formula 1-2-2; protibial spur bifid at apex, shorter than mid and hind-tibial spurs that are subequal in length, straight and simple; metacoxa distinctly larger than pro- and meso-coxae, its outer margin expanded apically by a lateral flange covering articulation of metatrochanter; metafemur moderately swollen medially (0.25 mm at maximum width) and nearly as long as metatibia (about 1.30 vs. 1.45 mm); tarsi pentamerous; metabasitarsus (about 0.79 mm) as long as remaining ones combined; fourth metatarsomere shortest; tarsal claws with small pre-apical tooth. Arolium present.

Forewing 2.85 mm long and 1.05 mm wide (maximal width); pterostigma slightly elongate, about five times as long as wide, only feebly swollen medially; 1-Rs reclivous, slightly arched, aligned with arched 1-M; 2r-rs proclivous, shorter than Rs+M; 2-Rs distinctly arched basally, with

no trace of 1r-rs; 2rs-m oblique, slightly sinuate, meeting Rs slightly behind 2r-rs, and slightly behind 2m-cu, enclosing long and subtriangular second submarginal cell; 3rs-m sinuate, subparallel to 2rs-m, delimitating short and skewed third submarginal cell; 5-Rs slightly long than half length of marginal cell, meeting R1 at acute angle near wing apex; 1m-cu subequal in length and subparallel to 1-M (discal cell subparallel-sided, more than twice as long as high); 2rs-m with one complete bulla (a second incomplete one close to Rs); 3rs-m, and 2m-cu each with two bullae; 1cu-a slightly anterior to M+Cu fork on right wing, distinctly postfurcal on left wing, oblique, shorter than 1-M; 2-Cu longer than 1m-cu; A straight, prolonged apically by claval furrow which forms a spurious vein margined with incrassate membrane. Hind wing 1.87 mm long, with basal and sub-basal cells entirely enclosed by tubular veins; basal cell long, about 1.6 as long as sub-

basal one; neither longitudinal vein reaching wing margin as a tubular vein; 1-Rs strongly curved, slightly sinusoidal, 1-Rs and 1-M long, 1-Rs longer than 1-M, more than twice as long as subvertical rs-m; 1-M slightly arched basally; 2-M+Cu only slightly shorter than 1-M, longer than 1cu-a; M+Cu fork slightly basad fork of Rs and R1; second anal vein (*sensu Myanmephialtites*) absent, anal lobe only incipiently delimited; anterior margin of wing with 6 distal hamuli.

Metasoma bipetiolate, both petiolar segments cushion-shaped, short and thick, hardly as long as high (difficult to measure because of the position of the specimen in the piece of amber), without tergosternal fusion and with deep, foveate pretergite; remaining metasoma ('gaster') oval, short, shorter than petiolar segment length combined; first and second gastral tergites largest of metasomal tergites, following gastral tergites gradually decreasing in size toward apex. Ovipositor short (apex of metasoma hidden by bubbles).

Remarks. Since the shape of certain veins and crossveins can be affected by taphonomic processes, we primarily base diagnostic characters on the insertion points of crossveins along the main veins.

Key to the species of Ohlhoffiidae:

1. Forewing with costal cell wide 3 (*Cretephialtites* Rasnitsyn & Ansoerge, 2000)
- Forewing with costal cell long and narrow 2
2. Stature stout; tibial spurs short; first and second metasomal (petiolar) segments compact, barely longer than high, cushion-shaped; forewing vein cu-a slightly antefurcal (but see discussion); hind wing without second anal vein 4 (*Ohlhoffia* Jouault *et al.*, 2020)
- Stature slim; tibial spurs long; petiolar segments elongate, more than twice as long as high, barrel-shaped; forewing vein cu-a interstitial (aligned with 1-M); hind wing with second anal vein *Myanmephialtites bashkuevi* Jouault *et al.*, 2020
3. Forewing with costal space distally almost wider than pterostigma; 2r-rs reaching Rs close to 2rs-m *Cretephialtites pedrerae* Rasnitsyn & Ansoerge, 2000
- Forewing with costal space distally thinner than pterostigma; 2r-rs reaching Rs well before 2rs-m *Cretephialtites(?) hispanicus* Rasnitsyn & Martínez-Delclòs, 2000
4. Small species with body about 3.7 mm long. Antennae with at least 25 flagellomeres. Forewing with pterostigma about five times as long as wide; 2r-rs originating before pterostigma midlength, shorter than Rs+M; 2m-cu reaching M very close to 2rs-m. Hind wing with six distal hamuli *Ohlhoffia minuta* **sp. nov.**
- Large species with body about 6.3 mm long. Antennae with 21 flagellomeres. Forewing with pterostigma about eight times as long as wide; 2r-rs originating near pterostigma midlength, longer than Rs+M; 2m-cu reaching M well before 2rs-m. Hind wing with eight distal hamuli *Ohlhoffia robusta* Jouault *et al.*, 2020

Superfamily Panguoidea Li *et al.*, 2019

Family Panguidae Li *et al.*, 2019

Genus *Pangu* Li *et al.*, 2019

Included species. *Pangu yuangu* Li *et al.*, 2019 (type species), and *Pangu antiquum* Li *et al.*, 2020

Pangu yuangu Li *et al.*, 2019

(Figs 4–6)

Material. Specimen NIGP207495, NIGPAS (in a rectangular piece of amber measuring 34 × 9 × 4 mm; with a Coleoptera, a Psocodea, two Diptera, a Heteroptera, a Coccoidea, and diverse insect debris).

Locality and horizon. Noiye Bum Hill, Hukawng Valley, Kachin State, Myanmar; upper Albion to lower Cenomanian, mid-Cretaceous.

Description. Small body size, about 4 mm long. Body apparently brownish with mesosoma (excluding legs but including petiole) darker than rest of the body, pronotum slightly paler; legs and metasoma pale brown, with tergites medially slightly darker. Ovipositor sheaths brown.

Head ovoid, wider than high in full face view, somewhat flat or thin, about 1 mm wide and 0.37 mm long in dorsal or ventral view. Eye massive, occupying most of head lateral surface, elongate ovate, nearly twice as long as wide, reaching mandibular base or nearly so, almost reaching head posterior margin in lateral view. Ocelli organized in small triangle (likely equilateral), about 0.1 mm wide and long, distance between lateral ocelli and eyes margin about 0.2 mm. Gena narrow, ribbon-like. Clypeus lobe like, lateral margin broadly arched, anterior margin sub-straight (lightly convex). Occipital carina complete and continuous, slightly lamelliform medio-dorsally, its ventral (anterior) branches subparallel and very wide apart, leaving postgenal bridge wide and moderately long and mouth cavity comparatively short. Mandibles stout and long, with right mandible overlapping left mandible, each with three teeth, distal one acute and longest, other oblong, before teeth a long distinct 'gnatal edge' with inner margins broadly arched. Maxillary palp with five visible elongate segments, labial one with fourth less elongated, becoming wider distally, with fourth widely rounded apically (presence of a short basal segment cannot be excluded for each pair of palps). Antenna 12-segmented, with scape and pedicel wider than flagellomeres, scape about twice as long as pedicel, apically obliquely truncate apex, pedicel cylindrical, wider than long (*i.e.*, transverse). Flagellomeres slightly shortening in length (about 0.12 mm long on average) and thinning (about 0.07 mm wide on average) towards apex from second to 9th (more or less 2.5× as long as wide), except apical one distinctly longer than wide and subacute (flagellomeres are slightly flattened diagenetically).

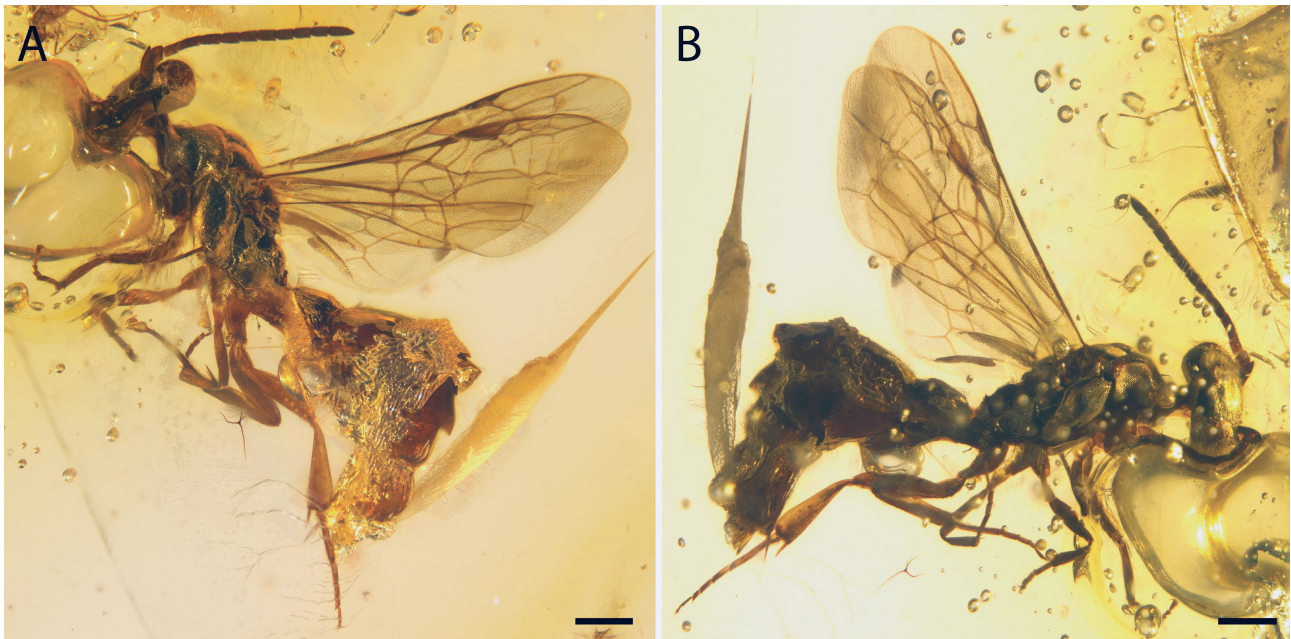


FIGURE 4. *Pangu yuangu* Li *et al.*, 2019, specimen NIGP207495. **A**, Habitus in left lateral view; **B**, Habitus in right lateral view. Scale bars: 0.4 mm.

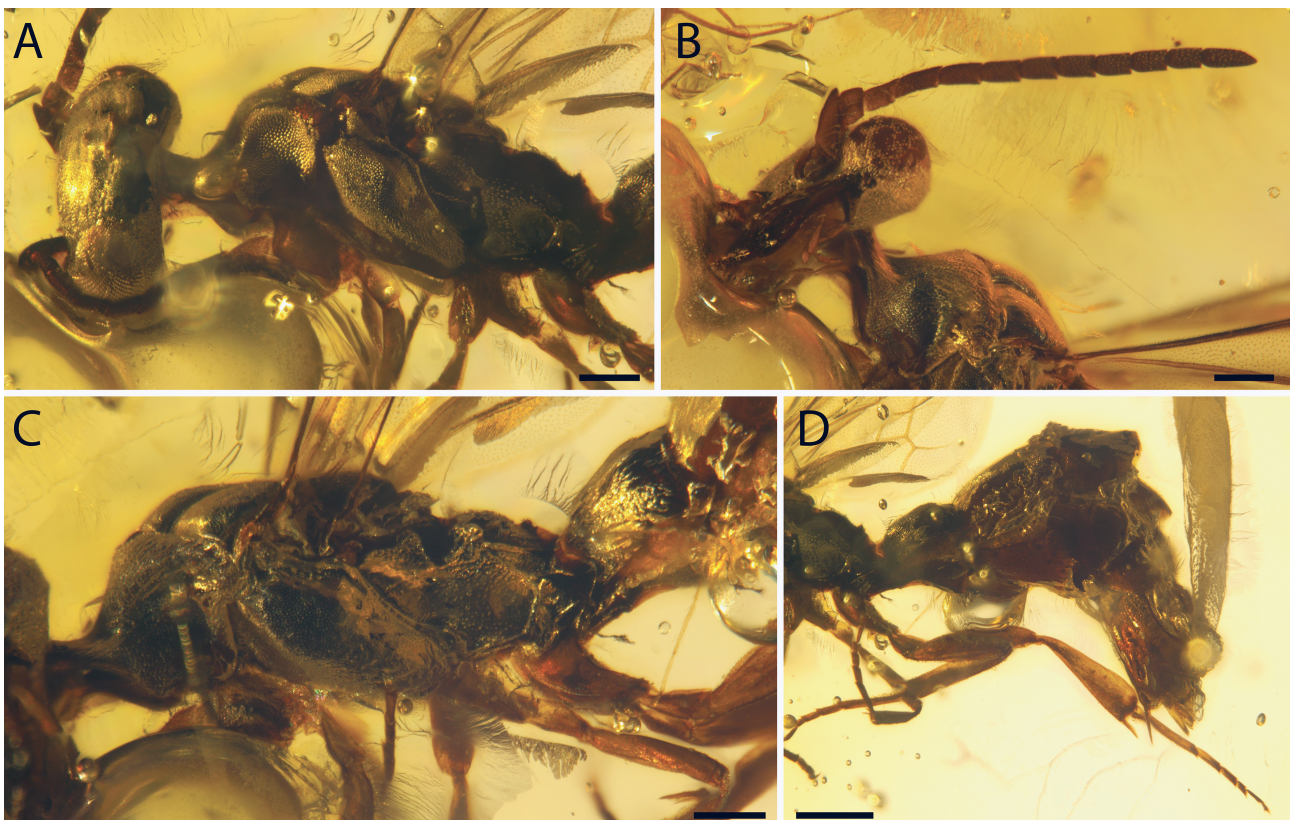


FIGURE 5. *Pangu yuangu* Li *et al.*, 2019, specimen NIGP207495. **A**, Detailed view of the head and mesosoma in right lateral view. **B**, Detailed view of the head in left lateral view. **C**, Detailed view of mesosoma in left lateral view. **D**, Detailed view of metasoma in right lateral view. Scale bars: 0.2 mm (**A–C**), 0.4 mm (**D**).

Mesosoma 1.53 mm long and 0.63 mm high (measured between pro and midcoxae). Pronotum without differentiation between dorsal and declivous parts, with dorso-posterior margin gently emarginated, posterolateral

lobes reaching tegula. Propleura moderately elongate. Mesonotum with notauli well impressed, converging posteriorly, never touching and almost reaching transscutal line, parapsidal furrows feebly marked, medial

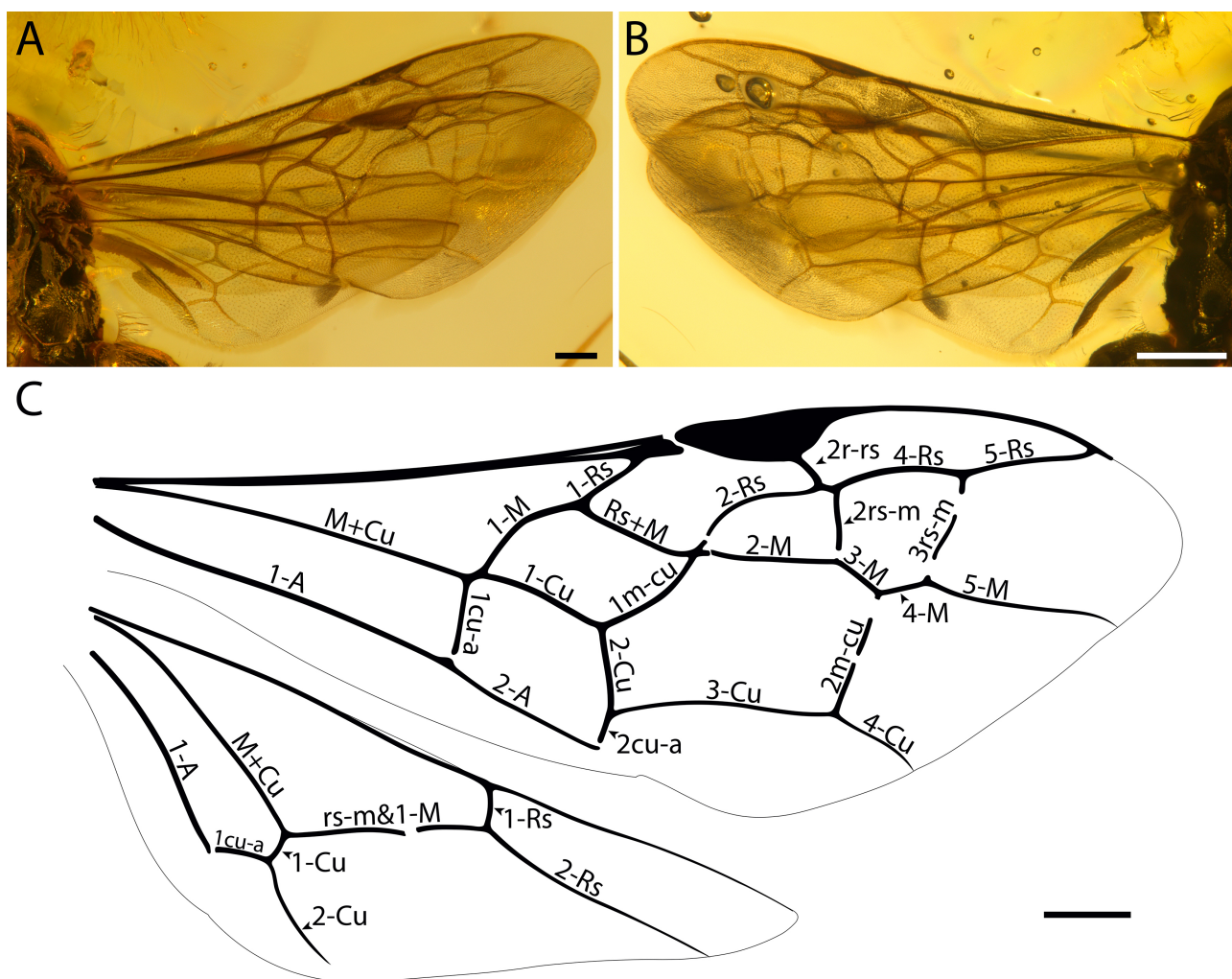


FIGURE 6. *Pangu yuangu* Li et al., 2019, specimen NIGP207495. **A**, Wings in left lateral view. **B**, Wings in right lateral view. **C**, Interpretative line drawing of fore- and hind wing venation, with names of veins labelled. Scale bars: 0.2 mm (**A**, **C**), 0.4 mm (**B**).

mesoscutal sulcus absent, prescutellar depression rather long, scutellum narrow, convex. Mesopleuron about 0.6 mm long and 0.4 mm high, with no suture or line visible except distinct triangular prepectus adjacent to posterior pronotal margin. Metanotum rather long below and behind mesoscutellum in lateral view (not clearly visible from above), metapostnotum rather long. Propodeum short. Fore- and midlegs configuration similar to hindlegs except being shorter (respective length of each part difficult to measure as curled up), and tibia not clavate. Hind legs with coxa elongate, trochanter relatively long, femur about 0.6 mm long, tibia about 0.65 mm long distinctly widening towards apex (maybe accentuated by taphonomy), tarsus with basitarsomere about 0.4 mm long, slightly shorter than combined length of remaining tarsomeres, tarsomeres I>II>III>IV, IV<V. Tibial spur formula 1-2-2. Tarsal claws simple, arolium small.

Forewing about 2.63 mm long and 0.9 mm wide (maximal), with costal space distinct all along Sc+R,

extremely narrow; pterostigma wide, with 2r-rs (about 0.1 mm long) straight and oblique, originating distad its midlength; M+Cu slightly arched, with fork slightly distad 1cu-a; first subdiscal cell about as long as discal cell; 1-Rs (0.18 mm) nearly straight, distinctly shorter than sinuate 1-M (0.28 mm), both angled at meeting point; Rs+M subequal and parallel to 1-Cu; discal cell rectangular, longer than wide; 2-Rs origin aligned with 1m-cu ending point, both broadly arched, without 1r-rs rudiment; second submarginal cell triangular, longer than wide; short Rs abscissa (3-Rs) present between 2r-rs and 2rs-m; 4-Rs and 5-Rs of similar length, both gently arched; marginal cell elongate, about 5.5 times longer than wide; 2rs-m nearly straight, shorter than 3rs-m; third submarginal cell pentagonal wider than long; 3rs-m reclival, slightly sinusoidal; 2-M longer than combined length of 3-M and 4-M, both of similar length and strongly angled at 2m-cu arrival point; 2m-cu entering third marginal cell slightly distad its midlength;

5-M ending free; 2-Cu shorter and strongly angled with 1-Cu; 3-Cu about as long as first submarginal cell; 4-Cu ending freely; 1-A and 2-A nearly straight; sub-basal cell rectangular, elongate, more than 5× longer than wide; 2cu-a length less than half 2-Cu length. Hindwing about 1.92 mm long and 0.6 wide (maximal), with five(?) distal hamuli, and two basal hamuli clustered along R slightly before wing midlength; with undifferentiated anojugal lobe delimited by weak notch along wing margin; 1-Rs (0.1 mm long) slightly proclival, slightly longer than 1-Cu, shorter than rs-m&1-M; rs-m&1-M very long (0.45 mm long) and almost straight, 1cu-a (about 0.15 mm long) reclival and much longer than 1-Cu. Free abscissa of Rs long, Cu short, absent in M and A.

Metasoma 2.19 mm long (excluding ovipositor), elongate, highest at about midlength, limits of tergites obscured by bubbles. Hypopygium incised apically. Ovipositor protruding for about 0.27 mm from metasoma, sheath lanceolate, tapering toward narrow apex.

Discussion

Specimen NIGP207494 is confidently assigned to the Ohlhoffiidae based on its antennae with more than 20 antennomers, a ‘toothed’ crown on the head, complex fore- and hind wing venation (e.g., with 2rs-m, 3rs-m, 2m-cu; and rs-m, respectively), and a two-segmented petiole. No other wasp family in the Kachin amber biota, or in other fossil deposits and modern ecosystems, exhibits this unique combination of traits (Jouault *et al.*, 2020).

Following the key to genera of Ohlhoffiidae proposed by Jouault *et al.* (2020) the specimen keys out into *Ohlhoffia* Jouault, *et al.* 2020 because of the following couplet: 1) forewing with costal cell long and narrow; and 2) stature stout; tibial spurs short; first and second metasomal (petiolar) segments compact, barely longer than high, cushion-shaped; forewing vein cu-a slightly antefurcal; hind wing vein 2A absent.

Specimen NIGP207495 is confidently assigned to the Panguidae based on its: 12 antennomers; symmetrical mandibles; a ‘centrally’ elongated pronotum that reaches the tegulae, with a gently curved posterior margin and not fused to the mesonotum; a mesonotum with distinct notauli and lacking a medial longitudinal suture; a mesopleuron without longitudinal or oblique sutures; a broad, ribbon-like metapostnotum; a moderately short propodeum; a narrow mesocoxal articulation with the mesosoma; wings with complete venation and lacking both a free M vein and a jugal lobe in the hind wing; and a metasoma with an internalized ovipositor, visible only at the extreme apices of the sheaths and sting (Li *et al.*, 2019, 2020; Zhuang *et al.*, 2024).

Following the key for identification of genera and species of Panguidae proposed by Zhuang *et al.* (2024), the new specimen keys out into the genus *Pangu* Li *et al.*, 2019 because of its slender propodeum and forewing with 2r-rs originating in distal 1/4th of pterostigma. Following the same key, it falls into *Pangu yuangu* because of its pedicel much shorter than first flagellomere, its forewing with 2r-rs originating well before its distal 1/4th of pterostigma, 2rs-m meeting Rs distad 2r-rs, 3rs-m sinuate, both ‘apical metanotum’ and ‘dorsal propodeum’ with transverse ‘keels’, metasoma with tergum 1 sharply attenuate basally in short petiole.

While body size alone is generally not a reliable character for distinguishing species of parasitoid or predatory wasps, since it is often influenced by the amount of food available to the developing larva, the combination of morphological traits observed in the new specimen of *Ohlhoffia* strongly suggests that it represents a distinct species (Jouault *et al.*, 2020). In the left forewing of the holotype of *Ohlhoffia minuta* **sp. nov.**, the crossvein 1cu-a is clearly postfurcal, a condition that is not mirrored in the right forewing. This asymmetry is noteworthy, as it may inform future taxonomic work on the family, particularly in assessing whether two specimens belong to the same species.

In contrast, the newly examined specimen of *Pangu yuangu* closely matches the holotype in terms of size and overall morphology. Only minor differences in wing venation were observed, which are not sufficient to justify the designation of a new species. For example, in the new specimen, crossvein 2m-cu meets the third submarginal cell slightly distal to the midpoint (*i.e.*, vein 3-M is slightly longer than 4-M), whereas the opposite is true in the type specimen. However, such subtle variations are more likely attributable to intraspecific variation rather than species-level differences (Li *et al.*, 2019).

Conclusion

The description of *Ohlhoffia minuta* **sp. nov.** expands the known diversity of the family Ohlhoffiidae in Kachin amber, bringing the total number of described species to four. The differences between this new species and the type species, particularly in body size, may, if supported by additional specimens, reflect adaptation to different hosts. However, given the current limited information, it remains difficult to assess the taxonomic significance of size variation within the family. Despite this uncertainty, the new species reinforces the idea that Ohlhoffiidae, with their articulated two-segmented petiole, were likely engaged in complex parasitic behaviours. The discovery of a second specimen of *Pangu yuangu* confirms the

morphological stability of this species and suggests that minor intraspecific variation may occur within members of the family.

Acknowledgements

I thank two anonymous reviewers for their useful comments and corrections on the first version of this manuscript. I am very grateful to my friend Prof. Dying Huang for hosting my stay in China and providing the specimens described in the present study. Financial support was provided by the National Key Research and Development Program of China (2024YFF0807601) and the National Science Foundation of China (42288201).

References

- Blaimer, B.B., Santos, B.F., Cruaud, A., Gates, M.W., Kula, R.R., Mikó, I., Rasplus, J.-Y., Smith, D.R., Talamas, E.J., Brady, S.G. & Buffington, M.L. (2023) Key innovations and the diversification of Hymenoptera. *Nature Communications*, 14, 1212.
<https://doi.org/10.1038/s41467-023-36868-4>.
- Branstetter, M.G., Childers, A.K., Cox-Foster, D., Hopper, K.R., Kapheim, K.M., Toth, A.L. & Worley, K.C. (2018) Genomes of the Hymenoptera. *Current Opinion Insect Science*, 25, 65–75.
<https://doi.org/10.1016/j.cois.2017.11.008>.
- Cruickshank, R.D. & Ko, K. (2003) Geology of an amber locality in the Hukawng Valley, northern Myanmar. *Journal of Asian Earth Sciences*, 21, 441–455.
[https://doi.org/10.1016/S1367-9120\(02\)00044-5](https://doi.org/10.1016/S1367-9120(02)00044-5)
- Darling, D.C. & Sharkey, M.J. (1990) *Order Hymenoptera*. In: Grimaldi, D.A. (Ed.), *Insects from the Santana Formation, Lower Cretaceous, of Brazil*. *Bulletin of the American Museum of Natural History*, 195, 123–153 pp.
- de Sena Oliveira, I.S., Bai, M., Jahn, H., Gross, V., Martin, C., Hammel, J.U., Zhang, W. & Mayer, G. (2016) Earliest onychophoran in Amber Reveals Gondwanan Migration Patterns. *Current Biology*, 26, 2594–2601.
<https://doi.org/10.1016/j.cub.2016.07.023>
- Grimaldi, D. & Engel, M.S. (2005) *Evolution of the insects*. Cambridge University Press, Cambridge, 755 pp.
- Grimaldi, D.A., Peñalver, E., Barrón, E., Herhold, H.W. & Engel, M.S. (2019) Direct evidence for eudicot pollen-feeding in a Cretaceous stinging wasp (Angiospermae; Hymenoptera, Aculeata) preserved in Burmese amber. *Communications Biology*, 2, 408.
<https://doi.org/10.1038/s42003-019-0652-7>
- Grimaldi, D. & Ross, A. (2017) Extraordinary Lagerstätten in amber, with particular reference to the Cretaceous of Burma. In: Fraser, N.C. & Sues, H.-D. (Eds), *Terrestrial conservation Lagerstätten: windows into the evolution of life on land*. Dunedin Academic Press, Edinburgh, 287–342 pp.
<https://doi.org/10.2307/jj.12638994.12>
- Huber, J.T. & Sharkey, M.J. (1993) Structure. In: Goulet, H. & Huber, J.T. (Eds), *Hymenoptera of the world: an identification guide to families*. Agriculture Canada, Ottawa, 13–59 pp.
- Jouault, C. (2021) Mid-Cretaceous Burmese amber peleciniid wasps (Hymenoptera, Peleciniidae) support the hypothesis of an Asian origin of the family. *Annales de Paléontologie*, 107, 102464.
<https://doi.org/10.1016/j.annpal.2020.102464>
- Jouault, C., Rasnitsyn, A.P. & Perrichot, V. (2020) Ohlhoftiidae, a new Cretaceous family of basal parasitic wasps (Hymenoptera: Stephanoidea). *Cretaceous Research*, 117, 104635.
<https://doi.org/10.1016/j.cretres.2020.104635>
- Jouault, C., Oyama, N., Álvarez-Parra, S., Huang, D.Y., Perrichot, V., Condamine, F.L. & Legendre, F. (2025) The radiation of Hymenoptera illuminated by Bayesian inferences from the fossil record. *Current Biology*, 35, 2164–2174.
<https://doi.org/10.1016/j.cub.2025.03.002>
- Li, L., Rasnitsyn, A.P., Shih, C., Li, D. & Ren, D. (2019) Two new rare wasps (Hymenoptera: Apocrita: Panguidae and Burmusculidae) from mid-Cretaceous amber of northern Myanmar. *Cretaceous Research*, 109, 104220.
<https://doi.org/10.1016/j.cretres.2019.104220>
- Li, L., Rasnitsyn, A.P., Shih, C.K., Li, D. & Ren, D. (2020) A new species and diagnostic characters for Panguidae (Hymenoptera, Pangoidea). *Cretaceous Research*, 115, 104563.
<https://doi.org/10.1016/j.cretres.2020.104563>
- Osten, T. (2007) Hymenoptera: bees, wasps and ants. In: Martill, D.M., Bechly, G. & Loveridge, R.F. (Eds), *The Crato Fossil Beds of Brazil*. Window into an Ancient World, 350–365 pp.
- Quicke, D.L.J. (2015) *The braconid and ichneumonid parasitoid wasps: Biology, Systematics, Evolution and Ecology*. Wiley-Blackwell, Chichester, 733 pp.
<https://doi.org/10.1002/9781118907085>
- Rasnitsyn, A.P. & Ansoorge, J. (2000) Two new Lower Cretaceous hymenopterous insects (Insecta: Hymenoptera) from Sierra del Montsec, Spain. *Acta Geologica Hispanica*, 35, 59–64.
- Rasnitsyn, A.P. & Martínez-Delclòs, X. (2000) Wasps (Insecta: Vespida = Hymenoptera) from the Early Cretaceous of Spain. *Acta Geologica Hispanica*, 35, 65–95.
- Ross, A.J. (2025) Supplement to the Burmese (Myanmar) amber checklist and bibliography, 2024. *Palaeoentomology*, 8 (1), 12–28.
<https://doi.org/10.11646/palaeoentomology.8.1.4>
- Shi, G.H., Grimaldi, D.A., Harlow, G.E., Wang, J., Yang, M.C., Lei, W.Y., Li, Q.L. & Li, X.H. (2012) Age constraint on Burmese amber based on U-Pb dating of zircons. *Cretaceous Research*,

37, 155–163.

<https://doi.org/10.1016/j.cretres.2012.03.014>

van Achterberg, C. (1993) Illustrated key to the subfamilies of the Braconidae (Hymenoptera: Ichneumonoidea). *Zoologische Verhandelingen*, 283, 1–189.

Zhang, Q., Rasnitsyn, A.P., Wang, B. & Zhang, H.C. (2018) Hymenoptera (wasps, bees and ants) in mid-Cretaceous

Burmese amber: a review of the fauna. *Proceedings of the Geologists' Association*, 129, 736–747.

<https://doi.org/10.1016/j.pgeola.2018.06.004>

Zhuang, Y., Li, J., Jarzembowski, E.A., Wang, B. & Zhang, Q. (2024) A new genus of Panguoidea in Lower Cretaceous Wealden amber. *Historical Biology*, 37, 484–487.

<https://doi.org/10.1080/08912963.2024.2309637>