

## A Diminutive Pelecinid Wasp in Cretaceous Amber from New Jersey (Hymenoptera: Pelecinidae)

Michael S. Engel<sup>1,2,\*</sup> and David A. Grimaldi<sup>2</sup>

**Abstract** - The first pelecinid wasp in Cretaceous amber is described and figured from a single male preserved in Turonian (ca. 90 Ma) amber from New Jersey. *Henopelecinus pygmaeus*, new genus and new species, is most notable for its minute body size (ca. 6.5 mm) and unexpanded sixth metasomal segment. The fossil is compared to other genera of Pelecinidae including those taxa of the controversial extinct “family” Iscopinidae.

### Introduction

Wasps of the proctotrupoid family Pelecinidae are large (ca. 25–60 mm long) parasitoids of beetles of the family Scarabaeidae. Despite their wide distribution in the New World, little is known of pelecinid biology aside from host records and some information on their mating biology and developmental stages (reviewed in Johnson and Musetti 1999). Fossils of Pelecinidae are exceptionally rare, with, until recently, only one definitive species from the geological record (Engel 2002, Johnson 1998). *Pelecinopteron tubuliforme* Brues (1933) was described from middle Eocene (Lutetian, ca. 45 Ma) amber of the Baltic region. Originally placed in a separate family, Pelecinopteridae, and sister to Pelecinidae (Brues 1933), there seems little reason to recognize multiple families or even subfamilies for this distinctive clade of generally modern pelecinids. Although described as a pelecinid, the Early Cretaceous *Iscopinus baissicus* Kozlov (1974) has since been removed from the family (Johnson 1998) and is likely a mesoserphid wasp (Proctotrupoidea): the apparent distal fork of Rs actually being an incomplete rs-m crossvein. More recently, Zhang (2005), Zhang and Rasnitsyn (2004), and Zhang et al. (2002) have described several putative pelecinids from the Early Cretaceous of Asia, returned *Iscopinus* to the Pelecinidae (Zhang et al. 2002), and assigned their new fossils to the basal subfamily Iscopiniinae (Rasnitsyn 1980, Zhang et al. 2002).

Herein we report a single male of a *Pelecinopteron*-like fossil identified in Late Cretaceous (Turonian, ca. 90 Ma) amber from New Jersey. This

<sup>1</sup>Division of Entomology, Natural History Museum, and Department of Ecology and Evolutionary Biology, 1345 Jayhawk Boulevard, Dyché Hall, University of Kansas, Lawrence, KS 66045-7163. <sup>2</sup>Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79<sup>th</sup> Street, New York, NY 10024-5192.

\*Corresponding author - msengel@ku.edu.

new fossil is the first of its lineage in Cretaceous amber and is the first fossil Pelecinidae from the Western Hemisphere. While modern pelecinids are confined to South and North America (Table 1), all previously documented fossils have come from Europe or Asia and the controversial "iscopinines" are similarly confined at present to the Cretaceous of Asia. Thus, the fossil described herein also represents a major paleobiogeographic record.

### Material and Methods

Measurements were made with an ocular micrometer while the microphotograph was prepared using a Microoptics ML-1000 digital imaging system. The format for the description generally follows that employed by Engel (2002) and Johnson and Musetti (1999), with venational terminology after Mason (1986).

### *Henopelecinus*, new genus

*Type species. Henopelecinus pygmaeus* Engel and Grimaldi, new species.

*Description.* Male. Body size is minute (ca. 6.5 mm). Antenna is 13-segmented, positioned at midpoint of face; combined lengths of scape and pedicel much shorter than length of first flagellomere; flagellomeres longer than wide, moderately thick; basal three flagellomeres with individual lengths ca. 4–5.5 x width, following flagellomeres with individual lengths ca. 3–4 x width; malar space extremely short, base of mandible nearly next to lower tangent of compound eye; occipital carina absent. Pronotum relatively short, dorsal length much less than compound eye width, dorsally with posterior section transverse, weakly trapezoidal, this section is not delimited anteriorly by a transverse carina; pronotum gently sloping from posterior section to anterior end; scutellum not arched; metanotum is short, slightly less than half length of scutellum; mesepisternum with gentle, transverse impression extending posteriorly; propodeum is elongate, weakly trapezoidal dorsally, apparently coarsely sculptured. Forewing is hyaline, without infuscation in any region of wing; only two tubular veins present (C and Sc+R); pterostigma is elongate, tapering to point on anterior wing margin, apparently without R extending beyond pterostigmal apex; r-rs arising in basal half of pterostigma; Rs almost spectral, forking just distal of level of pterostigmal apex, forming two branches ( $Rs_1$  and  $Rs_2$ ), each branch spectral and apparently disappearing shortly before reaching wing apex;  $Rs_1$  arching anteriorly before disappearing; other wing veins not evident; hind wing with only C present along anterior wing margin, with hyaline membrane. Metafemur is not clavate; metatibia is not expanded apically, metatibial length approximately equal to combined lengths of metafemur and metatrochanter; tibial spur formula 1-2-2; metabasitarsus is distinctly longer than following

tarsomeres; second metatarsomere is less than one-half length of metabasitarsus; fourth metatarsomere is shortest, with inner apical margin projecting under fifth metatarsomere; pretarsal claws are simple, arolium is large. Male metasoma is elongate, tubular; first metasomal segment is only slightly larger than second metasomal segment; sixth metasomal segment is not swollen, not expanded near mid-region; sixth metasomal tergum and sternum fused (suture between them not evident as it is on preceding metameres); seventh metasomal segment is falcate, slightly expanded and tapering from base to wider apex, with tergum and sternum fused. Female. Unknown.

*Etymology.* The new genus-group name is a combination of *henos* (Gr., meaning, "old") and *Pelecinus* (type genus of the family). The name is masculine.

*Diagnosis.* *Henopelecinus* differs from *Pelecinopteron* most notably in its minute body size (*Pelecinopteron* ranges from 10–15 mm in total body length: *vide* Engel 2002), absence of an occipital carina, absence of the transverse carina on the dorsal surface of the pronotum, and the sixth metasomal segment not greatly swollen (not expanded near mid-region) and lacking ventral teeth.

*Comments.* The new genus is most similar to *Pelecinopteron*; both genera have 13-segmented antennae, a shortened malar space, hyaline wing membranes, r-rs arising in the basal half of the pterostigma, the metabasitarsus longer than metatarsomere II, and an elongate male metasoma with the distalmost segment falcate. All of these features are presumed plesiomorphic for Pelecininae except for the reduced number of antennal segments and the elongate, tubular metasoma, which are putatively apomorphic in the family. Indeed, comparing these structures across males of modern Pelecinidae, *Protopelecinus*, *Pelecinopteron*, and putative stem-group pelecinids, it would appear that the metasomal structure (particularly the falcate seventh metasomal segment) is a synapomorphy for *Henopelecinus* and *Pelecinopteron*. The 13-segmented antenna may also be a synapomorphy for these genera among crown-group pelecinids.

### ***Henopelecinus pygmaeus*, new species (Fig. 1)**

*Description.* As described for the genus, with the following additions. Male. Head length = 0.7 mm; mesosoma length = 1.6 mm; metasoma length = 4.2 mm; forewing length = 2.2 mm; gena narrower than compound eye. Coloration of integument not preserved owing to clearing of specimen, apparently preserved in a few places on metasoma and appearing black. Setation sparse, setae (where evident) short, simple, and suberect or erect except on metasoma where such setae are subappressed, setae apparently slightly more dense on seventh metasomal segment.

Sculpturing of head obscured by microscopic Schimmel layer; integument of mesosoma with some sculpturing evident and appearing as follows: imbricate with scattered, coarse punctures on mesoscutum and pleura; propodeum apparently with low but coarse reticulate sculpture. Metasoma is elongate tubular; segments are node-like (i.e., somewhat constricted basally and apically; Fig. 1), mostly obscured by microscopic froth of Schimmel; terga and sterna are distinct on metasomal segments one through five, fused on sixth and seventh metasomal segments; first metasomal tergum basally with short, longitudinal rugae, otherwise apparently imbricate with scattered punctures (where evident); segment similar in construction, slightly longer than wide, but progressively and slightly diminishing in proportions from first to fifth segment; sixth segment tubular, much longer than wide, not expanded medially and without armature, gently tapering from narrow base to slightly wider apex (in this respect appearing somewhat club shaped); seventh segment falcate, about as long as sixth segment.

*Diagnosis.* As for the genus (*vide supra*).

*Holotype.* Male; AMNH NJ-181, Late Cretaceous [Turonian], NEW JERSEY: Middlesex Co., Sayreville, White Oaks Pit, 1995, coll. Keith Luzzi (KL133); also labeled "Holotype, *Henopelecinus pygmaeus* Engel and Grimaldi". Deposited in the Amber Collection of the Division of Invertebrate Zoology, American Museum of Natural History, New York, NY.

*Etymology.* The specific epithet is the Latin word *pygmaeus*, meaning "little" and referring to the diminutive size of the species.

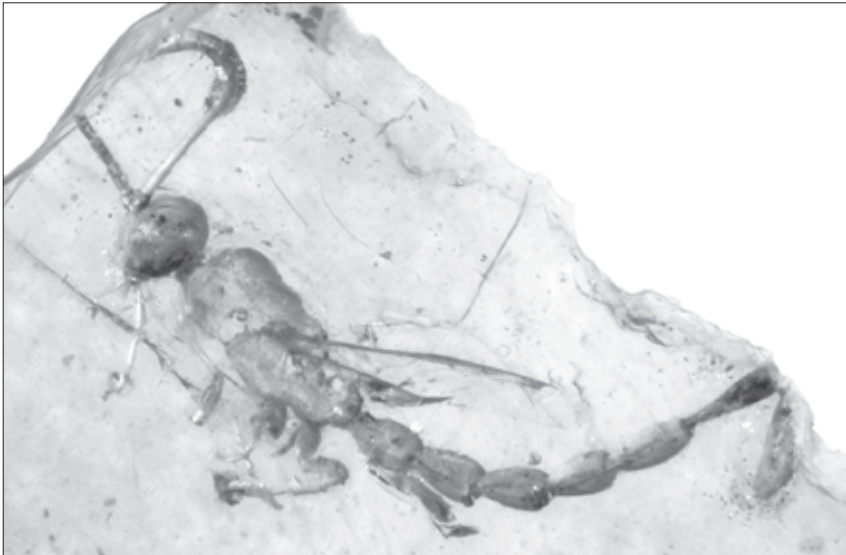


Figure 1. Photomicrograph of holotype male of *Henopelecinus pygmaeus*, new genus and species (AMNH NJ-181).

*Comments.* The holotype is partially preserved (as discovered). The right half of the animal is exposed at the amber surface, revealing the interior of the head and mesosoma. The right antenna is preserved only through the third flagellomere, while the left antenna is complete. The body is almost entirely cleared (Fig. 1), with some microscopic Schimmel obscuring some of the integumental sculpturing on the head and mesosoma. Fortunately, the remains of *H. pygmaeus* preserve almost all of the characters necessary for meaningful comparison with living species.

## Discussion

*Henopelecinus* is the first definitive peleciniid from Cretaceous amber. It is also the smallest member of the family, being more reminiscent of other proctotrupoids in physical stature than the modern giants of *Pelecinus*. Although Kozlov (1974) and more recently Zhang et al. (2002), Zhang and Rasnitsyn (2004), and Zhang (2005) have described numerous Cretaceous fossils of the Iscopininae and attributed them to Peleciniidae, Johnson (1998) excluded the subfamily from the family and accorded iscopinines familial status (as Iscopinidae). We have similarly considered Iscopinidae as separate from the peleciniids since none possess true synapomorphies with this group (e.g., none have the forewing Rs forked). Iscopinines are possibly stem-group Peleciniidae, but extensive phylogenetic work remains to be undertaken on living and fossil Proctotrupeoidea, particularly given the potentially paraphyletic nature of the superfamily (e.g., Ronquist et al. 1999). As previously noted, Johnson (1998) separated *I. baissicus* from the Peleciniidae noting that the putative “Rs<sub>2</sub>” is instead an incompletely preserved crossvein and that the “elongate metasoma” is not of the same construction as seen in Peleciniidae (it similarly differs in the same manner from all other “iscopinines”). It seems well warranted to

---

Table 1. Species of Peleciniidae (s.str.); refer to Zhang and Rasnitsyn (2004) for a listing of the “iscopinine” species. Daggers (†) indicate extinct taxa.

### Family PELECINIDAE Haliday

#### Genus †*Protopelecinus* Zhang and Rasnitsyn

† <i>P. regularis</i> Zhang and Rasnitsyn	Cretaceous (Hauterivian), Baissa, Russia
† <i>P. furtivus</i> Zhang and Rasnitsyn	Cretaceous (Hauterivian), Baissa, Russia
† <i>P. dubius</i> Zhang and Rasnitsyn	Cretaceous (Aptian), Bon Tsagan, Mongolia
† <i>P. deformis</i> Zhang and Rasnitsyn	Cretaceous (Aptian), Bon Tsagan, Mongolia

#### Genus †*Henopelecinus*, n. gen.

† <i>H. pygmaeus</i> , n. sp.	Cretaceous (Turonian), New Jersey
-------------------------------	-----------------------------------

#### Genus †*Pelecinopteron* Brues

† <i>P. tubuliforme</i> Brues	Eocene (Lutetian), Baltic region
† <i>P.</i> sp.	Paleocene, Sakhalin, Siberia

#### Genus *Pelecinus* Latreille

<i>P. dichrous</i> Perty	Holocene, northern Argentina, southern Brazil
<i>P. polyturator</i> (Drury)	Holocene, North and South America
<i>P. thoracicus</i> Klug	Holocene, western Mexico

---

follow Johnson's (1998) conclusions regarding *I. baissicus* and consider it a family of undetermined status near Mesoserphidae (as Iscopinidae, reinstated status). The other "iscopinines" described by Zhang et al. (2002), Zhang and Rasnitsyn (2004), and Zhang (2005), however, exhibit a metasomal structure more indicative of Pelecinidae (henceforth they are hereafter referred to as "sinopelecines"). Zhang and Rasnitsyn (2004) suggested that Pelecinidae s.l. might be paraphyletic. This is strictly a result of the inclusion of the "sinopelecines" as it was hypothesized that some of them were more closely allied to Proctotrupidae than to crown-group Pelecinidae (i.e., Pelecinidae s. str.; Table 1). While no conclusive characters were identified, these observations further support the idea that the "sinopelecines" should be excluded from the family as was done by Johnson (1998) for *I. baissicus* and is done here.

The only other definitive pelecinid fossils are those of *Pelecinopteron* in Paleogene amber from Eurasia (Engel 2002, Johnson 1998). Recent inspection in July of 2002 of the Paleocene amber *Pelecinopteron* from Sakhalin Island, Siberia, has revealed that it represents an as-of-yet undescribed species, distinct from *P. tubuliforme* in the younger (middle Eocene) Baltic amber. The Paleocene species is also a male, but the modifications of the terminalic structures and the absence of ventral teeth on the sixth metasomal segment (which is greatly expanded in its mid-region, typical of *Pelecinopteron*) suggest that it is not conspecific with those specimens from the Eocene of Europe. Unfortunately, the specimen is fragmentary, merely preserving the metasoma and portions of the hind legs. As additional amber is excavated from Sakhalin, it will be interesting to discover more complete material of this little known species.

It is interesting to note the diminutive size of *H. pygmaeus* as well as of *Pelecinopteron*, *Protopelecinus*, and the "sinopelecines" (i.e., the putative stem group to Pelecinidae), all of which are around a centimeter or less in length. These dimensions accord with the idea that while modern Pelecinidae (i.e., *Pelecinus*) are giants among the Proctotrupoidea, they were formerly less pronounced in physical stature and had body sizes more typical of other proctotrupoids. This observation supports the notion that the general weakness and absence of wing veins in *Pelecinus*, enigmatic for such large-sized wasps, is perhaps an evolutionary holdover. Like most proctotrupoids of small size, the venation of the wings was considerably reduced in ancient pelecinids and stem-group Pelecinidae (and other minute proctotrupoids). As species in the lineage grew in physical proportions, the venation was not reacquired, resulting in large wasps with the reduced venation of otherwise minute species. Once a comprehensive phylogenetic analysis has been undertaken for Pelecinidae, stem-group pelecinids, and related proctotrupoid lineages, it will be possible to more conclusively test these hypotheses. First and foremost, it will be interesting to examine how phylogenetic constraints (i.e., vein loss) result in changes to flight biomechanics.

### Acknowledgments

We are grateful to the efforts of Dr. Norman F. Johnson and the anonymous reviewers for their critiques of the manuscript prior to publication. Support was provided by NSF EF-0341724 and DEB-0542909 (to M.S. Engel), while NSF grants DBI-9987372 and DEB-0542726 (to D.A. Grimaldi) generously supported work on fossil insects in the AMNH. This is contribution No. 3438 of the Division of Entomology, Natural History Museum and Biodiversity Research Center, University of Kansas.

### Literature Cited

- Brues, C.T. 1933. The parasitic Hymenoptera of the Baltic amber: Part 1. *Bernstein-Forschungen* 3:4–178.
- Engel, M.S. 2002. The fossil peleciniid *Pelecinopterion tubuliforme* Brues in Baltic amber (Hymenoptera: Pelecinidae). *Journal of Hymenoptera Research* 11(1):5–11.
- Johnson, N.F. 1998. The fossil peleciniids *Pelecinopterion* Brues and *Iscoptinus* Kozlov (Hymenoptera: Proctotrupeoidea: Pelecinidae). *Proceedings of the Entomological Society of Washington* 100(1):1–6.
- Johnson, N.F., and L. Musetti. 1999. Revision of the proctotrupoid genus *Pelecinus* Latreille (Hymenoptera: Pelecinidae). *Journal of Natural History* 33(10):1513–1543.
- Kozlov, M.A. 1974. An early Cretaceous ichneumon of the family Pelecinidae (Hymenoptera, Pelecinoidea). *Paleontologicheskii Zhurnal* 1974(1):144–146. [In Russian; English translation in: *Paleontological Journal* 8(1):136–138]
- Mason, W.R.M. 1986. Standard drawing conventions and definitions for venational and other features of wings of Hymenoptera. *Proceedings of the Entomological Society of Washington* 88(1):1–7.
- Rasnitsyn, A.P. 1980. Origin and evolution of the Hymenoptera. *Trudy Paleontologicheskogo Instituta Akademii Nauk SSSR* 174:1–192. [In Russian]
- Ronquist, F., A.P. Rasnitsyn, A. Roy, K. Eriksson, and M. Lindgren. 1999. Phylogeny of the Hymenoptera: A cladistic reanalysis of Rasnitsyn's (1988) data. *Zoologica Scripta* 28(1):13–50.
- Zhang, H.-C., and A.P. Rasnitsyn. 2004. Peleciniid wasps (Insecta, Hymenoptera, Proctotrupeoidea) from the Cretaceous of Russia and Mongolia. *Cretaceous Research* 25(6):807–825.
- Zhang, H.-C., A.P. Rasnitsyn, and J.-F. Zhang. 2002. Peleciniid wasps (Insecta: Hymenoptera: Proctotrupeoidea) from the Yixian Formation of western Liaoning, China. *Cretaceous Research* 23(1):87–98.
- Zhang, J.-F. 2005. Eight new species of the genus *Eopelecinus* (Hymenoptera: Proctotrupeoidea: Pelecinidae) from the Laiyang Formation, Shandong Province, China. *Paleontological Journal* 39(4):417–427.