A new paper wasp from Late Eocene of France
(Hymenoptera: Vespidae: Polistinae)

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Abstract

The new vespid genus and species Palaeopolistes jattioti gen. et. sp. nov. is described from the Late Eocene of Monteils (Gard, France). The new taxon has clear features of the Polistinae but its tribal assignment is uncertain.

Key words: Vespidae, Polistinae, Late Eocene, gen. nov., sp. nov.

Introduction

The Polistinae is the most diverse subfamily of social wasps with more than 950 extant species described from 26 recognised genera (Pickett & Carpenter 2010). These wasps are the subject of numerous studies on the evolution of social behaviour as they exhibit different forms of social organization (Noll et al. 2004; Noll & Wenzel 2008).

However, this group is poorly represented in the fossil record with only nine described fossil species.

The oldest known Polistinae is Polistes vergnei Piton, 1940, described from the Menat formation in France (Paleocene). Unfortunately, the holotype of this species is lost, probably during the Second World War. Five other described fossils have been associated with Polistes Latreille, 1802 of the cosmopolitan tribe Polistini, viz. P. attavinus (Heer, 1849) (Early Miocene, Parschlug, Austria, see Bequaert 1930), P. industrius Théobald, 1937 (Middle Oligocene, Céreste, France), P. signatus Statz, 1936 (Late Oligocene, Rott, Germany), P. kirbyanus Cockerell, 1915 and P. primitiva Heer, 1865 (Late Miocene, Öhningen, Germany), the last one being a nomen nudum. Of the three remaining fossils, two from the Late Eocene—Early Oligocene of Isle of Wight (UK) were described as Polybia Lepeletier (P. anglica Cockerell, 1921a and P. oblita Cockerell, 1921b), a genus comprising swarming wasps of the tribe Epiponini with modern species restricted to the New World. These last identifications were disputed by Carpenter & Grimaldi (1997) and are under revision (Antropov, pers. com.). The last described fossils of Polistinae were specimens of a swarming wasp of the New World tribe of Epiponini, Agelaia electra Carpenter & Grimaldi, 1997, described from the Miocene Dominican amber. Finally, Kotthoff (2005) figured and briefly described three unnamed Polistinae gen. et sp. indet. from the Early Miocene of Randeck Maar (Germany).

Recently, two new fossils of Polistinae wasps were found in the lacustrine limestone of the Late Eocene Monteils formation in the south of France. As these fossils presented similar wing venation, dimensions, and coloration pattern, and as they were found in the same outcrops and layers, we considered them as belonging to the same species.

Material and methods

The two fossils were found at the Monteils formation in the south of France (44°05’9”N, 04°11’39”E). The first fossil is an almost complete print and counterprint of a specimen in lateral position with ventral part of the head,
tarsi, fore legs and metasomal sterna only partly visible (Fig. 1A-B). The second fossil is a print and counterprint of a specimen in dorsal view, one wing folded, the head partially hidden by the thorax, legs non visible except for the right hind femora and metasomal segments 2 to 6 only partially visible (Fig. 1C-D).

The formation is dated from the Late Eocene (BRGM geological map 1/50 000, number 912). We follow here the wing venation nomenclature of Vespidae as described in Carpenter (1982), with abbreviations: A anal vein; C costal vein; Cu cubital vein; M median vein; R radial vein; R₁ first radial; Rₛ radial sector; Sc subcostal vein; 1cu-a crossvein between M and Cu₁; 2r-m and 3r-m crossveins between Rₛ and M; 1m-cu and 2m-cu crossveins between M and Cu₁; r₂ crossvein between Rₛ and R₁.

**Vespidae Latreille, 1802**

**Polistinae Lepeletier, 1836**

**Genus Palaeopolistes Perrard, gen. nov.**

**Etymology.** Named after palaeus, old, and genus Polistes. Gender masculine.

**Type species.** *Palaeopolistes jattioti* Perrard, sp. nov. by monotypy.

**Diagnosis:** First metasomal segment elongated and flasklike, with a maximal width at half of width of second segment; occipital carina, pronotal carina, scrobal sulcus present; marginal cell pointed; prestigma length less than 1/3 of pterostigma length; vein r₂ joining pterostigma around its middle; length of cross-section of vein M between Rₛ and 1m-cu shorter than between 1m-cu and 2m-cu; vein 1cu-a not strongly postfurcal, i.e. 1cu-a longer than ¼ of section of Cu₁ between M and 1cu-a; transversal segment of Cu₁ more than twice as long as Cu₁ₛ.

**Palaeopolistes jattioti** Perrard, sp. nov. (Figs. 1, 2)

**Material examined.** Holotype, MNHN.F.A50409 (Nel leg.), paratype, MNHN.F.A50410 (Jattiot R. leg.), deposited in the laboratory of Palaeontology, MNHN, Paris.

**Etymology.** Named after Romain Jattiot who discovered the paratype and gave it to us for study.

**Diagnosis.** As for the genus.

**Description. Female/worker:** Head dark with light marks on frons and behind eyes. Pronotum dorsally dark, light ventrally. Mesonotum dark with two longitudinal light lines. Mesepisternum with dark and light marks. Scutellum and metanotum dark. Propodeum dark with two extensive lateral light marks. First metasomal segment elongated, enlarged in its posterior half, dark with two light marks. Second metasomal tergum light with an anterior and a middle dark bands joining laterally. Terga two to six light with anterior dark bands.

Approximate total length 8.41mm (head + mesonotum + metasomal segments 1 and 2). Measurements (in mm)

- Holotype; Figs 1A-B, 2, 3: head length 0.69; mesosoma length 3.13; 1st metasomal tergum length 2.27; 2nd metasomal tergum length 2.32; midfemora length 1.24; hind femora length 1.64; hind tibia length 1.56; fore wing length* 6.8; prestigma length 0.13; pterostigma length* 0.82; marginal cell 1.96; 1st median cell maximum length* 3.27. Lengths of fore wing veins: Rₛ+M* 1.33; Cu₁a* 1.53; 1m-cu* 1.03; 2m-cu 0.69; 2rm 0.42; 3rm 0.50; r₂ 0.46; hind wing length 4.2; lengths of hind wing veins: section of Rₛ between R+Sc and r-m 0.74; section of M between cu-a and r-m 1.44 (“*” are measurements encompassing a small fracture in the fossil).

- Paratype; Figs 1C-D, 3: mesosoma length 2.82; 1st metasomal tergum length 2.21; 1st metasomal tergum maximum width 0.83; 2nd metasomal tergum maximum width 2.37; midfemora length 1.24; fore wing length 6.63; prestigma length 0.12; pterostigma length 0.75; marginal cell length 1.93; 1st median cell maximum length 3.11. Length of fore wing veins: Rₛ+M 1.22; Cu₁a 1.43; 1m-cu 0.96; 2m-cu 0.66; 2rm 0.36; 3rm 0.49; r₂ 0.39.

**Male, larvae and nests:** unknown for this species.
Discussion

The two fossils studied can be attributed to the Vespidae because of the emarginated eyes, and longitudinally folded wings. The pointed marginal cell, absence of a parategula and the elongated shape of the first metasomal segment indicate that they can be attributed to the Polistinae (Carpenter 1982).

The identification keys of extant taxa allow the discrimination of these fossils from most of the genera (Snelling 1981; Carpenter & Nguyen 2003; Carpenter 1982, 2004). The first metasomal segment is elongated (excluding the Polistini: Polistes) but flasklike shaped (excluding the Mischocytarini: Mischocytarus de Saussure). More precisely, the occipital carina is clearly visible in our fossils (excluding Nectarinella Bequaert, Chartergellus Bequaert and Pseudopolybia de Saussure). The pronotal carina is present (excluding Polybioides du Buysson), and there is a lateral fovea on the pronotum (excluding Brachygastra Perty, Chartergus Lepeletier, Clypearia Ducke, Synoea de Saussure, Epipona Latreille, Metapolybia Ducke, and Asteloeca Raw). The interocellar distance is short (excluding Protonectarina Ducke), and the ocelli are not enlarged (excluding Apoica Lepeletier). The pterostigma is distinctly longer than the prestigma (excluding Parachartergus R. von Ihering).
The mesepisternum has a transverse scrobal sulcus (excluding *Leipomeles* Möbius, *Belonogaster* de Saussure, *Protopolybia* Ducke, *Charterginus* Fox, *Protonectarina* Ducke, *Polybia* Lepeletier, and *Ropalidia* Guérin-Méneville). However, as the clypeus is barely visible and the postero-lamellae of the mesoscutum may not have been fossilised, the fossil cannot be distinguished from three genera on the basis of published morphological characters, i.e. the two Epiponini *Agelaia* Lepeletier and *Angiopolybia* Araujo, and the Ropalidiini *Parapolybia* de Saussure. Nevertheless, the venation pattern of our fossils does not match with known patterns of wing venation in extant species of these three genera (Fig. 3): the segment of the apical part of the median vein (*M*) between crossveins 1m-cu and 2m-cu is longer than the segment of *M* between 1m-cu and vein *R*_s and the cu-a vein is not strongly postfurcal (excluding *Angiopolybia*). The vein *Cu*₁₉ is twice as short as the transversal segment of vein *Cu*, (excluding *Agelaia*). Finally, the r2 vein is inserted in the middle of the pterostigma rather than towards the apex, with a pterostigma distinctly rounded and not elongated (excluding *Parapolybia*).

**FIGURE 2.** *Palaeopolistes jattioti* sp. nov., holotype. Drawing of the counterprint. For more clarity, only one pair of wings was represented. Scale bar 1 mm.
FIGURE 3. Wing venation patterns of Agelaia myrmecophilta (Duke), Parapolybia varia (Fabricius), Angiopolybia paraensis (Spinosa) and of the two specimens of Palaeopolistes jattioti sp. nov.. Venation nomenclature is explained in the text.

Furthermore, these fossils cannot be attributed to any described fossils: Polistes vergnei, P. industrius, P. signatus, P. kirbyanus, and the three Polistinae described by Kotthoff (2005) have a very different metasoma. Polistes attavim, described on the basis of a folded wing, present a different venation pattern, especially around the marginal cell, and is from late Miocene, it is therefore unlikely that it belongs to the same species as our fossils from the late Eocene. The species of Agelaia found in Dominican amber is also from a later time (Miocene) and is of greater size. On another hand, the two “Polybia” species described by Cockerell on the basis of their wings are also from late Eocene and from a formation relatively close to the Monteils formation. While these fossils may have been from contemporary species, their venation differs greatly: Polybia anglica has a much longer prestigma and a pterostigma of a different shape, and both Polybia anglica, and P. oblita have a longer Cu₁b than Palaeopolistes jattioti.

We thus attribute our fossils to a new extinct genus of Polistinae, Palaeopolistes. Morphological features clearly exclude its belonging to the Holartic tribe Polistini or the New-world tribe Mischocyttarini. Its morphology is more similar to Parapolybia of the Old World Ropalidiini or to the genera Agelaia and Angiopolybia of the New World Epiponini all intertropical species. Many other intertropical species were collected from South of France late Eocene (Théobald 1937), supporting the association of our fossil with intertropical species. Extant Ropalidiini are distributed across the Old World and some species lives in temperate areas in Asia and in Southern Africa, while Epiponini are restricted to Neotropical areas. On the ground of present-day distribution, it would be thus more likely that the fossils belonged to the lineage of the Ropalidiini tribes, even if this tribe is now absent from Europa.
However, even if there is no evidence that Epiponini wasps were once distributed outside from the Neotropical area on the basis of its extant distribution (Carpenter 1993), we cannot exclude that an Eocene fossil from Europe could be closely related to this tribe. Other fossils from Europe Eocene were previously related to Neotropical groups. For example, the Bolcathoridae known from the Eocene of Monte Bolca (Italy) and the late Eocene—early Oligocene of Isle of Wight have the Neotropical family Polythoridae for closest relatives (Gentilini 2002). The position of Palaeopolistes jattioti is thus unresolved in the subfamily because Ropalidiini may be the sister group of all other Polistinae: Mischocyttarini + (Epiponini + Polistini) (Pickett & Carpenter, 2010). Further analyses with methods such as geometric morphometrics (de Meulemeester et al. 2012, Wappler et al. 2012) may help produce morphological evidence for the attribution of this fossil to Ropalidiini or Epiponini tribes.

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