

Two new wedge-shaped beetles in Albo-Cenomanian ambers of France (Coleoptera: Ripiphoridae: Ripiphorinae)

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Abstract. *Paleoripiphorus deploegi* gen. n., sp. n. and *Macrosiagon ebboi* sp. n., described from two French Albo-Cenomanian ambers (mid Cretaceous), are the oldest definitely identified representatives of the Ripiphoridae: Ripiphorinae. They belong to or are closely related to extant genera of this coleopteran subfamily. Together with *Myodites burmiticus* Cockerell, 1917 from the Albian Burmese amber, they demonstrate that the group is distinctly older than suggested by the hitherto available fossil record. By inference after the biology of the extant Ripiphorinae, *Macrosiagon ebboi* may have been parasitic on wasps and *Paleoripiphorus deploegi* on bees, suggesting that Apoidea may have been present in the Lower Cretaceous.

INTRODUCTION

The Ripiphoridae is a small family of parasitic beetles rather poorly represented in the fossil record, mainly by species from the Eocene Baltic amber (Spahr, 1981) and the Paleogene of Florissant (Colorado, USA) (Scudder, 1890; Meyer, 2003). Only one species is recorded from the Cretaceous Burmese amber. The known fossil species were described in the 19th century or at the beginning of the 20th century and need revisions (see the list of fossil taxa in appendix below). We regard the present study of two Albo-Cenomanian specimens of great importance to estimate the age of this family.

MATERIAL AND METHODS

The specimens studied here were discovered in two distinct French ambers. The first one in the Albian amber of Archingeay/Les-Nouillers, SW France (Néraudeau et al., 2002), and the second one in the Cenomanian amber of Salignac, near Sisteron, SE France (Fig. 1). The latter is the first fossil inclusion described from this amber deposit.

The Albian amber of Archingeay is honey-coloured to clear brown and rather dusty, whereas the Cenomanian amber of Salignac is dark red-coloured. It was thus impossible to study these inclusions without preparing the specimens. First, the surrounding amber was removed in order to get as close as possible to the inclusions. This operation and the separation of the associated inclusions were carried out under a stereomicroscope using shaving blades transformed into a micro-saw. Then, each specimen was fixed on the head of a pin and mounted in Canada balsam on a rotary mechanism, which allows an easier view of all sides of the specimen during its study (Fig. 2). This new method of exam was created by Gaël de Ploëg.

FAMILY RIPIPHORIDAE

Subfamily Ripiphorinae

Genus *Paleoripiphorus* gen. n.

Type species. *Paleoripiphorus deploegi* sp. n.

Diagnosis. Very close to the modern genus *Ripiphorus*, the only visible difference being the presence of only ten antennal segments, instead of eleven (seven biflabellate antennomeres instead of eight).

Etymology. After “paleo” and the extant genus *Ripiphorus*.

Paleoripiphorus deploegi sp. n.

(Figs 3–5)

Diagnosis. That of the genus.

Description. Head partly hidden under thorax; length 0.48 mm, width 0.56 mm, not sharply constricted at neck; antennae inserted in front of eyes, 0.96 mm long, strongly flabellate, with two basal simple segments, seven biflabellate segments and one apical uniflabellate segment; antennal expansions 0.28 mm long and 0.12 mm wide; eyes very large, nearly meeting on dorsal side of head and strongly extended but not contiguous on ventral side of head; without small group of ommatidia along posterior margin of eye; mouth-parts not visible, except for the apices of labial palps.

Pronotum 0.48 mm long, 0.8 mm wide, general shape trapezoidal, lateral margins rounded, anterior angles smooth; posterior angles weakly protruding posteriorly; median crest on disk apparently absent; ventral structures of thorax poorly visible.

Legs. Procoxae 0.24 mm long, trochanter 0.16 mm long, femur 0.44 mm long, 0.12 mm wide, tibia 0.56 mm long, 0.08 mm wide, first tarsal segment 0.10 mm long,

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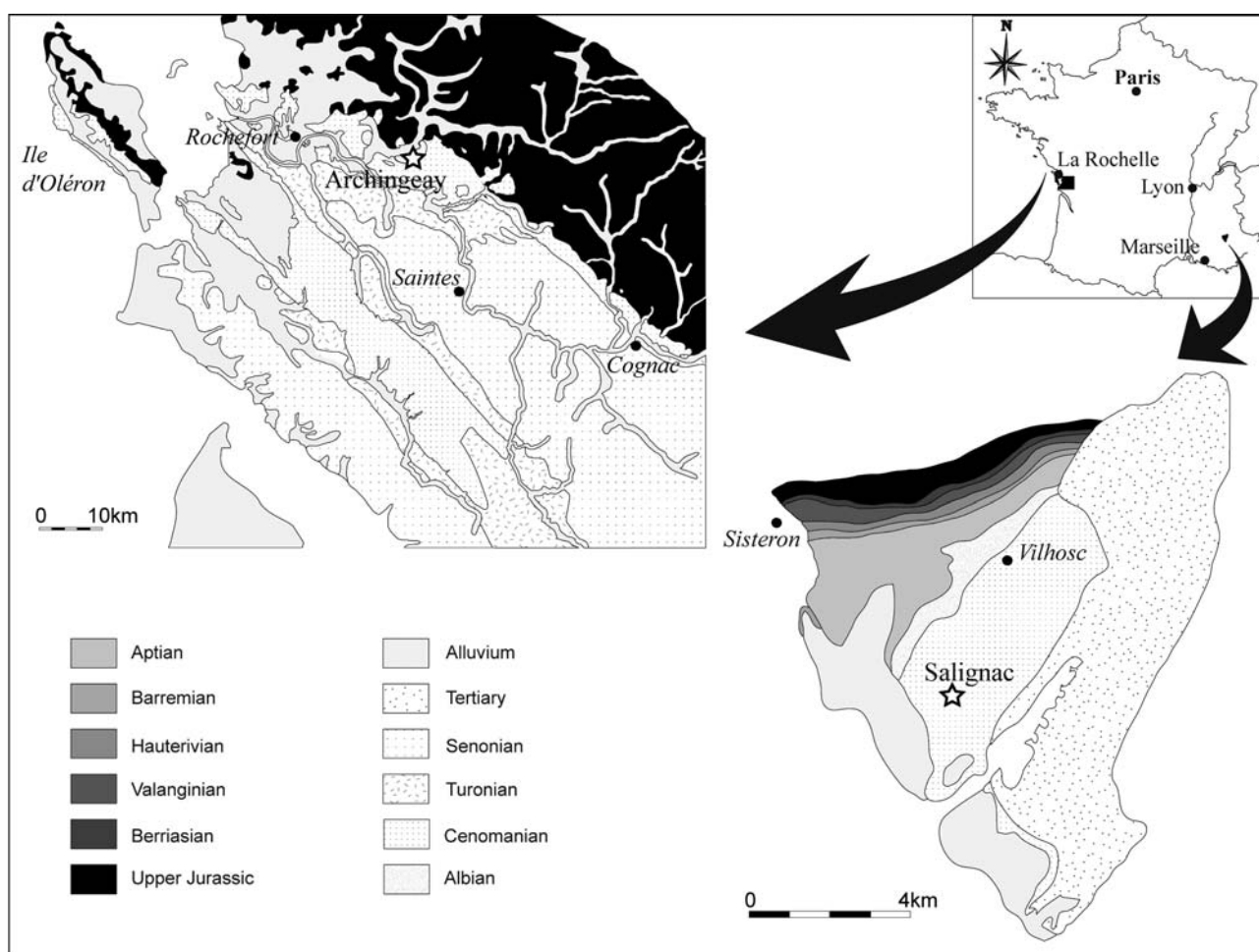


Fig. 1. Location of the studied amber localities (modified from Waterlot & Polvêche, 1958; Haug et al., 1964).

second 0.09 mm long, third 0.07 mm long, fourth 0.07 mm long, fifth 0.09 mm long; mesocoxae 0.28 mm long, 0.16 mm wide, trochanter 0.16 mm long, 0.08 mm wide, femur 0.48 mm long, 0.16 mm wide, tibia 0.6 mm long, 0.08 mm wide, first tarsal segment 0.10 mm long, second 0.07 mm long, third 0.07 mm long, fourth 0.04 mm long, fifth 0.07 mm long; metacoxae 0.28 mm long, trochanter 0.2 mm long, 0.08 mm wide, femur 0.52 mm long, 0.16 mm wide, tibia 0.68 mm long, 0.08 mm wide, first tarsal segment 0.12 mm long, second 0.06 mm long, third 0.06 mm long, fourth 0.09 mm long; tarsal claws serrate but without lobiform appendages; tarsal formula 5-5-4; tarsal segments all similar, simple; tibial spurs very small and simple.

Elytra very short, 0.72 mm long, 0.24 mm wide; well separated, punctured, with rounded apex just reaching base of abdomen.

Hind wing 1.6 mm long, about 0.6 mm wide, wing venation reduced, with no closed cell, only veins R1, M, and two posterior veins (maybe Cu1 and Cu2) visible as more or less straight simple veins; anal area more or less sclerotized; vein M only sclerotized in its median part but not basally.

Abdomen 1.28 mm long, 0.76 mm wide, elongate, with eight segments and apex of ninth segment visible; apical

parts of genital appendages partly visible but useless for description.

Holotype. Specimen ARC 254.6, in the same piece of amber with one Ceratopogonidae (Diptera), two small hymenopterans, one larva of Blattodea, the leg of another blattodean, one beetle, and two mites. Deposited in the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris, France.

Type locality. Archingeay/Les Nouillers, Charente-Maritime, SW France.

Horizon and age. Lower Cretaceous, Uppermost Albian (Néraudeau et al., 2002).

Etymology. Dedicated to our friend and colleague Mr. Gaël de Ploëg, who found and prepared the studied specimen.

Remarks. *Paleoripiphorus* gen. n. can be attributed to the Ripiphoridae on the basis of the following characters: tarsal formula 5-5-4, tarsal claws serrate, tibial spur simple, elytra partly reduced, antenna strongly biflabellate (Crowson, 1967). The classification of the family is based on rather old works of Linsley et al. (1952), Besuchet (1956), and Selander (1957). *Paleoripiphorus* gen. n. shares with the Ripiphorinae: Ripiphorini the following currently used tribal characters: antennae inserted immediately above the eyes, and strongly biflabellate, with only the two basal segments of antenna simple; eyes entire and oval; elytra well separated and very small; hindwing venation reduced, represented by thickened

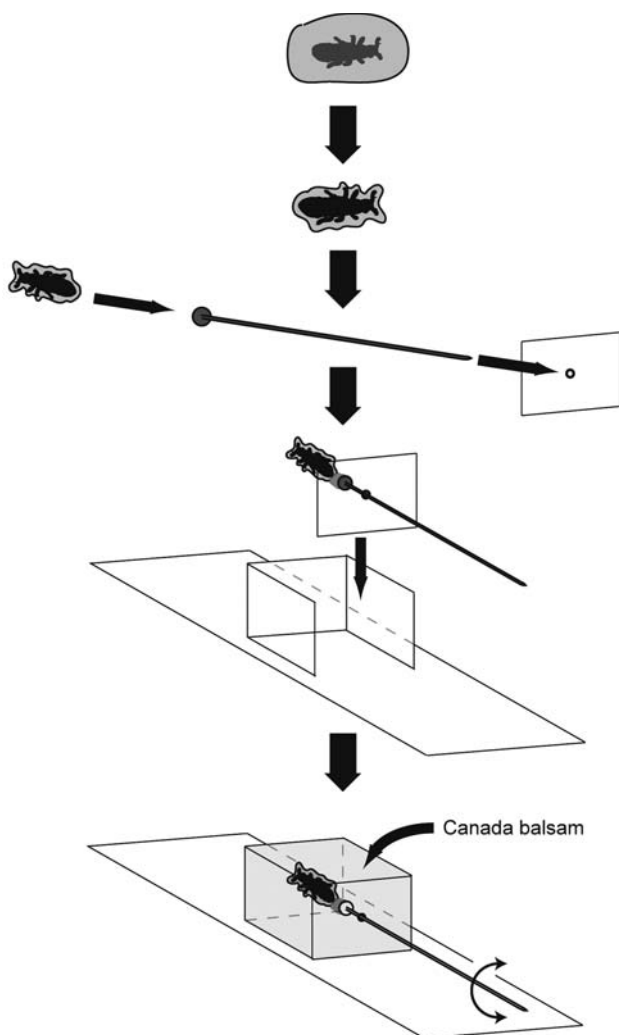


Fig. 2. Preparation of inclusions in amber for study.

streaks, with only veins R, M and Cu still present and no cells in hind wing. Although no phylogenetic analysis of the family is available, some features such as the biflabellate antennae, the very reduced hindwing venation and the very short elytra, can be considered as synapomorphies with other Ripiphorini. Therefore, they strongly support the placement of *Paleoripiphorus* gen. n. in this tribe.

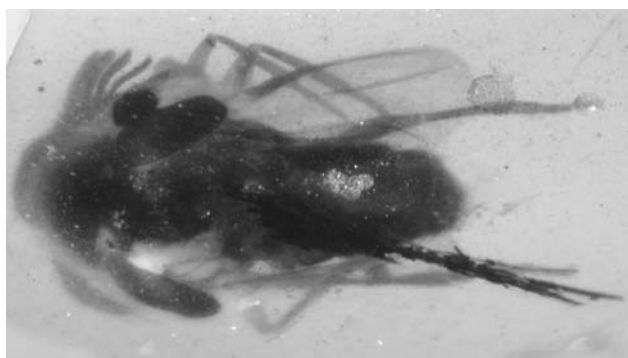


Fig. 3. *Paleoripiphorus deploegi* gen. n., sp. n., holotype ARC 254.6, photograph of dorsal view.

Paleoripiphorus gen. n. differs from *Ripiphorus* Bosc, 1792, unique extant Ripiphorini, in the following character: antenna with only seven biflabellate segments, instead of eight biflabellate segments in male *Ripiphorus*, or ten uniflabellate or simple segments in female *Ripiphorus* (Rivnay, 1929).

Modern *Ripiphorus* spp. appear to be strictly parasitic on bees (Selander, 1957; Lawrence & Britton, 1991; Falin et al., 2000). By inference it appears plausible to assume that *Paleoripiphorus* gen. n. was probably parasitic on "ancestral" bees. The oldest known bee appears later during the Turonian, but it belongs to a very advanced lineage in the bee family Apidae (Engel, 2000). Thus the present discovery of *Paleoripiphorus* gen. n. in the French Lower Cretaceous amber supports the hypothesis of the presence of the Apoidea during the Albian. Furthermore the presence of the very advanced subfamily Ripiphorinae in the Albian supports the hypothesis of appearance of the Ripiphoridae during the Lower Cretaceous or the Upper Jurassic.

Genus *Macrosiagon* Hentz, 1830

Macrosiagon ebboi sp. n.

(Fig. 6)

Diagnosis. Body black, about 5 mm long; posterior angles of pronotum sharp and strongly protruding posteriorly; elytra long, covering three quarters of the abdomen; legs long and slender; one tibial spur on protibia and two long spurs on meso- and metatibiae.

Description. Body black; head almost completely destroyed and useless for description; mouth parts, eyes, frons and insertion of antennae not visible; only one antenna almost completely preserved, 1.7 mm long, strongly flabellate, with two basal simple segments, eight biflabellate segments and one apical uniflabellate segment; antennal expansions 0.79 mm long and 0.057 mm wide.

Pronotum 1.7 mm long, 1.3 mm wide. General shape trapezoidal, lateral margins rounded, anterior angles smooth; posterior angles sharp and strongly protruding posteriorly, 0.4 mm long; apparently without median crest on disk; ventral structures of thorax poorly visible.

Legs. Protibia about 0.85 mm long, first tarsal segment 0.51 mm long, second 0.22 mm, third to fifth 0.17 mm long; mesotibia about 1.13 mm long, first tarsal segment



Fig. 4. *Paleoripiphorus deploegi* gen. n., sp. n., holotype ARC 254.6, photograph of ventral view.

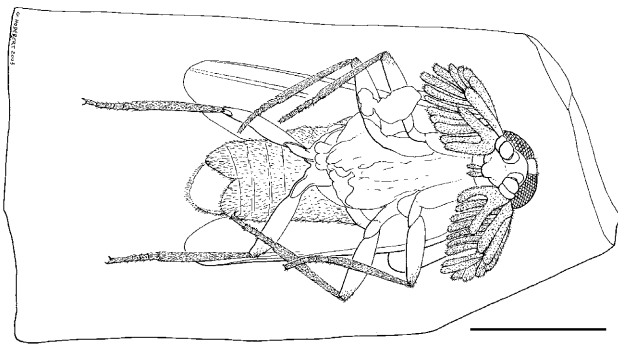


Fig. 5. *Paleoripiphorus deploegi* gen. n., sp. n., holotype ARC 254.6, ventral view, scale bar represents 1 mm.

0.51 mm long, second 0.22 mm long, third 0.17 mm long, fourth 0.17 mm long, fifth 0.17 mm long; metafemur 1.98 mm long, 0.56 mm wide, tibia 2.15 mm long, 0.11 mm wide, first tarsal segment 1.076 mm long, second 0.68 mm long, third 0.56 mm long, fourth 0.45 mm long; tarsal claws long, serrate, without lobiform appendages; tarsal formula 5-5-4; tarsal segments simple; two short spurs at apex of all tarsal segments; protibia with one spur; meso- and metatibia with two very long and simple spurs, mesotibial spurs 0.22 mm long, metatibial spurs 0.34 mm long.

Only one elytra preserved, covering three quarters of the abdomen, 3.85 mm long, 0.9 mm wide; strongly acuminate and probably dehiscent, punctured.

Hindwing 3.96 mm long, partly covered by the elytra, but wing venation apparently very reduced without closed cell, only veins R1 and M visible as more or less straight simple veins.

Abdomen 4.25 mm long, elongate, eight segments and apex of ninth segment visible.

Holotype. Specimen Sis 2.1, deposited in the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris, France.

Type locality. Salignac, near Sisteron, Alpes-de-Haute-Provence, France.

Horizon and age. The amber was discovered in a marine deposit of blue marls. Although the precise dating remains uncertain, it is assumed of Cenomanian age after the geological map of the area (Haug et al., 1964) (Fig. 1).

Etymology. Dedicated to Mr. Luc Ebbo, who discovered the outcrop of Salignac and gave us the piece of amber with the insect.

Remarks. *Macrosiagon ebboi* sp. n. can be classified in the Ripiphoridae: Ripiphorinae on the basis of the following characters: tarsal formula 5-5-4; tarsal claws serrate; tibial spur simple; antenna strongly bilabellate, with only the two basal segments simple; hindwing venation reduced. The elytra well developed and clearly acuminate, the long tibial spurs and the sharp posterior angles of the pronotum are characters of the Macrosiagonini. The two extant genera of this tribe, *Macrosiagon* Hentz, 1830 and *Metoecus* Gerstaecker, 1855 can be distinguished on the basis of the shape of their occiput (Gressitt, 1941), which is destroyed in *M. ebboi* sp. n., but also on the basis of the presence of a tibial spur on protibiae and two long spurs on meso- and metatibiae in



Fig. 6. *Macrosiagon ebboi* sp. n., holotype Sis 2.1, photograph of lateral view.

Macrosiagon and *M. ebboi* sp. n., unlike *Metoecus*. Thus we provisionally attribute the present specimen to the genus *Macrosiagon*, because there is no known argument to separate them.

Modern Ripiphorinae: Macrosiagonini live on wasps but also on bees (Selander, 1957; Lawrence & Britton, 1991; Falin et al., 2000). By inference it appears plausible to assume that *Macrosiagon ebboi* sp. n. was probably parasitic on wasps or bees.

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APPENDIX - Commented list of fossil beetles attributed to the family Ripiphoridae

Subfamily Pelecotominae:

Pelecotoma sp., Upper Eocene Baltic amber. Undescribed fossil, first citation in Klebs (1910). Spahr (1981) listed previous citations.

Subfamily Ripidiinae:

Ripidius megalophus Dalman, 1826. Upper Eocene Baltic amber. Original description in Dalman (1826). Spahr (1981) listed other citations.

Ripidius primordialis Stein, 1877. Upper Eocene Baltic amber. Original description in Stein (1877). Spahr (1981) listed other citations. Hieke & Pietrzeniuk (1984) also listed three specimens attributed to this species.

Ripidius pyrrholophus Dalman, 1826. Upper Eocene Baltic amber. Original description in Dalman (1826). Spahr (1981) listed other citations.

Pauroripidius groehni Kaupp & Nagel, 2001. Upper Eocene Baltic amber.

Subfamily Ripiphorinae:

Ripiphorus burmiticus (Cockerell, 1917) comb. n. in Albian Burmese amber (new datation by Cruickshank & Ko, 2003). Originally described by Cockerell (1917) in the genus *Myodites* Latreille, 1819, junior synonym of *Ripiphorus*, listed in Spahr (1981), Ross & York (2000) and Rasnitsyn & Ross (2000). This fossil would need a revision. Cockerell (1917: 22) indicated that it has “five or six long processes” on its “flabellate antennae”. After the photograph given by Ross & York (2000: Fig. 12), it seems to have bilabellate antennae but a direct exam of the type specimen would be necessary to establish its exact relationships and generic attribution. It differs from *Paleoripiphorus deploegi* at least in its hind wing vein M basally sclerotized.

Ripiphorus sp. Upper Eocene Baltic amber. Undescribed fossil, Spahr (1981) listed previous citations.

Macrosiagon geikei (Scudder, 1890). Upper Eocene to Lower Oligocene, Florissant beds, Colorado, USA. Original description in Scudder (1890) and citation in Scudder (1900) in the genus *Ripiphorus*, but named *Macrosiagon geikei* by Wickham (1920). This fossil clearly needs a revision.

Kulicka & Slipinski (1996) also listed several undescribed specimens of wedge-shaped beetles in various Baltic amber collections.

Swanson & Lewis (1993) listed the presence of the family Ripiphoridae in the Eocene Green River Formation (USA) after Scudder but without further precision of date.

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