
A new fossil ichneumon wasp from the Lowermost Eocene amber of Paris Basin (France), with a checklist of fossil Ichneumonoidea s.l. (Insecta: Hymenoptera: Ichneumonidae: Metopiinae)

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ABSTRACT

We describe a new fossil genus and species *Palaeometopius eocenicus* of Ichneumonidae Metopiinae (Insecta: Hymenoptera), from the Lowermost Eocene amber of the Paris Basin. A list of the described fossil Ichneumonidae is proposed.

KEYWORDS | Insecta. Hymenoptera. Ichneumonidae. n. gen., n. sp. Eocene amber. France. List of fossil species.

INTRODUCTION

Fossil ichneumonid wasps are not rare. Brues (1910a) listed 12 genera in the Baltic amber and 34 genera in the Oligocene Florissant shales (U.S.A.). Statz (1938) listed 124 species of fossil Ichneumonidae from eight lacustrine outcrops ranging between the Eocene and the Miocene, and only 15 species from the Upper Eocene Baltic amber. Currently, circa 190 species have been described (see appendix). Fossil taxa from lacustrine outcrops are mainly based on wing venational characters. Nearly all of them would need a revision. The oldest representatives of the family are supposed to be Upper Jurassic - Lower Cretaceous, but their exact affinities remain rather uncertain. The first representatives of the modern subfamilies are Upper Cretaceous. Gokhman (1988, 1990) supposed that 'the earliest Ichneumoninae were described from Lower Oligocene', but such an assumption would need a confirmation, after the revision of the described species.

Nevertheless, the present fossil record suggests that the family was already very diverse during the Eocene and Oligocene.

We describe the first fossil representative of the subfamily Metopiinae, discovered in the Lowermost Eocene amber of the Paris basin. The present discovery supports the hypothesis of a high diversity of the Ichneumonidae during the Paleogene. We follow the standard conventions for wing veins proposed by Mason (1986) and the wing venational terminology of Goulet and Huber (1993).

SYSTEMATIC PALAEONTOLOGY

Order: Hymenoptera LINNAEUS, 1758
Family: Ichneumonidae LATREILLE, 1802
Subfamily: Metopiinae FÖRSTER, 1869

GENUS *Palaeometopius* n. gen.

Type species: Palaeometopius eocenicus, by monotypy.

Diagnosis: This genus shares the main diagnostic characters of the Metopiinae, as defined by Townes (1971). Its closest relative among recent genera appears to be *Pseudometopius* DAVIS 1897. It differs from the recent genera of this subfamily as follows: ovipositor projecting beyond tip of abdomen; absence of median longitudinal carinae on second metasomal tergite, spiracle of first metasomal tergite in its middle, not in its basal part; supraclypeal area process shorter, not ending into a lamella.

Etymology: After Palaeo and the recent genus *Metopius* PANZER 1806.

Palaeometopius eocenicus n. sp.

Figures 1 and 2

Material: Female holotype specimen PA 2439, mounted in Canada balsam, in collection De Ploëg and Individision Langlois-Meurine, deposited in Muséum National d'Histoire Naturelle, Paris. Specimens collected in Le Quesnoy all bear the letter PA for Paris (meaning Paris Basin), the following number is the ordinal number in the collection.

Locality deposit: Le Quesnoy, Chevrière, region of Creil, Oise department, France.

Geological age: Lowermost Eocene, Sparnacian, level MP7 of the mammal fauna of Dormaal. We have demonstrated that the amber is autochthonous and very different from the Baltic amber in age, chemical composition and origin (Nel et al., 1999).

Diagnosis: That of the genus.

Etymology: After the Eocene age of the amber.

Description: Body about 5.4 mm long; forewing 4.8 mm long, 2.0 mm wide; thorax + propodeum about 1.6 mm long; metasoma 3.5 mm long.

Head: mouthpart not cyclostome (labrum not exposed and lower part of clypeus not recessed) (Quicke et al., 1999); multiporous plate sensilla of antenna not entire, occupying less than 0.5 length of flagellomere; scapus in dorsal view broad, more or less ovoid, only slightly longer than wide; 5 maxillary palpomeres visible; no teeth on apical margin of clypeus; apex of both antennae broken but 11 antennal flagellomeres visible; clypeus not

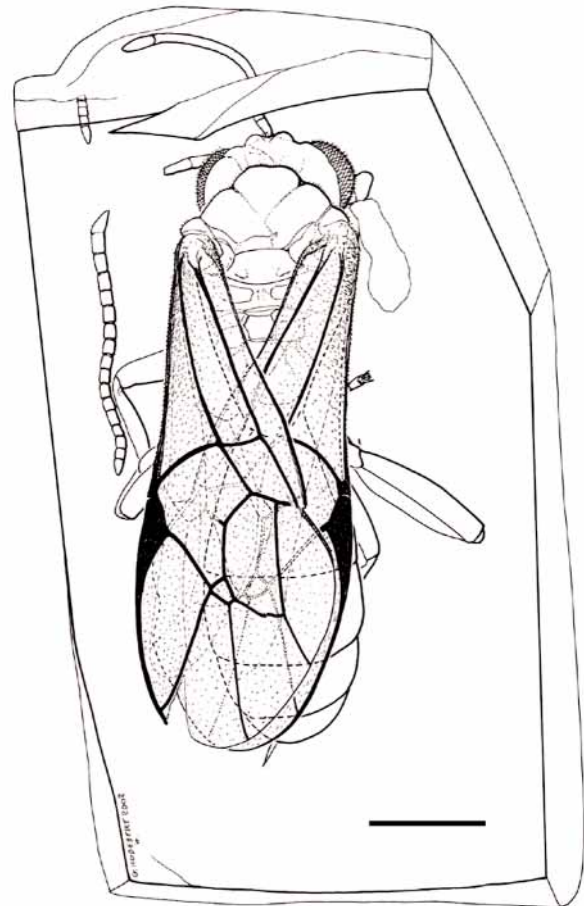


FIGURE 1 | *Palaeometopius eocenicus* n. gen., n. sp., female holotype specimen PA 2439, dorsal reconstruction. Scale : 1 mm.

separated from supraclypeal area by distinct groove; clypeus and supraclypeal area convex; eye without setae; dorsal margin of supraclypeal area with a small triangular process extending between toruli; mandible strong, not twisted apically, with 2 teeth; ocelli of moderate size, not enlarged.

Mesosoma + propodeum. Apex of scutellum without median spine; propodeum with transverse carinae, delimiting cell-like surfaces; pronotum smooth dorsally, without bifurcate or bilobate process; notaulus represented with a wide shallow furrow; scutellum large, transverse.

Legs. Metatarsal claws less than half as long as tarsomere 5; all tarsal claws without basal lobe, but basally conspicuously pectinate; all tibiae with 2 apical spurs.

Forewing of normal size; vein 1/Rs+M absent (= vein 1-SR+M *sensu* Quicke et al., 1999); vein R and parastigma contiguous, not separate; veins C+Sc and R merged, with a distinct groove between them visible in dorsal pro-

file; vein 1a' absent; vein 2a' absent; vein 2m-cu present, with 2 bullae; vein 1m-cu with one bulla; vein 1cu-a very slightly distal of vein M; vein 3r-m absent; vein 2-Rs apical of apex of pterostigma; areolet closed, small pentagonal, not rhombic.

Hind wing of normal size; vein r-m with a bulla and far distal to junction of Sc+R with costal margin; vein 2-Cu present and confluent with cu-a; distal spur of vein C joining Sc+R near the distal hamuli present; vein Sc+R separating from C very close to wing base; secondary hamuli hook-shaped.

Metasoma depressed; terga 2 and 3 separated; sterna 2-4 flat or slightly depressed; ovipositor straight, not curved downward, without teeth; ovipositor projecting beyond tip of metasoma; ovipositor sheath visible, short and curved; ovipositor short, uniform in diameter, without teeth; hypopigium small, not triangular in lateral view; spiracle of tergite 1 at middle and near center, segment 1 in dorsal view not strongly constricted in its anterior part; no lateral longitudinal carina on tergite 1; sternum 1 short, not extending to spiracle; no visible median longitudinal carina on tergites (but metasoma partly hidden by wings); segments 5 and 6 not wider than preceding segments; apex of segment 6 not rounded.

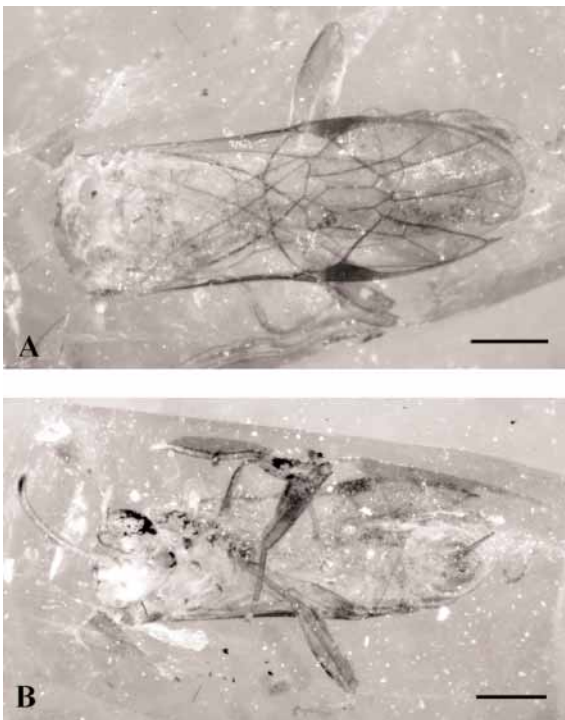


FIGURE 2 | *Palaeometopius eocenicus* n. gen., n. sp., female holotype specimen PA 2439. A) Photograph of dorsal view. B) Photograph of ventral view. Scale : 1 mm.

Discussion: The monophyly of the Ichneumonidae is controversial (Sharkey and Wahl, 1992; Quicke et al., 1999). Furthermore, the internal classification of the family is still far from being stable (Gauld and Wahl, 2000). After Sharkey and Wahl (1992), *Palaeometopius* n. gen. has the two synapomorphies of the Ichneumonidae, i.e. 'forewing: vein 1Rs + M present' and 'forewing vein 2-Rs apical of apex of pterostigma'. Quicke et al. (1999) criticized Sharkey and Wahl (1992). They considered that the character state 'forewing: vein 1Rs+M present' is plesiomorphic. But, as all these authors used (different) hypothetical ancestors instead of taxa as outgroups, the problem remains open. After Quicke et al. (1999), *Palaeometopius* n. gen. has the basal synapomorphy of the (Eoichneumonidae + Ichneumonidae + Braconidae), i.e. 'the forewing veins C+Sc and R merged, with a distinct groove between them visible in dorsal profile'. Furthermore, *Palaeometopius* n. gen. has none of the synapomorphies of the Cretaceous family Eoichneumonidae Jell and Duncan, 1986, or of the Paxylommatidae, Xoridinae, and the fossil genus *Tanychora* TOWNES 1973. In parallel, Gauld and Wahl (2000) reanalysed the basal division of the Ichneumonidae proposed by Kasparyan (1993, 1996) and subdivided the family into two clades, i.e. the [Townesioninae & Adelognathinae & (Tryphoninae + Eucerotinae) & 'Ctenopelmatine complex'], and the 'other Ichneumonidae'. Their characters are not very useful for the present study. Belshaw and Quicke (2001) proposed a new phylogeny of the Ichneumonidae, based on molecular characters we cannot use herein.

Townes (1969a, b, 1970, 1971) divided the Ichneumonidae into 25 subfamilies, but Gauld (1995) considered that there are 36 subfamilies. Goulet and Huber (1993) proposed a key for 35 Holarctic and Neotropical subfamilies. We follow it to determine the possible subfamily position of *Palaeometopius* n. gen. It falls into the Metopiinae after: absence of spine at apex of scutellum; metatarsal claws short; female tarsal claws without basal lobe; ovipositor sheath curved, visible and without teeth; areolet close and not rhombic; propodeum with transverse carinae; pronotum smooth medio-dorsally; labrum not visible; clypeus not separated from supraclypeal area by a groove, clypeus plus supraclypeal area convex; apical margin of clypeus without teeth; metasomal segment with spiracle at middle; metasomal sternum short; mesotibia with 2 apical spurs; eye bare; scapus broad and short; dorsal margin of supraclypeal area produced into a triangular process. If we follow the key of Central America subfamilies proposed by Gauld (1995), it also falls into the Metopiinae.

Nevertheless, *Palaeometopius* n. gen. differs from the recent genera of Metopiinae in its ovipositor projecting beyond tip of metasoma (Townes, 1971). After Townes' (1971) key of metopiine genera, *Palaeometopius* n. gen.

falls near *Pseudometopius*, because of the following characters: mesothoracic tibia with 2 spurs; supraclypeal area convex; tarsal claws conspicuously pectinate; areolet present; fifth and sixth metasomal segments not wider than preceding segments; metasoma parallel-sided. Nevertheless, *Palaeometopius* n. gen. differs from *Pseudometopius* in: absence of median longitudinal carinae on second metasomal tergite, spiracle of first tergite in its middle, not in its basal part, and in supraclypeal area process shorter, not ending into a lamella.

Comparison with fossil subfamilies

Townesitinae Kasparyan, 1994 (Upper Eocene Baltic amber): members of this group are characterized by their elongate scapus, among other characters. *Palaeometopius* n. gen. can be excluded from this group after this character and after the presence of a well-defined areola.

Pherombinae Kasparyan, 1988 (Upper Eocene Baltic amber): members of this group have very large quadrilateral areola and an elongate first metasomal segment, unlike *Palaeometopius* n. gen. (Kasparyan, 1988a).

The Metopiinae have a worldwide distribution (Goulet and Huber, 1993). *Pseudometopius* is known from Eastern North America and Japan, but the potential similarities between *Palaeometopius* n. gen. and this genus may not reflect any close phylogenetic relationships. Biogeographic inferences shall become possible only after the achievement of a phylogenetic analysis of the subfamily.

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Appendix: List of fossil Ichneumonoidea s.l.

Wahl, 2001 (internet site: http://iris.biosci.ohio-state.edu/catalogs/ichneumonids/master_list2.html) proposed a list of the fossil genera of Ichneumonidae, but not a list of the fossil species. Many of the described fossil species would need a revision and numerous fossil Ichneumonidae await a description.

Pleistocene

The ichneumonid wasps are rather frequent in the Pliocene-Pleistocene outcrops. They correspond to modern genera and species.

Pliocene

- Willershausen (Germany): *Ichneumoninites sulfatorius* STEINBACH and SCHMIDT 1967, *Pimplites praeparatus* STEINBACH and SCHMIDT 1967.

Upper Miocene

- Bellver, Cerdanya, Spain: *Pygmaeolus* cf. *nitidus* (BRIDGMAN 1889) (Arillo and Bremond, 1992).
- Gabbro, Toscana, Italy (Messinian): ‘*Cryptinae bosniakii*’ (Handlirsch, 1906-08; Ponomarenko and Schlutz, 1988), ‘*Ichneumonidae* s.l. *gabbroensis*’ (Handlirsch, 1906; Ponomarenko and Schlutz, 1988).
- Oeningen (Germany): *Acoenitus lividus* HEER 1849, *Anomalon protogaemum* HEER 1849, *Cryptus antiquus* HEER 1849, *Hemiteles fasciata* HEER 1849, *Ichneumonites bellus* HEER 1867.
- Shanwang, Shandong, China: *Epicharopimpla achaica* ZHANG et al. 1994, *Luia lacaris* HONG 1985 (revised by Zhang, 1989).
- Latah formation, Spokane (Washington state, U.S.A.): *Periope ivesi* LEWIS 1969.

Lower Miocene

- Radoboj, Croatia (list in Pongracz, 1921-1923): *Bracon pallidus* HEER 1867, *Ichneumonites (Trogus?) fusiformis* HEER 1867, *Ophion longaevus* (HEER 1849) (originally described in the genus *Ichneumon*, transferred into *Ophion* by Pongracz, 1928), *Pimpla (Rhysa) antiqua* HEER 1867 (nec *Pimpla antiqua* SAUSSURE 1852).

Oligocene

- Gubei district, Shandong, China: *Pimpla amplifemora* LIN 1988, *Pimpla impuncta* LIN 1988 (Lin erroneously labelled the genus name Pimla).

- Aix-en-Provence, France: *Bassus filipalpis* THÉOBALD 1937, *Demophorus (?) fumipennis* THÉOBALD 1937, *Exacrodes flexuosus* THÉOBALD, 1937, *Exetastes postornata* THÉOBALD, 1937, *Fintona* cf. *nigripalpis* CAMERON 1909 (Théobald, 1937), *Nemeritis longicornis* THÉOBALD 1937 (= ? *Pimpla renevieri* MEUNIER 1903, after Théobald, 1937), *Ophion annulatus* THÉOBALD 1937, ‘*Pimpla? saussurii*’ HEER 1856 (revised by Théobald, 1937), *Pimpla antiqua* SAUSSURE 1852 (= ? *Ichneumon sublongaevus* MEUNIER 1914, revised by Théobald 1937), *Pimpla (?) anomalensis* THÉOBALD 1937, *Pimpla aquensis* THÉOBALD 1937, *Promethes tilloyi* THÉOBALD 1937. The Ichneumonidae are not rare in this outcrop but all described species need a revision.
- Céreste, Vaucluse, France: *Pimpla (?) anomalensis* THÉOBALD 1937, *Pimpla aquensis* THÉOBALD 1937 (both also listed from Aix-en-Provence by Théobald, 1937), Lutz (1984) figured some other Ichneumonidae. Several other species await descriptions, especially in the MNHN collection.
- ‘Potasse d’Alsace’, Haut-Rhin, France: *Hemiteles* sp., *Plectiscus* sp. (Quiévreux, 1935).
- Kleinkembs, Rhine valley, Germany: *Cremastus primus* THÉOBALD 1937, *Ichneumon pteromajus* THÉOBALD 1937, *Parapimpla rhenana* THÉOBALD 1937, *Pimpla seyrigi* THÉOBALD 1937.
- Rott am Siebengebirge, Germany: *Acanthocryptus bischoffi* STATZ 1936, *Acoenites statzi* MEUNIER 1917, ‘*Campoplex*’ *parvulus* STATZ 1938, ‘*Campoplex*’ *pumilus* STATZ 1938, *Cryptus capitatus* STATZ 1938, *Hemiteles hirsuta* STATZ 1936, *Microcryptus terebrator* STATZ 1936, *Orthopelma curvitalialis* STATZ 1936, *Phygadeuon crassicornis* STATZ 1936, *Pimpla cyclostigmata* STATZ 1936, *Pimpla morleyi* MEUNIER 1923 (= *Cryptus? morleyi* STATZ 1936), *Protarchus antiquus* STATZ 1936, *Stenomacrus obliquus* STATZ 1936.
- Formation Tremembé (Bacia do Taubaté, Brazil): *Taubatehymen minuta* MARTINS-NETO 1998.
- Chagrin Valley (Green River formation, Colorado, U.S.A.): *Ichneumon petrinus* SCUDDER 1877 (position discussed in Cockerell, 1919b).
- Florissant, Colorado, U.S.A.: *Absyrtus decrepitus* BRUES 1910, *Acoenites defunctus* BRUES 1906, *Amblyteles pealei* COCKERELL 1927, *Anomalon confertus* BRUES 1910, *Anomalon deletum* BRUES 1910, *Anomalon excisum* BRUES 1910, *Anomalon miocenicum* COCKERELL 1919, *Barypyla primigena* BRUES 1910, *Camerotops solidatus* BRUES 1910, *Cryptus delineatus* BRUES 1910, *Demophorus antiquus* BRUES 1910, *Exenterus dormitans* COCKERELL 1924, *Exetastes invetera-*

tus BRUES 1910, *Exochilum inusitatum* BRUES 1910, *Exochus captus* BRUES 1910, *Glypta aurora* BRUES 1910, *Hellwigia obsoleta* (BRUES 1910) (originally described in the fossil genus *Protohellwigia* BRUES 1910, later synonymized with *Hellwigia* by Townes, 1966), *Hemiteles lapidescens* BRUES 1910, *Hemiteles obtectus* BRUES 1910, *Hemiteles priscus* BRUES 1910, *Hemiteles suffocates* BRUES 1910, *Hiatensor semirutus* BRUES 1910 (this fossil genus was revised by Townes, 1966, who synonymized *Hiatensor funditus* BRUES 1910 with *H. semirutus*), *Ichneumon alpha* BRUES 1910, *Ichneumon pollens* BRUES 1910, *Ichneumon obduratus* BRUES 1910, *Ichneumon decrepitus* BRUES 1910, *Ichneumon exesus* BRUES 1910, *Ichneumon torpefactus* BRUES 1910, *Ichneumon provectus* BRUES 1910, *Ichneumon dormitans* BRUES 1910, *Ichneumon concretus* BRUES 1910, *Ichneumon somniatus* BRUES 1910, *Ichneumon cannoni* COCKERELL 1910 (in Brues, 1910), *Labrorychus latens* BRUES 1910, *Lampronota stygialis* BRUES 1910, *Lampronota tenebrosa* BRUES 1910, *Lampronota pristine* BRUES 1910, *Lapton daemon* BRUES 1910, *Leptobatopsis ashmeadii* BRUES 1910, *Limnerius vetustum* BRUES 1910, *Limnerius plenum* BRUES 1910, *Limnerius depositum* BRUES 1910, *Limnerius consuetum* BRUES 1910, *Limnerius tectum* BRUES 1910, *Lithoserix williamsi* BROWN 1986 (Brown, 1986; Kasparyan and Rasnitsyn, 1990), *Megatryphon mortiferus* COCKERELL 1924, *Mesochorus lapideus* BRUES 1910, *Mesochorus carceratus* BRUES 1910, *Mesochorus abolitus* BRUES 1910, *Mesochorus revocatus* BRUES 1910, *Mesochorus terrosus* BRUES 1910, *Mesochorus cataclysmi* BRUES 1910, *Mesochorus aboriginalis* BRUES 1910, *Mesochorus dormitorius* BRUES 1910, *Mesoleptus exstirpatus* BRUES 1910, *Mesoleptus apertus* BRUES 1910, *Mesopimpla sequoiarum* COCKERELL 1919, *Mesostenus modestus* BRUES 1906, *Opheltes* sp. (Brues, 1910), *Orthocentrus primus* BRUES 1906, *Orthocentrus defossus* BRUES 1910, *Parabates memorialis* BRUES 1910, *Pimpla appendigera* BRUES 1906, *Pimpla senilis* BRUES 1910, *Pimpla rediviva* BRUES 1910, *Pimpla morticina* BRUES 1910, *Pimpla revelata* BRUES 1910, *Plectiscidea lanhami* COCKERELL 1941, *Polysphincta mortuaria* BRUES 1910, *Polysphincta inundata* BRUES 1910, *Polysphincta petrorum* BRUES 1910, *Polysphincta saxea* SCUDDER 1877 (= 'probably a *Polysphincta*', BRUES 1910), *Polysphincta statzi* MEUNIER (in Statz, 1936), *Porizon exsectus* BRUES 1910, *Rhyssa petiolata* BRUES 1906, *Theronia wickhami* COCKERELL 1919, *Trogus vetus* BRUES 1910, *Tryphon explanatum* COCKERELL 1919, *Tryphon lapideus* BRUES 1910, *Tryphon cadaver* BRUES 1910, *Tryphon peregrinus* BRUES 1910, *Tryphon senex* BRUES 1910, *Tryphon florissantensis* BRUES 1910, *Tylomomus pimplodes* BRUES 1910, *Xylonomus sejugatus* BRUES 1910.

Note: the presence of about 80 different ichneumonid

species in this outcrop is extraordinary. A complete revision of this fauna is necessary in order to verify their identity.

Upper Eocene

- Célas, Gard, France: *Anomalon afflictum* THÉOBALD 1937, *Pimpla* sp. (Théobald, 1937).
- Gurnet Bay, Isle of Wight, U.K.: *Acourtia perplexa* COCKERELL 1921, *Coelocentrus gurnetensis* COCKERELL 1921, *Cremastus* (?) *arcuatus* COCKERELL 1921, *Holomeristus* (?) *vectensis* COCKERELL 1921, *Ichneumon acourti* COCKERELL 1921, *Itopectis saxosus* COCKERELL 1921, *Lampronota disrupta* COCKERELL 1921, *Lithapechtis fumosus* COCKERELL 1921, *Polysphincta* (?) *anglicus* COCKERELL 1921, *Polysphincta* (?) *atavina* COCKERELL 1921, *Stilpnus oligocenicus* COCKERELL 1921.
- Creede formation, Colorado, U.S.A.: *Tylomomus creedensis* COCKERELL 1941,
- Tranquille River, 'Similkameen deposits', 'Kamloop area' (Wilson, 1977), British Columbia, Canada: *Xylonomus lambei* HANDLIRSCH 1910.
- Quesnel, British Columbia, Canada: *Pimpla decessa* SCUDDER 1877, *Pimpla saxea* SCUDDER 1877, *Pimpla senecta* SCUDDER 1877.
- White River, Colorado, U.S.A.: *Phygadeuon petrifactellus* COCKERELL 1920, *Tilgidopsis haesitans* COCKERELL 1921.
- Green River formation, Wyoming and Colorado, U.S.A.: *Eopimpla grandis* COCKERELL 1920, *Lithotorus cressoni* SCUDDER 1890 (discussed in Cockerell, 1919b; revised by Townes, 1966), *Pimpla eocenica* COCKERELL 1919, *Tryphon* (s.l.) *amasidis* COCKERELL and LEVEQUE 1931.
- Little Duck Creek, Colorado, U.S.A.: *Pimpla eocenica* COCKERELL 1919 (see also Cockerell, 1920).
- Cap Staratschin, Spitsbergen (originally considered as Miocene): 'Ichneumonidae, genus incertus, boreale' (HEER 1870) (= *Myrmicium boreale* HEER 1870) (Birket-Smith, 1977).
- Baltic amber (list in Spahr, 1987): *Astigmaton ichneumonoides* KASPARYAN 2001, *Ghilarovites tarsatorius* KASPARYAN 1988, *Lygurella tibialis* KASPARYAN 1994, *Marjorietta major* KASPARYAN 1994, *Marjorietta minor* KASPARYAN 1994, *Paxylommites reticulatus* KASPARYAN 1988, *Pherhombus antennalis* KASPARYAN 1988, *Pherhombus brischkei* (BRUES 1923) (originally described as *Astiphromma brischkei* BRUES 1923) (Kasparyan, 1988), *Pimpla succini* GIEBEL 1856, *Plectiscidea vetusta* KASPARYAN and KHUMALA 1995, *Rasnitsynites tarsalis* KASPARYAN 1994, *Scutellator macrommatus* KASPARYAN and KHUMALA 1995, *Scutellator spinatorius* KASPARYAN and KHUMALA 1995, *Tobiasites striatus* KASPARYAN 1988, *Thymariodes areolaris* KASPARYAN 1988, *Townesites mandibularis* KASPARYAN 1994.

Paleocene/Eocene

- Mo-Clay, Fur formation, Denmark: *Pimpla sigmatica* HENRIKSEN 1922 (see Larsson (1975)), Rust (1990) described and figured several Ichneumonidae from the same formation and considered that their attribution to '*Pimpla*' must be rejected. Rust (1999) described this material and attributed it to several unnamed genera and species).

Paleocene

- Menat, Puy-de-Dôme, France: *Phaenolobus arvernus* PITON 1940.

Upper Cretaceous

- Taimyr amber (Santonian, Siberia): *Eubaeus leiponeura* TOWNES 1973, *Urothryphon pusillus* TOWNES 1973, *Catachora minor* TOWNES 1973.

Lower Cretaceous

- Orapa Mine, South Africa (Coniacian/Cenomanian): Rayner et al. (1991) figured an undescribed Ichneumonidae.
- Baissa (Neocomian, Transbaikalia, Russia): *Archobraconus caudatus* RASNITSYN and SHARKEY 1988, *Archobraconus imperfectus* RASNITSYN and SHARKEY 1988, *Archobraconus microphthalmus* RASNITSYN and SHARKEY 1988, *Archobraconus oculatus* RASNITSYN and SHARKEY 1988, *Archobraconus pallidus* RASNITSYN and SHARKEY 1988, *Archobraconus parvus* RASNITSYN and SHARKEY 1988, *Baissobracon striatus* RASNITSYN and SHARKEY 1988, *Cretobraconus antennatus* RASNITSYN and SHARKEY 1988, *Cretobraconus brachyurus* RASNITSYN and SHARKEY 1988, *Cretobraconus micron* RASNITSYN and SHARKEY 1988, *Cretobraconus pusillus* RASNITSYN and SHARKEY 1988, *Cretobraconus robustus* RASNITSYN and SHARKEY 1988, *Tanychora petiolata* TOWNES 1973, *Tanychora sessilis* TOWNES 1973, *Tanychorella parvula* RASNITSYN 1975.
- Ulugey Formation (Early Cretaceous, Mongolia): *Cretobraconus maculatus* RASNITSYN and SHARKEY 1988, *Cretobraconus mongolensis* RASNITSYN and SHARKEY 1988.
- Sahai formation (Upper Jurassic or Early Cretaceous?, Liaoning province, China): *Tanychora petriolata* TOWNES 1973 (sic) (Hong, 1988).
- Koonwara Fossil Bed, South Gippsland, Victoria, Australia (Aptian?, Early Cretaceous): *Eoichneumon duncanæ* JELL and DUNCAN 1986.

Late Jurassic

- Laiyang, Shandong province, China: *Polychorella magica* ZHANG 1985, *Tanychora sinensis* ZHANG 1991.

Other citations of fossil Ichneumonidae. Numerous authors indicated the presence of ichneumonid wasps in various outcrops, but without generic or specific attribution. Serres (1828, 1829) and Curtis (1829) cited the presence of '*Ichneumon*', and '*Pimpla*' in the Upper Oligocene of Aix-en-Provence (France). Sordelli (1882) figured an Ichneumonidae from the 'Quaternary' deposits of Pianico (Italy). Brischke (1886) cited the presence of Ichneumonidae in the Baltic amber. Meunier (1898) cited an Ichneumonidae in the Munich Museum from the Oligocene of Florissant. Brues (1910) indicated the presence of a *Phygadeuon* sp. (Cryptinae) from the Oligocene of Florissant (U.S.A.). Cameron (1917) cited the presence of Ichneumonidae from the Eocene of the Similkameen valley (British Columbia, Canada). Zeuner (1938) figured a forewing of an Ichneumonidae from the Miocene 'Mainzer Hydrobienkalks' (Germany). Bachofen-Echt (1949) listed and figured several Ichneumonidae in Baltic amber. Berger (1950) and Papp and Mandl (1951) figured a wing of '*Exetastes*' (or '*Paniscus*', Bachmayer, 1960) from the Miocene of Austria. Pierce and Gibron (1962) figured an Ichneumonidae from the Miocene Calico Mountains nodules. Becker (1965) figured one Ichneumonidae from the Eocene of the Ruby River basin (U.S.A.). Lewis and Luhman (1988) listed and figured several other specimens from the same locality. Lewis et al. (1990a) also figured an Ichneumonidae from the same place. Lewis et al. (1990b) listed the Ichneumonidae from the Miocene of Clarkia site (Idaho, U.S.A.). Werner (1969) figured two Ichneumonidae from the Early Pleistocene of the Rita Blanca lake, Texas, U.S.A. Fujiyama and Iwao (1975) described a *Glypta* sp. from the Mio-Pliocene of Japan. Ríha (1977) listed the Ichneumonidae from the Cenozoic of Slovakia. Wilson (1977) figured several different Ichneumonidae from the Middle Eocene of British Columbia. Miller (1983) cited the family Ichneumonidae from the Pleistocene Rancho-la-Brea asphalt pit (California, U.S.A.). Fujiyama (1985) figured an Ichneumonidae from the Early Miocene of Sado Island, Japan. Fujiyama and Nomura (1986) figured an Ichneumonidae from the Early Miocene of Japan (Hachiya Formation, Gifu Prefecture). Poinar (1987) indicated the discovery of a spider parasited by an Ichneumonidae (egg). Lutz (1990) cited the family Ichneumonidae from the Middle Eocene of Messel (Germany). Martínez-Delclòs et al. (1991), Anento et al. (1997) cited the presence of the Ichneumonidae in the Oligocene of Rubielos de Mora, Teruel (España). Peñalver (1998) described them (without naming). Ansoorge (1993) figured an undescribed Ichneumonidae from the Paleocene/Eocene 'Mo-clay' (Denmark). Pike (1994) listed the family Ichneumonidae in the Upper Cretaceous amber of Alberta

(Canada), but did not describe the fossil(s). Douglas and Stockey (1996) figured several wings of Ichneumonidae from the Middle Eocene of British Columbia (Canada) and Washington State (U.S.A.). Lewis (1989) listed the fossil Ichneumonidae from the United States Miocene localities. Lewis and Heikes (1991) listed the fossil Ichneumonidae from the United States Cenozoic. Lewis (1992, 1994), Wehr and Barksdale (1996), and Wehr (1998) listed and figured some Ichneumonidae from the Klondike Mountain formation (Cenozoic, Republic, Washington, U.S.A.).

Swanson and Lewis (1993) listed the family Ichneumonidae from the Green River formation. Weitschat and Wichard (1998) listed the Ichneumonidae from the Baltic amber. Gelhaus and Johnson (1996) indicated the presence of 'Ichneumonoidea' from the Turonian (Upper Cretaceous) amber of New Jersey (U.S.A.). Grimaldi et al. (2000) confirmed the presence of this family in this amber. Archibald and Mathewes (2000) listed and figured some Ichneumonidae from the Early Eocene of the British Columbia (Canada).