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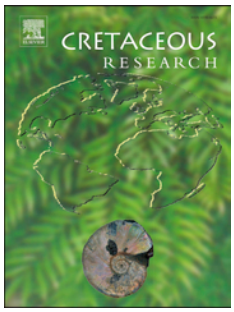

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A new myanmarinid wasp (Hymenoptera: Stephanoidea) from mid-Cretaceous Burmese amber

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ABSTRACT

The myanmarinid wasp *Myanmarina sidorchukae* sp. nov. is described and illustrated from the Cenomanian Burmese amber, based on an exquisitely preserved specimen. The new species is characterized by the presence of 12 antennomeres, with first and second flagellomeres equal in length, fourth and fifth flagellomeres distinctly longer than others; the maxillary palps very elongated; and the meso- and metatibiae with a dorso-apical tooth. We also provide an updated key to species of *Myanmarina*.

Keywords. Hymenoptera, Myanmarinidae, Albian, Cenomanian, fossil record, new species

1. Introduction

The recently described family Myanmarinidae is represented by only four species from mid-Cretaceous Burmese amber (Zhang et al., 2018a; Li et al., 2018). Myanmarinidae belong to the superfamily Stephanoidea according to their straight propodeum (in lateral view) lacking a posterior slope, and the lack of a strong constriction between the propodeum and the metasoma. This charac-

ter state is shared by other stephanoid wasps such as the living family Stephanidae and extinct Ephialtitidae and Aptenoperissidae (Rasnitsyn and Zhang, 2010; Rasnitsyn et al., 2017; Zhang et al., 2018a; Li et al., 2018), which strengthens the placement of Myanmarinidae among the Stephanoidea. Myanmarinidae differ from other Stephanoidea in having a more slender body, a sexually dimorphic, oligomerous antenna, a wing venation conspicuously reduced, and a membranous mesosomal dorsum, in addition to lacking the main apomorphies of Stephanidae (crown of teeth around fore ocellus) and of Aptenoperissidae (two protibial spurs, long geniculate and polymerous antenna, wingless female with the mesosomal segments forming a 'carapace'). Myanmarinidae also differ from Ephialtitidae in having reduced wing venation and antennomere number (Zhang et al., 2014: figs. 1-2). Like in many extinct groups, the biology of Myanmarinidae is unknown.

2. Material and methods

The amber piece containing the specimens studied herein derives from the deposits of Noije Bum in the Hukawng Valley (26° 29′ N, 96° 35′ E), Kachin State, northern Myanmar (see detailed map in Grimaldi and 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 sediments (Shi et al., 2012). Some ammonites found in the amber-bearing bed and within amber corroborates a late Albian–early Cenomanian age (Cruickshank and Ko, 2003; Yu et al., 2019).

The new myanmarinid specimen is embedded in a piece of clear yellow amber. It is a complete male individual. The specimen is housed in the amber collection of the Geological Department and Museum (IGR) of the University of Rennes, France under the collection number IGR.BU-010. The specimen was examined and photographed using a Leica MZ APO stereomicroscope equipped with a Canon EOS 5D Mark II camera. All images are digitally stacked photomicrographic composites of several individual focal planes, which were obtained using HeliconFocus 6.7 software. The figures were composed with Adobe Illustrator CC 2019 and Photoshop CC 2019 software. Nomen-

nomenclature of the wing venation follows Li et al. (2018). The lengths provided for antennomeres are mean measurements from both antennae.

This published work and the nomenclatural acts it contains have been registered in ZooBank (http://www.zoobank.org/, last access: 21May 2020),with the following LSID (reference): urn:lsid:zoobank.org:pub:BCCFA795-43AF-4874-829D-1AA7DEFDF442

3. Systematic paleontology

Superfamily Stephanoidea Leach, 1815

Family Myanmarinidae Zhang and Rasnitsyn, 2018

Genus *Myanmarina* Zhang and Rasnitsyn, 2018

Included species: *Myanmarina lisu* Zhang and Rasnitsyn, 2018 (type species); *Myanmarina kachin* Zhang and Rasnitsyn, 2018; *Myanmarina lahu* Zhang and Rasnitsyn, 2018; *Myanmarina jeannneae* Li et al., 2018; *Myanmarina sidorchukae* sp. nov.

Myanmarina sidorchukae Jouault, Rasnitsyn & Perrichot sp. nov.

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Figs. 1-2

Material. Holotype IGR.BU-010, preserved in a rectangular, polished piece of amber measuring 6 × 6 × 2 mm.

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

Etymology. The specific epithet is a patronym honoring Katya Sidorchuk, an exceptional paleoarthropodologist. The species epithet is to be treated as a noun in the genitive case.

Diagnosis. Head rounded, slightly longer than wide in dorsal view. Maxillary palp very elongated. Antenna with 12 antennomeres. First and second flagellomeres equal in length. Fourth and fifth flagellomeres distinctly longer than others. Meso- and metatibiae each with a dorso-apical tooth. Apex of claspers conspicuous but their length unknown.

Description. Specimen dark brown. Head, mesosoma and metasoma smooth without distinct setation. Total body length (antennae excluded): 3.55 mm, head + mesosoma: 1.60 mm.

Head separated from mesosoma by a conspicuous neck. Head subglobose, head height 0.41 mm, head length 0.45 mm. Compound eye height 0.27 mm, width 0.22 mm, prominent and ovoid. Ocelli small, well separated from compound eyes and posterior head margin. Gena prominent and projected ventrolaterally. Occipital carina apparently complete (not fully visible dorsally due to amber). Antenna inserted low on head in lateral view, slightly above level of ventral eye margin, with 12 antennomeres, densely covered with thin setae, curved trichoid sensilla absent. Scape cylindrical, about twice the length of pedicel and relatively straight. Flagellomeres thinner than pedicel, cylindrical, conspicuously longer than wide and becoming gradually thicker. First flagellomere basally curved. Flagellomeres IV and V longer than other flagellomeres. Flagellomere VI and following ones progressively decreasing in length. Apicalmost flagellomere shorter than others, rounded. Lengths of antennomeres (in mm): 0.06, 0.04, 0.21, 0.21, 0.24, 0.27, 0.26, 0.24, 0.21, 0.20, 0.17, 0.16. Maxillary palp longer than head height, with four-palpomeres: basal one short, two median palpomeres long and thin, apical one shorter than the two preceding ones, all slightly widening apically.

Mesosoma elongated, longer than high (ca. 1.11 mm long excluding neck, ca. 0.22 mm high); much slenderer than head in lateral view. Pronotum short medially, very long laterally and elongated in a distinct neck. Mesonotum plong, ca. 0.52 mm, occupying half of the dorsal surface of the metasoma, straight in lateral view, separated from mesoscutellum by a conspicuous suture. Mesoscutellum ca. 0.14 mm long. Metanotum only visible laterally, thereby, hard to describe. Pro-

podeum more than twice as short as mesonotum with its posterior margin (in dorsal view) concave. Propodeum separated from metanotum by a shallow constriction. Legs long and thin, with short appressed hairs. Meso- and metacoxae closely approximated, and greatly separated from procoxa. Fore leg with femur distinctly longer and wider than tibia; pro- and mesotibia short, nearly as long as basitarsomere. Protarsus with five tarsomeres; probasitarsomere slightly shorter than remaining tarsomeres combined. Leg dimensions (in mm): procoxa 0.24, profemur 0.61, protibia 0.38, protarsomeres combined 0.94 (probasitarsomere 0.42); mesocoxa 0.36, mesofemur 0.46, mesotibia 0.41, mesotarsomeres combined 1.05 (mesobasitarsomere 0.45); metacoxa ca. 0.39, metafemur 0.52, metatibia 0.84, metatarsomeres combined 1.08 (metabasitarsomere 0.49). Tibial spur formula: 1-1-1. Meso- and metatibiae each with a distinct, short, dorso-apical tooth (tooth not visible on protibia). Tarsal claws simple, acute, moderately bent; arolium inconspicuous. Fore wing long and narrow, hyaline, densely pubescent, with long setae along posterior margin, 2.30 mm long and 0.88 mm wide; only several veins present in basalmost area; costal area absent since C and R are fused; pterostigma hardly developed; veins 1Rs and 1M aligned and fused as Rs&M (basal vein), widening toward apical wing margin, shorter than M+Cu; no RS+M, RS and M distal of Rs&M; five radiating, long, setose folds running further distal (possible homologs of RS and M are difficult to identify among them); M+Cu forming an obtuse angle with Rs&M, practically spectral in its basal two thirds; 1Cu short, less than one-third as long as Rs&M; cu-a aligned with 1A, meeting Cu distinctly distal of M+Cu apex; free Cu long, nebulous, subparallel to posterior margin of wing, continuing into long, setose, weak fold similar to those between Cu and R. Hind wing very narrow in basal half, slightly widened distally, bearing 2-3 hamuli at about distal third of anterior wing margin and long setae along posterior margin, with a single vein (R or C+R). Metasoma 2.06 mm long and ca. 0.33 mm high, elongated, attached high on propodeum, with anterior face almost as high as posterior face of propodeum, with eight visible terga sub-equal in length except for shorter apical one; first metasomal segment trapezoid in dorsal view (narrow basally); other segments almost as wide

as second segment, except apical segment narrowing toward apex. Clasper of male genitalia with apex external, exposed part about as long as apical tergum.

Female unknown.

Updated key to species of *Myanmarina* males from Li et al. (2018):

1. Antenna 11-segmented, with first flagellomere very long, about twice as long as second …… 2

– Antenna 12-segmented, with first flagellomere short, nearly as long as second ……. 3

2. Metafemur (with trochantellus) nearly as long as metatibia; metacoxa and male claspers very long (as long as or longer than preceding metasomal segment) …… *Myanmarina lisu*

– Metafemur at most 0.7 times as long as metatibia; metacoxa and male claspers short (shorter than preceding metasomal segment) ……..…… *Myanmarina kachin*

3. Maxillary palp short (shorter than head height). Metafemur thin, only slightly wider medially, about as long as metatibia ……. *Myanmarina lahu*

– Maxillary palp long (as long as or longer than head height). Metafemur thick, conspicuously wider medially, much shorter than metatibia ……. 4

4. Male head elongated, much longer than wide in dorsal view.…… *Myanmarina jeannineae*

– Male head short, rounded, slightly longer than wide in dorsal view.…… *Myanmarina sidorchukae* sp. nov.

4. Discussion

The current knowledge of Myanmarinidae is rather poor, only five species being described, all from Burmese amber. The family could be endemic to this paleoregion, as suggested for several other insect families known exclusively from the mid-Cretaceous Burmese amber biota so far (Zhang et al., 2018a; Li et al., 2018). This potentially reduced distribution is congruent with an isolation of the West Burma plate (Westerweel et al., 2019), and a possible indication of an island endemism

(Zhang et al., 2018b). Thus we consider future discoveries of this family in other Cretaceous amber as possible but not very likely.

Among Hymenoptera, only a limited number of families display the wing venation reduced to an extent comparable to that of Myanmarinidae. Among these families, the most similar is maybe the extinct Spathiopterygidae, known also from Burmese amber as well as from Cretaceous Lebanese, Spanish, and Raritan ambers (Engel et al., 2013, 2015; Krogmann et al., 2016). Myanmarinid wasps are particularly similar to *Mymaropsis baabdaensis* Krogmann et al., 2016 from Lebanese amber, which also displays RS&M, M+Cu and 1Cu forming a Y-like pattern at the wing base. Additionally, similar venation has been described for *Cretapria tsukadai* Fujiyama, 1994, from Aptian Choshi amber (Fujiyama, 1994), which could belong to the Spathiopterygidae family as well. However, this similarity is a possible homoplasy because of striking differences in many important features: *Mymaropsis* shares synapomorphies with the Proctotrupomorpha and Diaprioidea. Such features are absent in Stephanoidea, and in particular in Maamingidae, such as the propodeum arched in side view and so forming a distinctive wasp-waist; antenna attached well above clypeus, oligomerous, elongate, and geniculate; first metasomal segment reduced to form a petiole. *Mymaropsis* has the venation even more reduced than in *Myanmarina*, with the remaining tubular veins closer toward the wing base and with anal and cu-a veins lost, in accordance to its particularly small size that generally induces reduction of wing venation (Rasnitsyn, 1969). However, the similarity is really deep, especially since it not only concerns the tubular veins but also a system of radiating and partially inter-nested setose folds on the wing disc. The wing-venation similarities, shared by both species mentioned above with the even older and enigmatic *Khutelchalcis gobiensis* Rasnitsyn, Basibuyuk & Quicke, 2004, from the earliest Cretaceous of Mongolia, is interesting to understand evolutionary trends in wing venation. *K. gobiensis* was described as a putative basal Chalcidoidea (Rasnitsyn et al., 2004). Recently, Rasnitsyn and Öhm-Kühnle (2020) discuss the relationships between Spathiopterygidae, Khutelchalcis and other Proctottrupomorpha. An attempt to explain these

similarities between taxonomically distant wasps, only sharing very small sizes, lies beyond the scope of the present publication and needs far wider and deeper analysis.

5. Conclusions

The description of *Myanmarina sidorchukae* sp. nov. extends the diversity of myanmarinid wasps in Burmese amber biota. This description suggests that new morpho-species will soon be discovered. Additionally, the family was recently recorded in Khamti amber (C.J. unpublished data), suggesting that new species will also be described from this deposit. Currently, myanmarinid wasps are endemic to Burmese amber biota, and thereby, strengthen the high endemism of the biota resulting from the geological history of the West Burma terrane during the Cretaceous period. It is hoped that the description of additional taxa will provide clues on the biology of this intriguing, extinct family.

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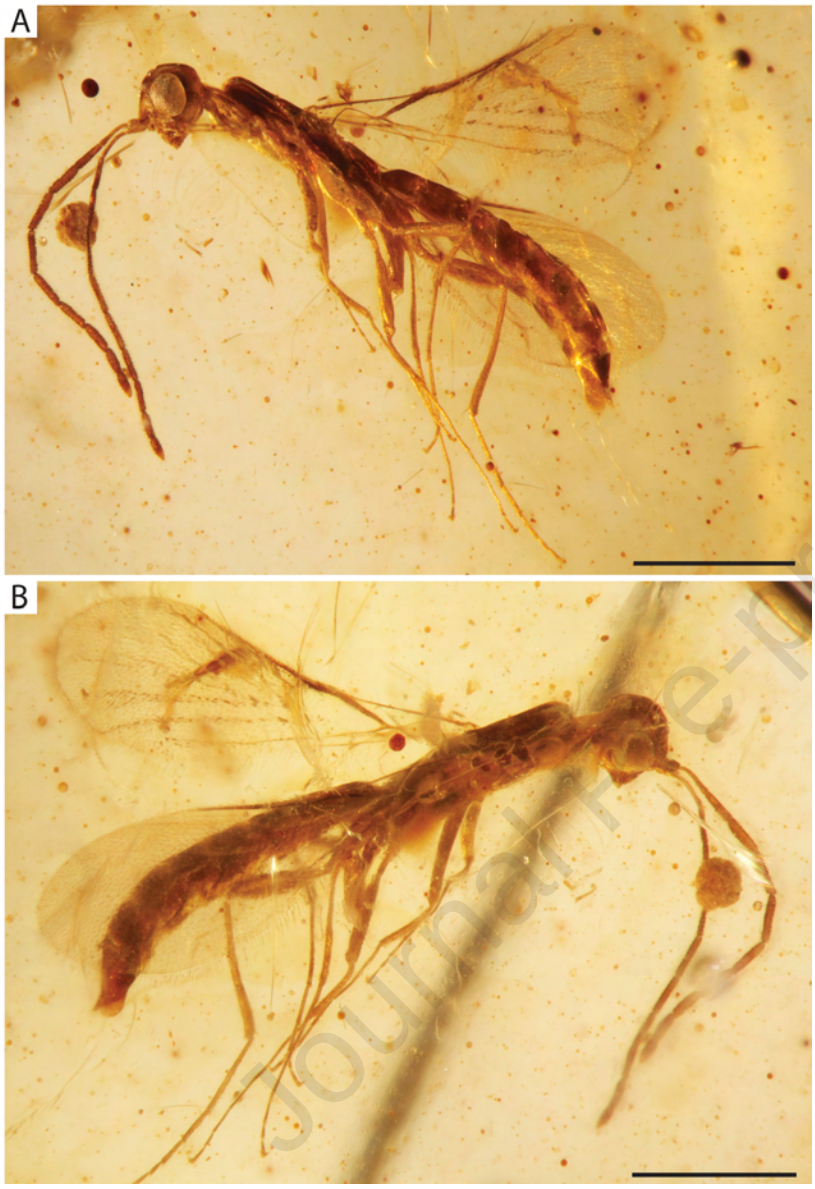
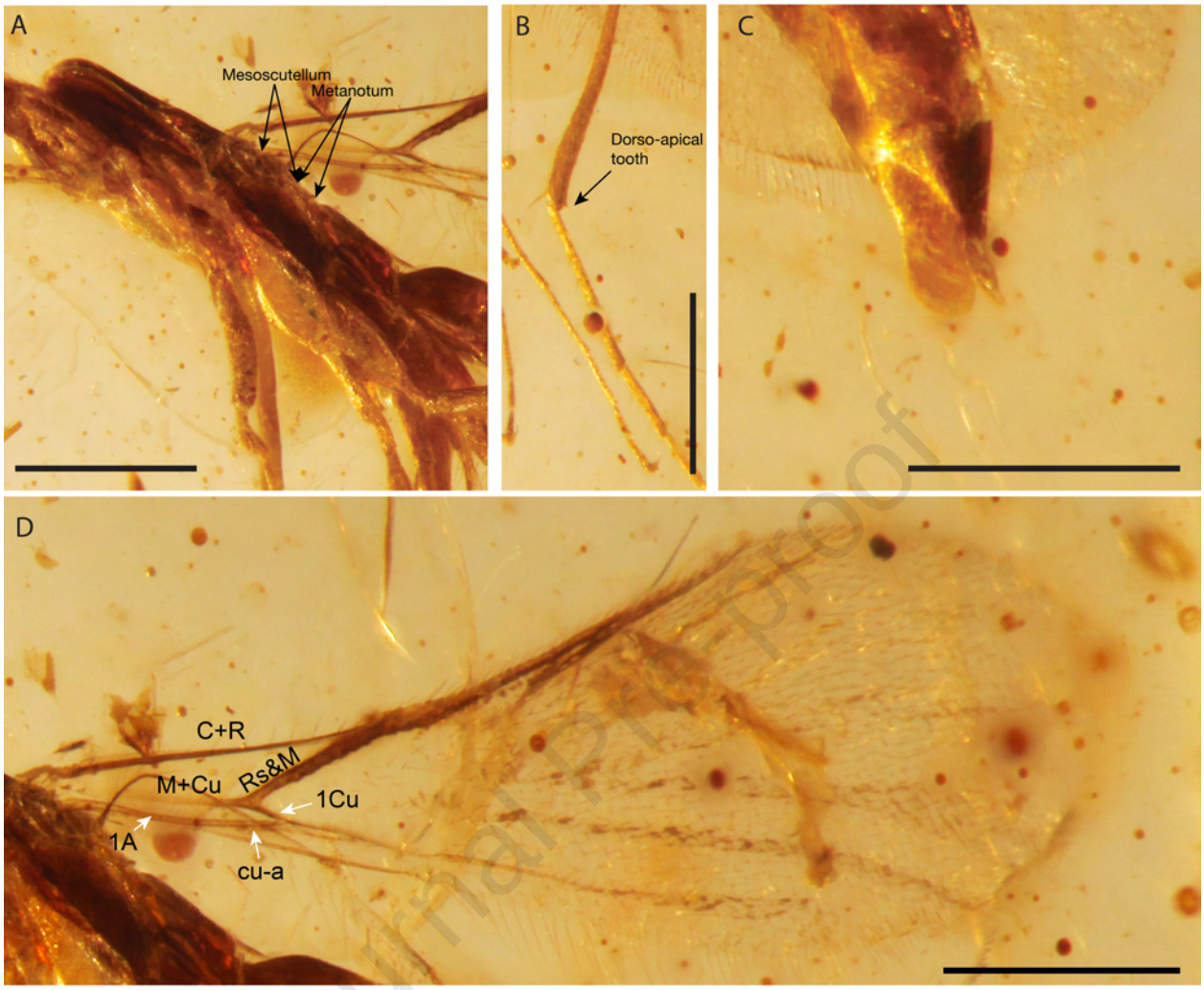
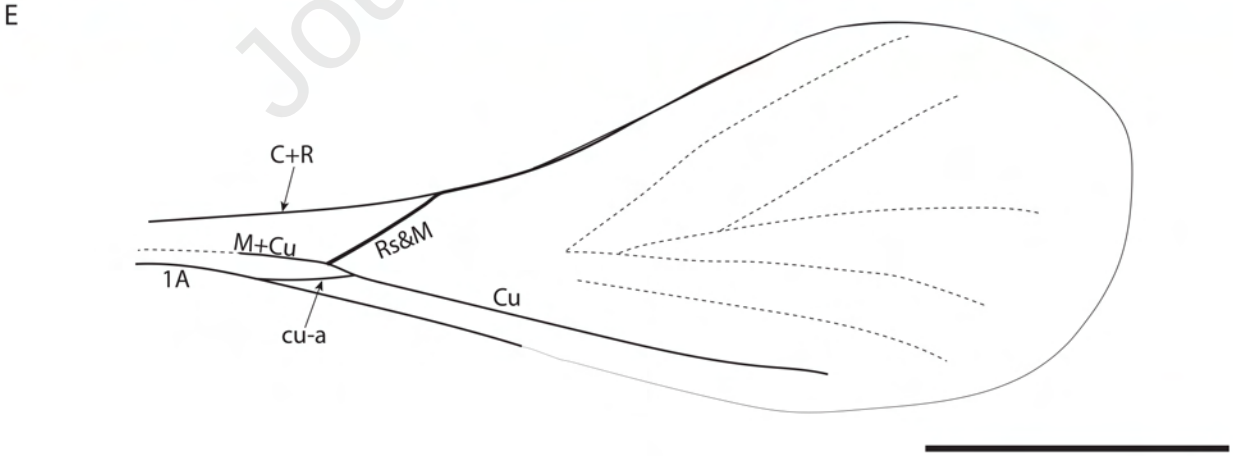
Figure 1. *Myanmarina sidorchukae* sp. nov., holotype IGR.BU-010. A: Habitus in right lateral view. B: Habitus in left lateral view. Scale bars: 1 mm.

253 **Figure 2.** *Myanmarlna slaborchukae* sp. nov., holotype IGK.BU-010. A: Mesosoma. B: Apex of me-
254 tatibia. C: Apex of metasoma. D: Labelled wing venation. E: Line drawing of wing venation with
255 indication of vein nomenclature. Scale bars: 0.5 mm.







Jouault: Conceptualization, investigation, material acquisition, investigation, writing original and reviewed manuscript. Rasnitsyn: investigation, writing original and reviewed manuscript. Perrichot: supervision, investigation, writing original and reviewed manuscript.

Declaration of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.