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A new Coniopterygidae from Lebanese amber

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ABSTRACT

We describe the oldest fossil Coniopterygidae, possibly attributable to the Coniopteryginae, in the new genus and species *Libanosemidalis hammanaensis*, from the outcrop Hammana / Mdeyrij in the Lower Cretaceous amber of Lebanon. This fossil shares with the extant and Cenozoic lineages of Coniopterygidae the presence of only two M branches, unlike other Cretaceous representatives of the family.

Keywords: Neuroptera. Coniopterygidae. Coniopteryginae. Lower Cretaceous amber. Lebanon. n.gen. and n.sp.

INTRODUCTION

Although the extant Coniopterygidae are fairly well represented on all continents (Meinander, 1975), the fossil record of this neuropterous family is relatively poor. Only twelve fossil species have been described (reviewed by Nel, 1991). Among them, seven are attributed to the Aleuropteryginae and five to the Coniopteryginae. The systematic relationships of several fossil genera are difficult to determine (Meinander, 1990). *Archiconiopteryx liasina* (HANDLIRSCH 1906), from the Late Lias (Lower Jurassic) in Germany, was attributed to the Coniopterygidae Aleuropteryginae by Enderlein (1909) and subsequent authors, but Ansorge (1996) restored it in the Hemiptera (Handlirsch, 1906). *Juraconiopteryx zherichini* MEINANDER 1975, from the Upper Jurassic of Karatau in Kazakhstan, is apparently the oldest known Coniopterigydae, but its state of preservation is rather poor, in peculiar for the wing venation.

The only other coniopterygid reported from Lebanese amber is *Glaesoconis fadiacra* WHALLEY 1980, attributed to the Aleuropteryginae by Whalley (1980) and Meinander (1975). Whalley's material was collected by Professor Aftim Acra, from the outcrop at Jezzine, in southern Lebanon (Acra, pers. comm.). Meinander (1975) described *Glaesoconis cretica* from the Upper Cretaceous amber of nothern Siberia and Grimaldi (pers. comm.) also discovered 2 genera and 4 species of Coniopterygidae from the Upper Cretaceous New Jersey amber (U.S.A.).

The oldest described Coniopteryginae is from the Eocene Baltic amber (Meinander, 1975). We report in the present study the discovery and the description of a probable new Coniopteryginae genus and species (*Libanosemidalis hammanaensis*) which is the oldest fossil record for this subfamily. This fossil insect is Lower Cretaceous (circa - 125 Myr) (Azar, 1998; Dejax et al., 1996, 1997), and comes from the locality Hammana /

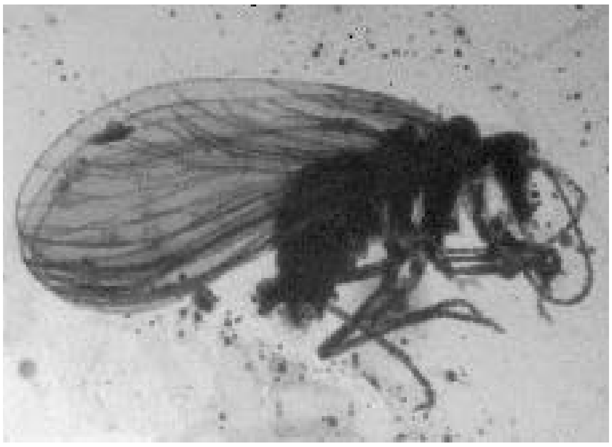

Figure 1. *Libanosemidalis hammanaensis* n.gen., n.sp.

Mdeyrij in central Lebanon, some 35 km north the Jezzine outcrop.

Family: Coniopterygidae BURMEISTER, 1839
Subfamily: Coniopteryginae BURMEITER, 1839

GENUS ***Libanosemidalis*** n.gen.

Type species: Libanosemidalis hammanaensis n.gen., n.sp.

Etymology: after *libano*, for Lebanon and *semidalis*, after '*Neosemidalis*': a genus of the tribe Coniopterygini. This genus has many wing vein and genitalia characters shared with the new genus.

Diagnosis: head hypognathous elongate with gibbous and prominent vertex. Antenna with 24 flagellomeres. Maxillary palps five-segmented. Prothorax short. Mesothorax with distinct lateral shoulders at the forewing base level. One radio-medial crossvein in the apical third of the forewing. Rs branching off from R very near the base of the wing. Only two apical branches of M (M1+2, M3+4), not 3 as in all other described Cretaceous coniopterygids. Sc-r crossvein at same level as bifurcation of Rs into R2+3 and R4+5.

Libanosemidalis hammanaensis n.gen., n.sp.
Figures 1 - 3

Holotype: specimen n° 326A, male, D. Azar collection, deposited in the Museum National d'Histoire Naturelle of Paris, France.

Age and outcrop: Lower Cretaceous, Late Neocomian / Lower Aptian (circa - 120-125 Myr), Hammana / Mdeyrij, Casa Baabda, Mouhafazit Jabal Libnen, Lebanon (Azar, 1998; Dejax et al., 1996, 1997).

Etymology: after Hammana, the amber outcrop where *Libanosemidalis hammanaensis* n.gen., n.sp. has been found.

Description: General body colour dark brown. The total length measured from tip of the head to tip of wings is 2.13 mm (Fig. 1, 2); the body length measured from tip of the head to tip of genitalia is 1.34 mm. Head (Fig. 3.2): hypognathous elongate, 0.39 mm long and 0.32 mm wide, with gibbous and prominent vertex. Compound eye well developed and oval, smallest diameter 0.11 mm, largest diameter 0.15 mm. Interocular distance, 0.14 mm. Antenna 1.17 mm long, with 24 flagellomeres. First and second flagellomeres longer than other flagellomeres, first flagellomere 0.06 mm long, 0.04 mm wide; second flagellomere 0.05 mm long, 0.03 mm wide. Other antennal segments cylindrical; nearly 2.5 - 3.0 x longer than broad. Antennal segments with scattered, dense covering of sensilla. Interantennal frontal portion not clearly visible, but seems to be sclerotized. Maxillary palps five-segmented, nearly 0.4 mm long; third segment, 0.07 mm long, slightly longer than first; second and fourth segment 0.06 mm long. Fifth segment particularly swollen basally, larger and broader than others, 0.13 mm long and 0.04 mm wide (others are 0.02 mm wide). Galea and lacinia obscured. Labial palps not visible. Thorax: 0.47 mm long. Prothorax short, 0.07 mm long, 0.12 mm wide. Mesothorax, 0.26 mm long, 0.3 mm wide, bearing two prominent tubercles dorsally, and two distinct lateral shoulders at the base of the forewings. Distance from tip to tip of shoulders, 0.46 mm. Metathorax 0.14 mm long, 0.49 mm wide. Forewing (Fig. 3.1): 1.92 mm long, 0.75 mm wide. Sc1 long and parallel to the costal margin after its basal third, reaching costal margin 1.81 mm from wing base. Very narrow distance (0.001 mm) between Sc1 and costal margin from basal third of Sc1 to wing apex. Presence of two crossveins between Sc1 and C, at 0.26 mm and 0.42 mm from wing base. Sc2 bifurcates from Sc1 at 1.38 mm from base of the wing, and stays free for 0.09 mm before it fuses with R1 at a strong angle, for 0.54 mm before reaching wing apex. R branching off from R+M at 0.52 mm from wing base, then bifurcating into R1 and Rs after a distance of 0.15 mm. R1 reaching wing apex. Free part of R1 0.67 mm long before its fusion with Sc2 for 0.54 mm. Rs 0.65 mm long, bifurcating into R2+3 and R4+5, 1.31 mm from wing base. R2+3 0.52 mm long. A crossvein between R1+Sc2 and

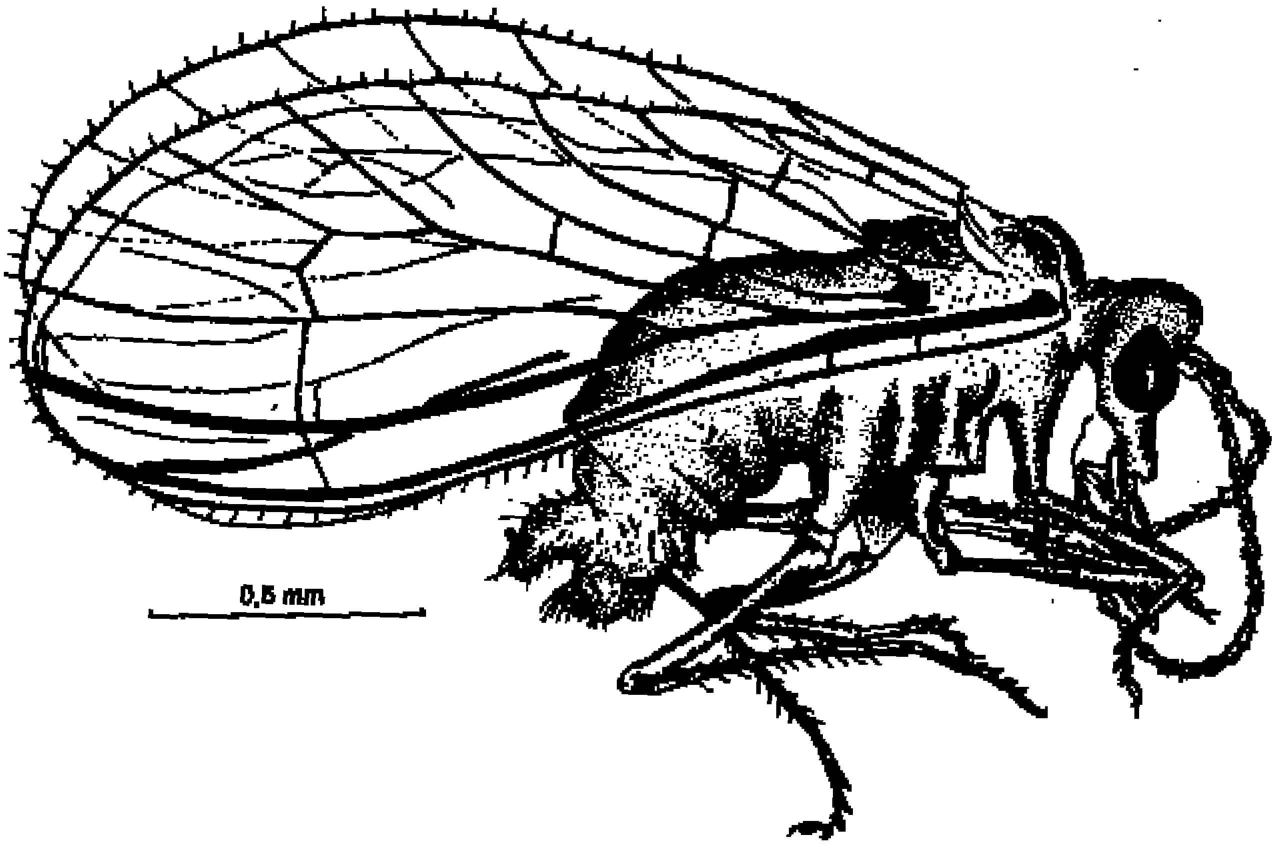

Figure 2. Habitus of *Libanosemidalis hammanaensis* n.gen., n.sp.

Rs, 0.2 mm long and 1.4 mm from wing base. R4+5 branches off from Rs, 1.31 mm from wing base. Distance between base of R4+5 and its apex, 0.45 mm. M (0.63 mm long) branching off from R+M, 0.52 mm from wing base, and bifurcating into M1+2 and M3+4, 1.12 mm from wing base. M1+2 curved, reaching wing margin, 1.6 mm from wing base. Presence of a crossvein between R4+5 and M1+2, 0.11 mm from base of M1+2. M3+4 nearly straight, 0.31 mm long, reaching wing margin 1.43 mm from wing base. Cu bifurcating into Cu1 and Cu2 0.32 mm from wing base. Cu1 curved, reaching wing margin 1.22 mm from the wing base. Presence of a crossvein between Cu1 and M 0.53 mm from base of Cu1. Cu2 curved, nearly parallel to Cu1, reaching wing apex 0.91 mm from wing base. Presence of a crossvein between Cu1 and Cu2 0.25 mm from base of Cu1 and Cu2. A1 reaching wing margin 0.72 mm from wing base. Two crossveins between A1 and Cu2 respectively at 0.33 mm and 0.56 mm from wing base. A2 reaching wing margin 0.53 mm from wing base. Two crossveins branching from A2, one between A1 and A2 0.45 mm from base of A2, and the other between A2 and wing margin, 0.32 mm from wing base. Hindwings, (Fig. 3.3): Slightly shorter than forewing, 1.61 mm long, 0.7 mm wide. Sc1 rather long and parallel to costal margin, reaching costal margin 1.32 mm from wing base. Sc2 bifurcates from Sc1, 1.2 mm from wing base, and stays free, for 0.12 mm before its fusion with R1 at a strong angle, for 0.42 mm before reaching wing apex. Bifurcation of R into R1 and Rs not clearly visible but in a very basal position. R1 (+Sc2) reaching wing apex. Rs bifurcating into R2+3 and R4+5 1.12 mm from wing base. R2+3, slightly curved, 0.44 mm long. A crossvein between R1 and R2+3, 0.17 mm long, at 1.19 mm from wing base. R4+5 branching off from Rs, 1.15 mm from wing base. Distance between base of R4+5 and end of R4+5, 0.35 mm. M (0.6 mm long) branching off from R+M very basally, 0.31 mm from wing base, and bifurcating into M1+2 and M3+4, 0.91 mm from wing base. M1+2 slightly curved, reaching wing margin, 1.35 mm from wing base. Presence of a crossvein between R4+5 and M1+2 0.14 mm from base of M1+2. M3+4, 0.29 mm long, reaching wing margin, 1.19 mm from wing base. Cu bifurcating into Cu1 and Cu2 very basally. Cu1 curved, reaching wing margin,

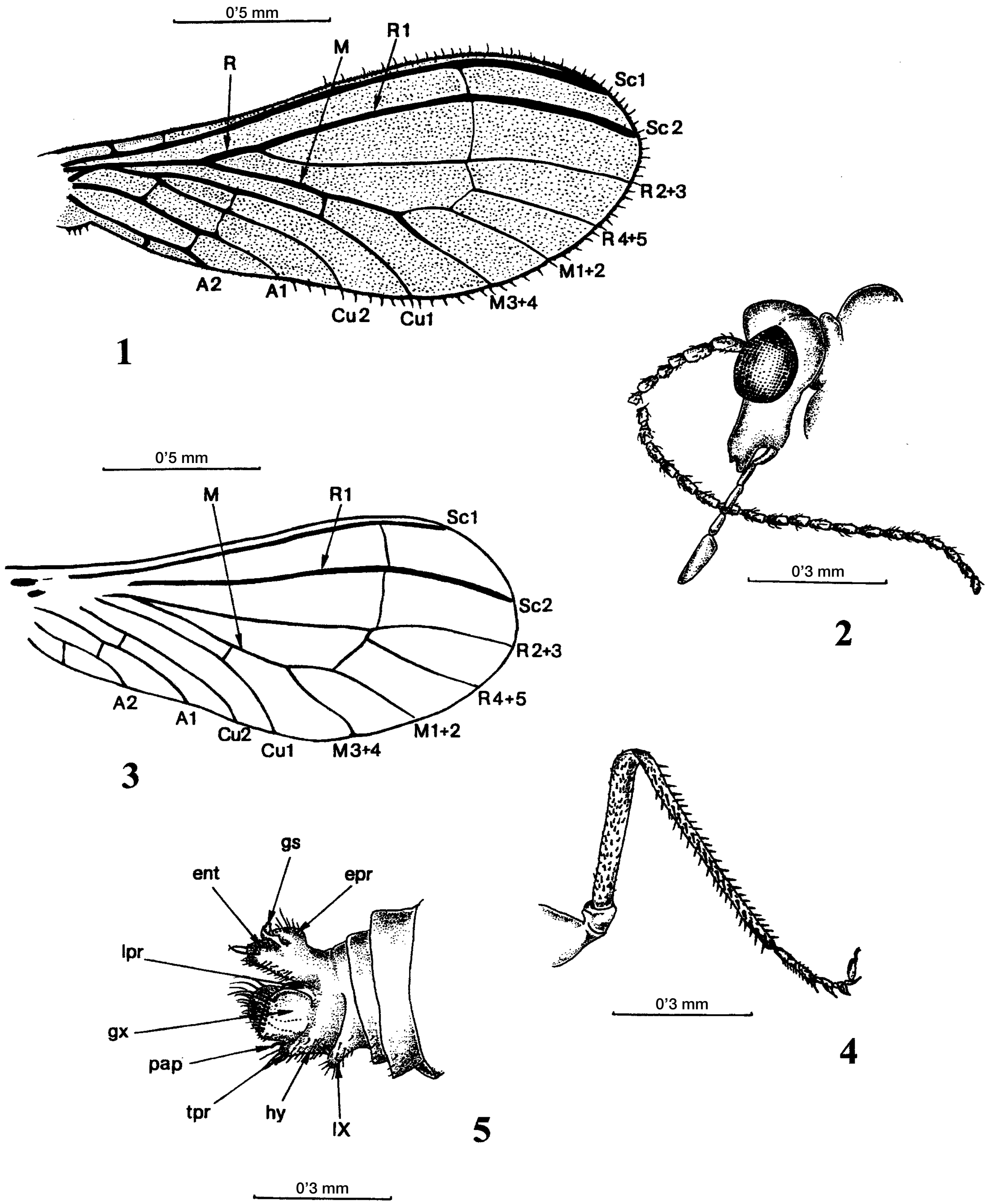

Figure 3. *Libanosemidalis hammanaensis* n.gen., n.sp. 1.- Forewing; 2.- Lateral view of the head; 3.- Hindwing; 4.- Left posterior leg; 5.- Male genitalia; ent = entoprocessus, epr = epiproct, gs = gonarcus, gx = gonocoxites, hy = hypandrium or 10th sternite, lpr = *processus lateralis,* pap = *processus apicalis,* tpr = *processus terminalis,* IX = 9th sternite.

0.97 mm from wing base. A crossvein between Cu1 and M, 0.73 mm from wing base. Cu2 curved, nearly parallel to Cu1, reaching wing margin, 0.85 mm from wing base. A1 reaching wing margin, 0.67 mm from the wing base. A crossvein between A1 and Cu2 branching off from A1, 0.42 mm from wing base. A2 reaching wing margin, 0.46 mm from wing base. Two crossveins branching from A2, between A1 and A2, 0.33 mm from base of A2, and between A2 and wing margin, 0.23 mm from wing base. Legs (Fig. 3.4): Legs slender and densely covered of microtrichiae. All tibiae rather long, covered with regular rows of regularly spaced setae. Tarsi five-segmented, covered with setae. First tarsomere long, slightly shorter than remaining tarsomeres. Second and third tarsomeres nearly of the same length. Fourth tarsomere flattened and shorter than others. Fifth tarsomere elongated. Abdomen: 0.65 mm long, 0.36 mm wide, including genitalia. Genitalia (Fig. 3.5): There is still a considerable confusion over the genitalic terminology of the Neuroptera. Acker (1960) attempted to interpret the terminal structures of all the Neuropteroidea, but for the Coniopterygidae, he only investigated two species of Coniopteryginae. We follow the nomenclature of Tjeder (1954, 1956, 1970) who remaned the structures. Genitalia very obscured, but clearly a male. Epiproct (epr), 0.07 mm long, with dense setae, slightly covered on ventral side by gonarcus (gs) (Tjeder, 1954). Only 0.05 mm of gonarcus visible. Entoprocessus (ent) 0.12 mm long and 0.06 mm wide; covered with small and fine setae, each side with a long, apically curved seta. Dorsal surface of entoprocessus covers ventral side of gonarcus. Processus lateralis (lpr) hardly visible. Gonocoxites (gx) with a large caudal extension, 0.09 mm long and 0.12 mm wide, membranous, apically with a brush of setae decreasing in length dorsally to ventrally. Processus apicalis (pap) visible for 0.02 mm, very thin, 0.007 mm wide. Enlarged hypandrium. Processus terminalis (tpr) with a well-rounded apex, covered with long setae.

Discussion: Since the beginning of this century, several works have been done on the phylogenetic position of the Coniopterygidae within the Neuroptera but there is still no consensus on the sister group relationships of this family. They could be the sister group of the Hemerobiidae after Handlirsch (1906) and Aspöck (1995), of the Osmylidae after Tillyard (1919), or of Neuroptera (except Ithonidae) after Withcombe (1925). Since no consensus phylogeny is yet adopted by all the authors, the sister group relationships of the Coniopterygidae are not accurate and a phylogenetic study of the family, including *Libanosemidalis hammanaensis*, is difficult to realise.

There has been only two attempts of phylogenetic analysis of the Coniopterygidae (Meinander, 1972, 1979). This author did not use the outgroup polarization method of the characters. He also presumed that 'the establishment of synapomorphy on the basis of recent material generally requires that the characters are unique and complex'. Actually, the establishment of the primary synapomorphic states of a character has to be based on outgroup comparison alone. Homoplasious characters are identified after the phylogenetic analysis has been done, not before (Grandcolas et al., 1994). As a result, many of the 'synapomorphies' he used are either plesiomorphic or highly homoplasious. The assumption of Meinander (1979) about phylogenetic value of the genitalia characters needs confirmation with a phylogenetic analysis of the genera, using the outgroup comparison method.

Great specialisation or modification of the genitalia of Coniopterygidae makes difficult to trace homologous organs. Also study of genitalia in fossils is complicated by the fact that internal genital structures are frequently not visible.

Libanosemidalis hammanaensis n.gen., n.sp. greatly differs from other Cretaceous coniopterygids in the presence of only two M branches. This character is found in Cenozoic and modern Coniopterygidae.

Libanosemidalis hammanaensis n.gen., n.sp. shares only one character with the Aleuropteryginae: the hindwing with vein Rs branching from R1 very near the wing base. It shares three characters with the Coniopteryginae: (1) forewing with only one R-M crossvein; (2) vein M without two long stiff setae at base; (3) no plicaturae on abdominal sternites, as in Aleuropteryginae (New, 1989). These three characters are not polarized and could be plesiomorphic. The structure of the galea is not visible in the fossil. Therefore, the present attribution to the Coniopteryginae is provisional and will need confirmation after a phylogenetic analysis of genera in the family.

Within Coniopteryginae, the separation into the tribes Coniopterygini and Conwentziini is based on gonarcus morphology. Some modern Coniopterygini have a gonarcus present but fused to the ventral part of the ninth sternite and more or less incorporated into the ectoprocts. In other Coniopterygini the gonarcus is obliterated but the styli apparently arise from the ventral part of the ectoprocts. In modern Conwentziini, the gonarcus is always obliterated and the styli (when present) arise from a sclerotized ring on the ninth segment (Meinander, 1972). *Libanosemidalis hammanaensis* n. gen., n. sp. has a well defined gonarcus. Therefore, it rather falls in the Coniopterygini, but this attribution requires confirmation after a phylogenetic study.

Nevertheless, the present discovery demonstrates that a derived, extant lineage of coniopterygids with two M branches was already present during the Lower Cretaceous, suggesting that the great antiquity of the modern lineages of the Coniopterygidae.

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