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Mymaropsis baabdaensis sp. n. from Lower Cretaceous
Lebanese amber – the earliest spathiopterygid wasp and the
first female known for the family



Mymaropsis baabdaensis sp. n. de l'ambre Crétacé inférieur du Liban –
la plus ancienne guêpe spathiopterygide et première femelle connue
pour cette famille

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ABSTRACT

The oldest fossil record of the extinct parasitoid wasp family Spathiopterygidae is provided from Lower Cretaceous (pre-Upper Barremian–Lower Bedoulian) Lebanese amber. The description of *Mymaropsis baabdaensis* sp. n. is based on the first female specimen available for the family and significantly expands the known temporal distribution of Spathiopterygidae to the Early Cretaceous. Female characters are added to the diagnosis of the family and phylogenetically relevant morphological characters are discussed.

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R É S U M É

Le plus ancien fossile connu de la famille de guêpes parasitoïdes Spathiopterygidae est décrit de l'ambre Crétacé inférieur (pré-Barrémien supérieur–Bédoulien inférieur) du Liban. La description de *Mymaropsis baabdaensis* sp. n. est basée sur le premier spécimen femelle découvert pour cette famille. Ce nouveau taxon étend de façon significative la distribution temporelle des Spathiopterygidae dans le Crétacé inférieur. Les caractères morphologiques de la femelle sont ajoutés à la diagnose de la famille ; ceux importants du point de vue phylogénétiques sont discutés.

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1. Introduction

Spathiopterygidae is an extinct lineage of Cretaceous proctotrupomorph wasps with representatives from ambers of Spain (Albian), New Jersey (Turonian), and Myanmar (Cenomanian) (Engel et al., 2013, 2015). Only four male specimens have been recorded previously. All of these were found in different localities and have been classified in separate genera: *Spathiopteryx* Engel and Ortega-Blanco, 2013 from Peñacerrada (Spain), *Mymaropsis* Engel and Ortega-Blanco, 2013 from San Just (Spain), *Spathopria* Engel, Ortega-Blanco and Grimaldi, 2013 from New Jersey (USA), and *Diaspathion* Engel and Huang, 2015 from Hukawng (Myanmar). Here we describe the oldest known spathiopterygid wasp from Early Cretaceous Lebanese amber based on the first known female specimen. We add female characters to the diagnosis of the family and discuss phylogenetically relevant characters.

2. Material and methods

The holotype is deposited in the Natural History Museum of the Lebanese University, Faculty of Sciences II, Fanar, Lebanon. The amber was cut, ground and polished and then included between two cover slips with Canada balsam medium as described by Azar et al. (2003). Terms for morphological structures follow Huber and Sharkey (1993). The descriptive terms “tubular”, “nebulous” and “spectral” for reduced wing venation are used in accordance to Mason (1986). In the descriptions, all veins are tubular veins unless otherwise noted. Measurements always refer to the maximum width or length of the respective body parts. Habitus images (Figs. 1a and 2c) were taken with a Leica DXM 1200 digital camera attached to a Leica MZ 16 APO microscope and processed using Auto-Montage (Syncroscopy) software. Images of selected body parts (Fig. 2b,d) and all measurements were done under a Keyence VHX 600 digital microscope under the highest possible magnification for the respective measurement (up to 2.500×). Digital drawings of wing venation and habitus (Figs. 1b and 2a) were done with a Wacom Bamboo Pen Tablet in Adobe Illustrator CS5 on the basis of digital photographs. Images were edited with Adobe Photoshop CS3 and figure plates assembled with Adobe Illustrator CS5.

3. Systematic paleontology

Family Spathiopterygidae Engel and Ortega-Blanco, 2013.

Included genera: *Diaspathion* Engel and Huang, 2015; *Mymaropsis* Engel and Ortega-Blanco, 2013; *Spathiopteryx* Engel and Ortega-Blanco, 2013; *Spathopria* Engel, Ortega-Blanco and Grimaldi, 2013.

Diagnosis: See Engel et al. (2013) for male characters. Female characters: Antenna 14-segmented (female:male antennal segments 14:14), flagellomeres apically without curved trichoid sensilla. Metasoma distinctly longer than head plus mesosoma. Last tergum (Mt8) tubularly expanded with apical cerci. Hypopygium situated close to apex of metasoma.

Genus *Mymaropsis* Engel and Ortega-Blanco, 2013.

Type species: *Mymaropsis turolensis* Engel and Ortega-Blanco, 2013.

Diagnosis: Frontal shelf weakly developed. Forewing densely covered with short setae, with well-defined, tubular vein (M+Cu) near wing base, distally forked into an anterior (M+Rs) and a posterior branch (Cu). Hindwing with small portion of membrane and three distal hamuli. Metasoma with second tergum largest. See Engel et al. (2013) for full diagnosis.

Mymaropsis baabdaensis sp. n. (Figs. 1 and 2).

Holotype: ♀: No. 855, deposited in the Natural History Museum of the Lebanese University, Faculty of Sciences II, Fanar, Lebanon.

Age and outcrop: Lower Cretaceous, Ante-Jezzinian = pre-Upper Barremian–Lower Bedoulian (Maksoud et al., 2014), amber of Hammana-Mdeyrij, Caza Baabda, Mohafazat Jabal Loubnan, Central Lebanon, Lebanon.

Description: ♀: Specimen dark brown to black. Head, mesosoma and metasoma largely devoid of setation. Head and metasoma with fine reticulation, metasoma smooth. Total body length: 0.92 mm, head plus mesosoma: 0.42 mm. Head subglobose, head height 0.24 mm, head length 0.17 mm. Eye height 0.17 mm, eye width 0.12 mm. Antenna inserted low on head, slightly above level of ventral eye margin. Frontal shelf present but indistinct. Antenna 14-segmented, antennomeres densely covered with thin setae (Fig. 2b), longitudinal setae and curved trichoid sensilla absent. Scape ventrally slightly expanded, about twice the length of pedicel. F1–F4 thin and cylindrical, F5–F11 distinctly broader rectangular or subquadrate, F12 elongate, slightly pointed at apex. F5–F12 pedunculate. Length:width of individual antennomeres (in µm): scape 105:46, pedicel 54:37, F1 61:19, F2 59:20, F3 50:20, F4 52:22, F5 45:30, F6 42:31, F7 50:40, F8 49:42, F9 48:38, F10 49:40, F11 53:38, F12 90:32.

Mesosoma very stout, as long (0.27 mm) as high (0.27 mm): Pronotum extremely shortened, hardly visible in dorsal view. Mesonotum not flattened. Propodeum shortened.

Forewing hyaline with sparse setation (Fig. 1a). Outer margin with short fringe. Forewing length 1.05 mm, forewing width 0.44 mm. Stronger setation along spectral veins (Fig. 1b). Forewing venation reduced (Fig. 1b): C absent, Sc+R (“submarginal vein”) very close to basal part of anterior wing margin, leaving only very small membranous area between Sc+R and anterior wing margin. Pterostigma (Pst) present and evenly thickened (“marginal vein”), 112 µm long, 23 µm broad, appressed along anterior wing margin. A short vein R1 (“postmarginal vein”) emerges distally from pterostigma, 106 µm long. Radial cell (R) present; 150 µm long, posteriorly delimited by rather strong vein M+Cu, that forks into an anterior short vein M+Rs ending in the pterostigma and a posterior vein Cu of similar length terminating just before the posterior wing margin. More distally a spectral vein emerges from the point of separation between M+Rs and Cu. This spectral vein seems to correspond to Rs+M. It is distally forked into an anterior branch Rs and a posterior branch M, both

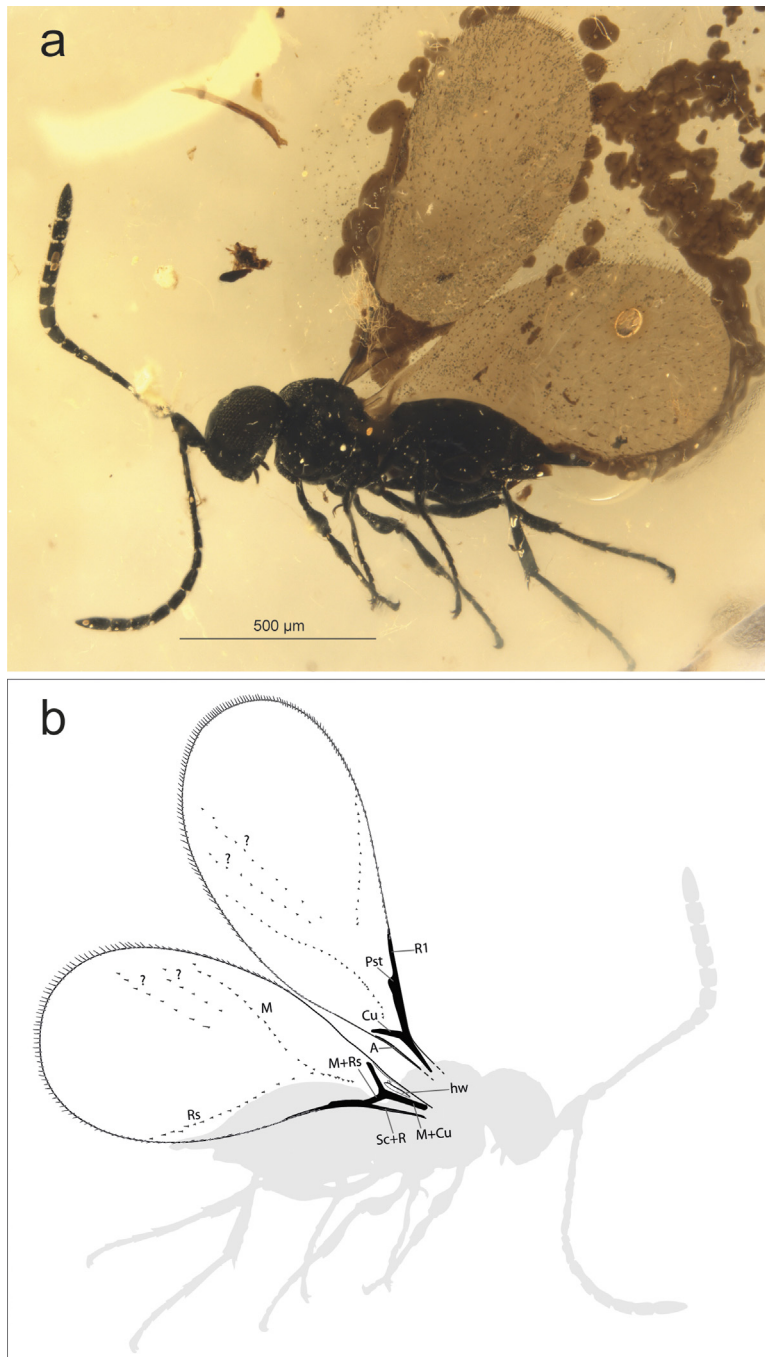


Fig. 1. Holotype female (No. 855) of *Mymaropsis baabdaensis* sp. n.: a: habitus in left lateral view; b: habitus in right lateral view, forewing veins labelled, hindwing (hw) indicated.

Fig. 1. Holotype femelle (n° 855) de *Mymaropsis baabdaensis* sp. n. : a : habitus en vue latérale gauche ; b : habitus en vue latérale droite, veines avant marquées, aile arrière indiquée (hw).

being spectral. Two additional spectral veins of unknown origin are running parallel to M (marked with question marks in Fig. 1b). Posterior to M+Cu, is a short nebulous vein parallel to posterior wing margin that corresponds to vein A. Hindwing extremely shortened, with membrane, hindwing length 97 µm, hindwing width 10 µm. Hindwing

without wing venation apart from Sc+R, three hamuli present (Fig. 2a).

Legs with all trochanters distinctly enlarged (Fig. 2c). Leg dimensions (in µm): Foreleg: coxa 90, trochanter 70, trochantellus 22, femur 77, tibia 93, tarsus 248 (basitarsus 94). Midleg: coxa 70, trochanter 52, trochantellus 20, femur

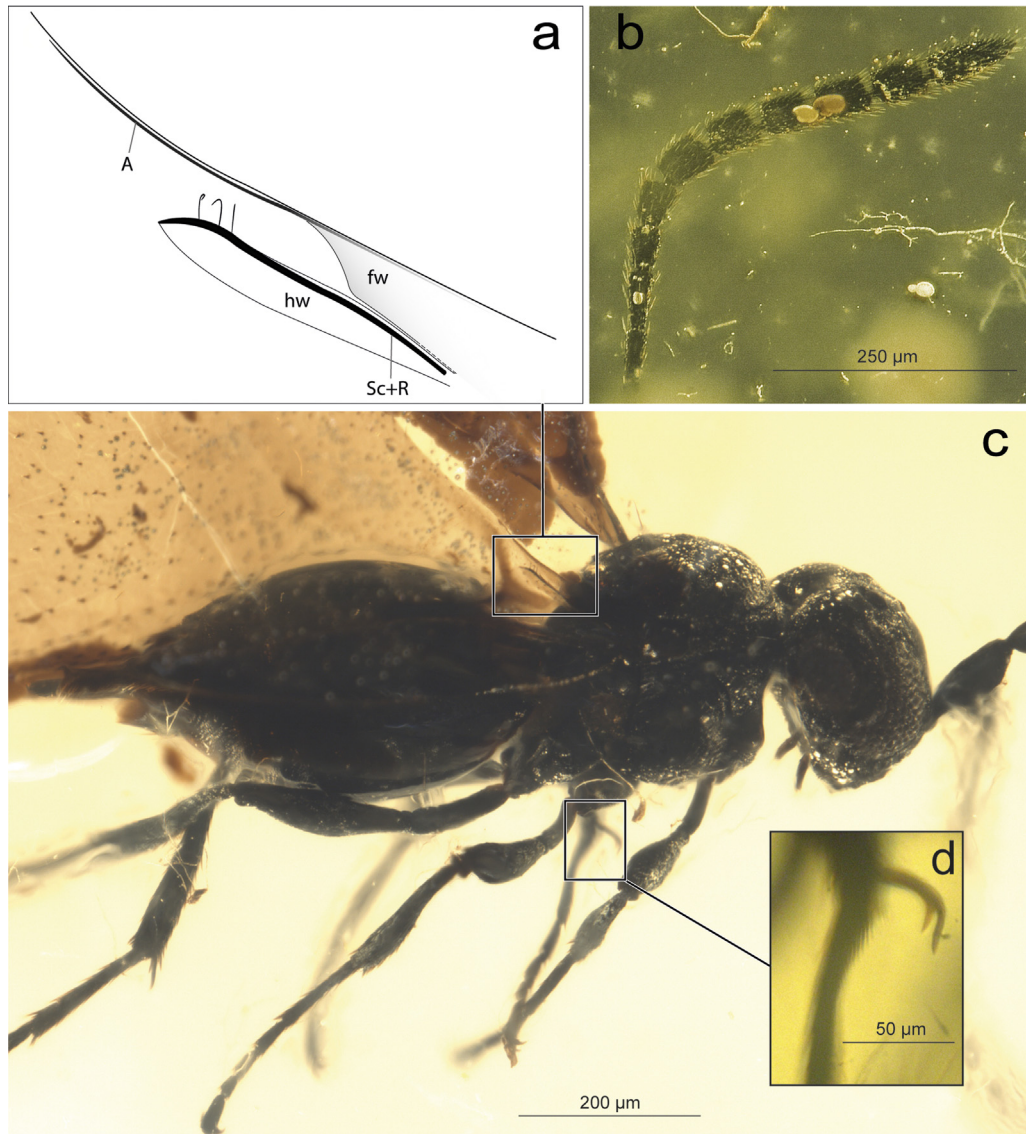


Fig. 2. Holotype female (No. 855) of *Mymaropsis baabdaensis* sp. n.: a: hindwing (hw) and posterior margin of forewing (fw) in ventral view, veins labelled; b: distal part of right antenna; c: body in right lateral view; d: protibial spur.

Fig. 2. Holotype femelle (n° 855) de *Mymaropsis baabdaensis* sp. n. : a : aile arrière (hw) et marge postérieure de l'aile avant (fw) en vue ventrale, veines marquées ; b : partie distale de l'antenne droite ; c : corps en vue latérale droite ; d : ramification protibiale.

89, tibia 137, tarsus 252 (basitarsus 99). Hindleg: coxa 57, trochanter 84, trochantellus 41, femur 178, tibia 153, tarsus 307 (basitarsus 152). Protibial spur curved with distinct apical cleft (Fig. 2d), 46 µm long, protarsal comb well developed. Hindtibia with single hindtibial spur, 42 µm long.

Metasomal length 0.51 mm, metasomal height 0.26 mm. Metasoma not collapsed with eight visible tergites, 2nd metasomal tergite the longest and ovipositor slightly expanded (Fig. 2c). Last tergum (Mt8) tubularly expanded with apical cerci. Length of metasomal tergites in dorsal view (in µm): Petiole (Mt1) 93, Mt2 229, Mt3 32, Mt4 36 (separation line between Mt3 and Mt4 difficult to discern), Mt5 38, Mt6 53, Mt7 39, Mt8 61. Length of exposed part of ovipositor 43 µm. Hypopygium situated close to apex of metasoma.

♂: Unknown.

Etymology: The new species is named after the Baabda District in Lebanon where the amber specimen was found.

4. Discussion

The superfamily Diaprioidea (sensu Sharkey, 2007) is a subunit of Proctotrupomorpha which has been consistently retrieved by molecular data (e.g., Castro and Dowton, 2006; Dowton and Austin, 2001; Heraty et al., 2011; Sharkey et al., 2012) but not in the morphological analysis of Vilhelmsen et al. (2010). Monophyly of Diaprioidea might be supported by the presence of a distinct frontal extension forming a shelf below the antennal foramina. This character was originally proposed by Early et al. (2001) as putative

synapomorphy of Diapriidae, Maamingidae and Monomachidae, even though it is less distinctly developed in the latter family and lacking in the former diapriid subfamily Ismarinae, which was elevated to family rank by Sharkey et al. (2012). The frontal shelf is also not very distinct in Spathiopterygidae but its presence still seems to be the only character supporting a phylogenetic placement in or close to Diaprioidea. This placement is currently tentative and needs to be tested by future phylogenetic studies. Engel et al. (2013) suggested a sister group relationship between Maamingidae and Spathiopterygidae based on the absence of an occipital carina and the absence of an enlarged petiole. The phylogenetic significance of the petiole is limited due to its homoplastic nature and also the occipital carina (which we cannot exclude with certainty from our fossil due to its head orientation) was convergently reduced numerous times within Proctotrupomorpha, e.g., in Maamingidae, Mymaromatidae and several groups of Chalcidoidea and may or may not be indicative of a sister group relationship between Spathiopterygidae and Maamingidae. A careful comparative study of morphological characters throughout Proctotrupomorpha would be needed to better define Diaprioidea and to infer the phylogenetic position of Spathiopterygidae relative to other diaprioid and proctotrupomorphan lineages.

The forewing venation of *Mymaropsis baabdaensis* is similar to that of *Mymaropsis turoloensis* in the presence of a well defined, tubular vein (M+Cu) near the wing base, distally forked into an anterior (M+Rs) and a posterior branch (Cu). These veins are spectral or absent in other Spathiopterygidae. Also vein A seems to be more sclerotized in *Mymaropsis* than in other Spathiopterygidae. *Mymaropsis* is also the only spathiopterygid genus with a membranous hindwing, which is completely absent or reduced to a veinal stub in the other genera. All of the above-mentioned wing characters seem to represent the plesiomorphic condition in *Mymaropsis* relative to the apomorphic reductions found in the other genera. The morphological evidence therefore agrees well with the fact that *Mymaropsis* is currently the earliest known genus of Spathiopterygidae.

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