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New false fairy wasps in Cretaceous amber from New Jersey and Myanmar (Hymenoptera: Mymarommatoidea)

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Three new species of the parasitoid wasp superfamily Mymarommatoidea (Proctotrupomorpha: Bipetiolarida) are described and figured in Cretaceous amber from New Jersey (Turonian) and Myanmar (Albian-Cenomanian boundary). The new taxa are *Archaeromma carnifex* Engel and Grimaldi, new species, in New Jersey amber, *A. gibsoni* Engel and Grimaldi, new species, in New Jersey amber (both Mymarommatidae), and *Galloromma kachinensis* Engel and Grimaldi, new species, in Burmese amber (Gallorommatidae).

Keywords: Mymarommatoidea, Turonian, Albian, Mesozoic, paleontology, taxonomy.

INTRODUCTION

The false fairy wasps (so-called owing to their superficial resemblance to fairy wasps of the chalcidoid family Mymaridae), superfamily Mymarommatoidea, are among the smallest of Hymenoptera and, although rarely collected, have been documented from various localities throughout the world (Gibson *et al.*, 2007). Numerous synapomorphic traits serve to unite the mymarommatoids (*e.g.*, Vilhelmsen and Krogmann, 2006; Gibson *et al.*, 2007) and they are apparently related to the extinct Serphitoidea, the only other proctotrupomorphan group with a distinctive, tubular, 2-segmented petiole, and these are together allied to Chalcidoidea, Platygastroidea, and Ceraphronoidea (*e.g.*, Kozlov and Rasnitsyn, 1979; Rasnitsyn *et al.*, 2004; Grimaldi and Engel, 2005). Indeed, serphitoids may eventually prove to be stem-group mymarommatoids.

Until recently the mymarommatoids were classified in a single family with three genera but Gibson *et al.* (2007) provided the first

analysis of morphological diversity in the superfamily and, based on their phylogenetic study, reclassified these wasps into three extant and three extinct genera in two families. Given the relative homogeneity of the group, subfamilies of a single family might have also been warranted so as to emphasize the unity of the group and its extreme disparity from other modern lineages of Proctotrupomorpha. Nonetheless, the study of Gibson *et al.* (2007) provided the first real foundation for a modern understanding of these Lilliputian wasps, for which nothing remains known of their biology although they are frequently suspected as egg parasitoids. Presently with ten living and ten extinct species (Gibson *et al.*, 2007), the superfamily is apparently one of those lineages that was more diverse in the past, particularly during the Cretaceous, than it is today. Perhaps not surprisingly, fossil mymarommatoids are documented strictly in fossiliferous resins wherein there exists sufficient fidelity to permit the preservation of such frail and minute insects. Mymarommatoid species have been previously described from Miocene

Sicilian amber (Schlüter and Kohring, 1990), middle Eocene Baltic amber (Meunier, 1901), Campanian Canadian amber (Brues, 1937; Yoshimoto, 1975), Santonian Japanese amber (Fursov *et al.*, 2002), Santonian and Cenomanian amber from Siberia (Kozlov and Rasnitsyn, 1979), and Cenomanian amber from France (Schlüter, 1978). In addition, Douitt (1973) recorded *Palaeomyrmar* in Oligocene-Miocene amber from southern Mexico and Alonso *et al.* (2000) reported in Albian amber from Spain an individual of an enigmatic wasp either in Mymarommatoida or closely allied, but this material requires careful examination by hymenopterists. Like the distribution of modern mymarommatoids, fossils of the superfamily are widely distributed across deposits.

Herein we provide the description of three new species of mymarommatoids preserved in Cretaceous resin from New Jersey (Turonian) and Myanmar (latest Albian-earliest Cenomanian), bringing the total number of fossil species to 13 (11 from the Cretaceous alone). These taxa are being validated so that their names can be used in forthcoming treatments on the Cretaceous record of proctotrupomorph wasps. In that same paper the relationships of these fossils with modern mymarommatoids and serphitoids will be elaborated upon (Engel and Grimaldi, in prep.). Morphological terminology and the current classification follow that of Gibson *et al.* (2007). Gibson *et al.* (2007) provide a complete account of features defining the superfamily and its included supraspecific clades.

SYSTEMATIC PALEONTOLOGY

Superfamily Mymarommatoida Debauche, 1948

Family Mymarommatidae Debauche, 1948

Genus *Archaeromma* Yoshimoto, 1975

Archaeromma carnifex, new species
(Figs. 1–3)

Mymarommatidae sp.; Grimaldi *et al.*, 2000: 27.

Mymarommatidae sp.; Grimaldi and Engel, 2005: 425, fig. 11.22 (of paratype).

Archaeromma sp.; Gibson *et al.*, 2007: 142, fig. 195 (of holotype).

Diagnosis

Species of *Archaeromma* with the following combination of traits: distinct, elongate posterobasal marginal seta offset by series of distinctly short setae from apical marginal fringe of 55 erect setae (Figs. 1–2); macrocheta absent at apex of marginal vein; antenna 13-segmented; pedicel about three-quarters length of scape; clavus 3-segmented; segments from second flagellar article to apex with whorls composed of numerous, relatively-long setae; ocelli present; pleura imbricate; metasoma smooth, without setae except apical margins of sixth and seventh metasomal terga with a few, short setae.

Description

Male. Total body length 0.64 mm; forewing length 0.50 mm. Body apparently dark brown (where evident). Head with compound eyes large, encompassing large portion of lateral surface of head, number of ommatidia not determinable; mandibles bidentate, exodont; malar space apparently as long as basal mandibular width; posterior of head with)"-shaped carinate margin demarcating area with collapsed "bellows" in occipital area; ocelli present; antenna 13-segmented (including scape and pedicel), pedicel about three-quarters length of scape, clavus 3-segmented, segments from second flagellar article to apex of antenna with whorls composed of numerous, relatively-long setae. Pronotum not reaching tegula; mesoscutum without notauli; mesosomal sculpturing scabrous, weakly so on mesoscutellum and metanotum; becoming more imbricate on pleura. Forewing pedunculate, with short, thin submarginal vein and short, circular marginal vein in stalk-like base; marginal vein without macrocheta at apex; disc broadly spatulate,



Figures 1–2. Holotype male of *Archaeromma carnifex* Engel and Grimaldi, new species (AMNH NJ-179), in Late Cretaceous (Turonian) amber from New Jersey. 1. Lateral aspect (total length of specimen 0.64 mm). 2. Detail of forewings (length of forewing 0.50 mm).



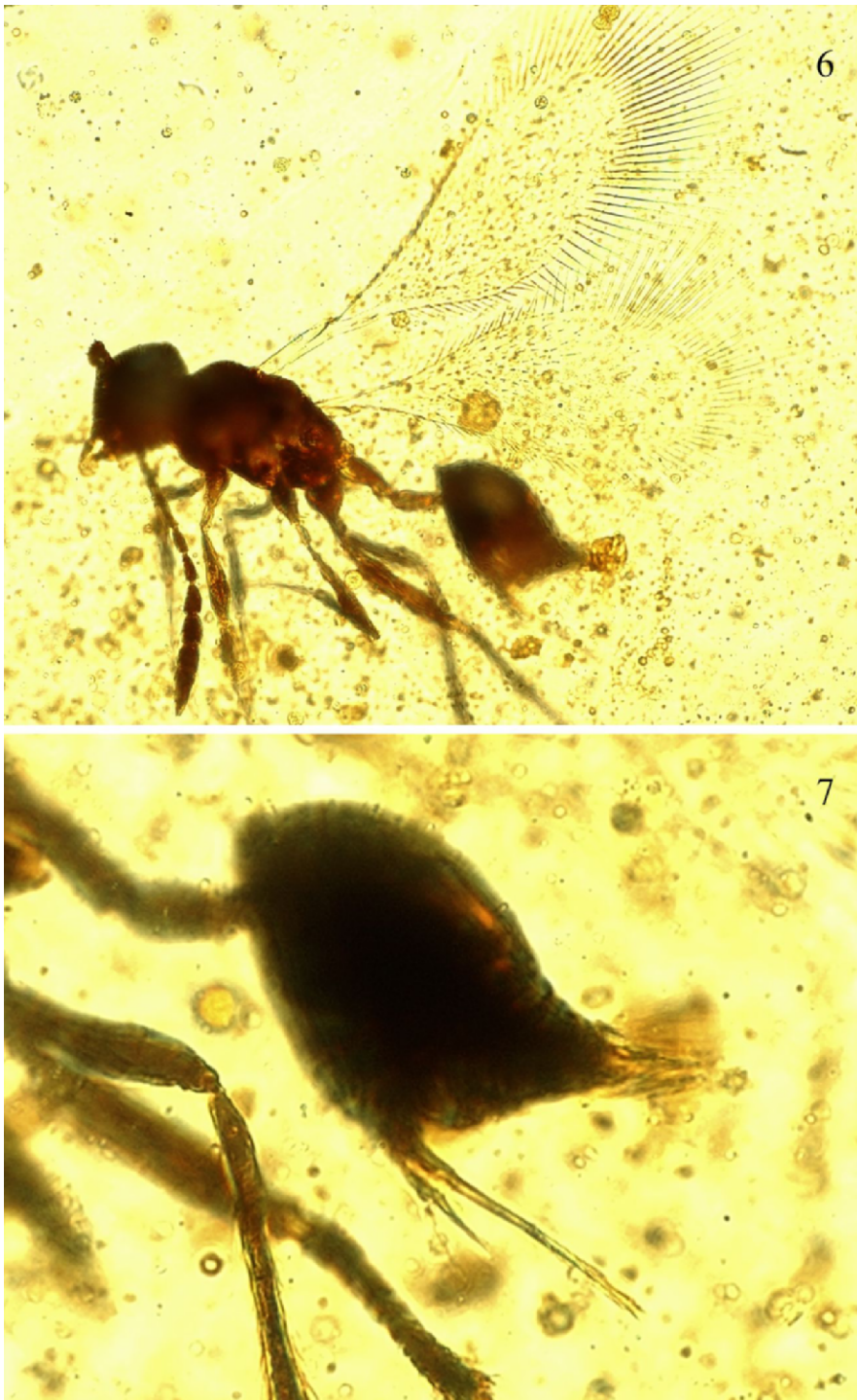
Figure 3. Lateral aspect of paratype male of *Archaeromma carnifex* Engel and Grimaldi, new species (AMNH NJ-1005), in Late Cretaceous (Turonian) amber from New Jersey (total length of specimen 0.51 mm).

disc membrane with distinct mesh-like rugosity or reticulations (Fig. 2), with a few scattered, short setae; distinct, elongate, suberect, posterobasal marginal seta (Fig. 2) offset by series of seven distinctly short and suberect setae from apical marginal fringe of elongate, erect setae; 55 erect marginal setae present (52 of these distinctly elongate) (Fig. 2).

Protibial calcar slightly curved near apex, short; meso- and metatibiae without apical spurs; tarsi pentamerous. Metasoma with two-segmented, tubular petiole; first petiolar segment slightly longer than second; integument of gaster smooth, without setae except apical margins of sixth and seventh metasomal terga with a few short setae;



Figures 4–5. Holotype male of *Archaeromma gibsoni* Engel and Grimaldi, new species (AMNH Bu-997), in Cretaceous amber from Myanmar. 4. Image in focal plane of wings. 5. Image in focal plane of body. Total length of specimen 0.44 mm, forewing length 0.40 mm.



Figures 6–7. Holotype female of *Galloromma kachinensis* Engel and Grimaldi, new species (AMNH Bu-0107), in Cretaceous amber from Myanmar. 6. Lateral aspect (total length of specimen 0.56 mm, forewing length 0.51 mm). 7. Detail of metasoma in focal plane of exposed ovipositor.

integument of petiolar segments apparently finely imbricate.

Type material

Holotype – male, NJ-179 [KL167] (Fig. 1), Late Cretaceous (Turonian) amber, New Jersey, Middlesex County, Sayreville, White Oaks pit, 1995, coll. K. Luzzi. Specimen deposited in the Amber Fossil Collection, Division of Invertebrate Zoölogy, American Museum of Natural History, New York. Paratype – one male, NJ-1005 (Fig. 3), Late Cretaceous (Turonian) amber, New Jersey, Middlesex County, Sayreville, White Oaks pit, 1997–1998, coll. P. Nascimbene. Specimen in same repository as holotype.

Additional material

One male, NJ-686a [KL562], Late Cretaceous (Turonian) amber, New Jersey, Middlesex County, Sayreville, White Oaks pit, coll. K. Luzzi. A poorly preserved individual that appears to represent the same species but is not designated as part of the type series.

Etymology

The specific epithet is the Latin term *carnifex*, meaning “executioner”, and is a reference to parasitoid biology. The name is treated as a noun in apposition.

Archaeromma gibsoni, new species
(Figs. 4–5)

Diagnosis

Species of *Archaeromma* with the following combination of traits: elongate posterobasal marginal seta absent; marginal fringe composed of 35–37 erect setae (Fig. 4), posterior border with fringe of 7–8 short, erect to suberect setae; macrocheta present at apex of marginal vein; antenna 13-segmented, pedicel about as long as scape (Fig. 5); clavus 3-segmented; flagellar articles with sparse, minute setae; ocelli present; pleura scabrous to strongly imbricate; metasoma apparently finely imbricate, without setae.

Description

Male. Length 0.44 mm; forewing length 0.40 mm. Body apparently dark reddish brown (where evident). Head with compound eyes large, encompassing large portion of lateral surface of head, number of ommatidia not determinable; ocelli present; mandibles bidentate, exodont; posterior of head with)”-shaped carinate margin demarcating area with collapsed “bellows” in occipital area; antenna 13-segmented (including scape and pedicel), pedicel about as long as scape, clavus 3-segmented, segments from second flagellar article to apex with sparse, minute setae. Pronotum not reaching tegula; mesoscutum without notauli; mesosomal sculpturing scabrous to strongly imbricate. Forewing pedunculate, with short, thin submarginal vein and short, circular marginal vein in stalk-like base; marginal vein with macrocheta present at apex; disc broadly spatulate, disc membrane with very faint reticulations, with numerous scattered, short setae (Fig. 4); elongate posterobasal marginal seta absent; posterior margin with series of 7–8 short setae; apical marginal fringe composed of 35–39 elongate, erect setae (Fig. 4). Protibial calcar faintly curved near apex, of moderate length; meso- and metatibiae without apical spurs; tarsi pentamerous. Metasoma with two-segmented, tubular petiole; first petiolar segment slightly longer than second; integument of metasoma apparently faintly imbricate, without setae.

Type material

Holotype – male, Bu-997 (Figs. 4–5), Cretaceous (latest Albian-earliest Cenomanian) amber, Myanmar, Kachin, Tanai Village (on Ledo Road 105 km NW Myitkyna). Specimen deposited in the Amber Fossil Collection, Division of Invertebrate Zoölogy, American Museum of Natural History, New York. Paratypes – three males, Bu-479 and Bu-184, both Cretaceous (latest Albian-earliest Cenomanian) amber, Myanmar, same data as holotype; specimens in the same repository as the holotype;

SEMC-KU Bu-024, Cretaceous (latest Albian-earliest Cenomanian) amber, Myanmar, same data as holotype, in Fossil Insect Collection, Division of Entomology, University of Kansas Natural History Museum.

Etymology

The specific epithet is a patronymic honouring Dr. Gary A.P. Gibson, who has provided much insight into the systematics of Chalcidoidea and Mymarommatoidea through his detailed comparative studies.

Family Gallorommatidae Gibson *et al.*, 2007
Genus *Galloromma* Schlüter, 1978

Galloromma kachinensis, new species

(Figs. 6–7)

Mymarommatidae sp.; Grimaldi *et al.*, 2002: 11.

Galloromma sp.; Gibson *et al.*, 2007: 142, figs. 189–191.

Diagnosis

The new species can be distinguished by the following combination of attributes: female antenna 13-segmented, clavus 4-segmented (clavus loosely defined); first petiolar segment distinctly longer than second (nearly twice as long as second); elongate, suberect, posterobasal setae of forewing absent; apical marginal fringe composed of 48–49 elongate, erect setae.

Description

Female. Length 0.56 mm; forewing length 0.51 mm. Body dark brown (where evident), antenna excluding clavus, legs, and petiolar segments slightly lighter brown. Head with compound eyes large, encompassing large portion of lateral surface of head, number of ommatidia not determinable; ocelli present; mandibles not exodont, without apical teeth (apparently with minute subbasal tooth), apparently capable of overlapping when in closed; posterior of head with occipital ridge rounded, without)"-shaped carinate margin demarcating area of collapsed occipital area

(*i.e.*, lacking occipital "bellows"); antenna 13-segmented (including scape and pedicel), pedicel slightly shorter than scape, clavus loosely defined, 4-segmented; flagellar articles with sparse, short setae; head general strongly imbricate. Mesosoma strongly imbricate. Protibial calcar long and curved; meso- and metatibiae without apical spurs; tarsi pentamerous. Forewing pedunculate, with short, thin submarginal vein and short, circular marginal vein in stalk-like base; marginal vein with macrocheta present at apex; disc broadly spatulate, disc membrane with very faint reticulations, with numerous scattered, short setae (Fig. 6); elongate posterobasal marginal seta absent; posterior margin with series of 13–14 short setae; apical marginal fringe composed of 48–49 elongate, erect setae (Fig. 6). Metasoma with two-segmented, tubular petiole; first petiolar segment distinctly longer than second (nearly twice as long as second); integument of petiolar segments apparently strongly imbricate, remainder of metasoma apparently faintly imbricate; anteromedial area of first gastral tergum (*i.e.*, third metasomal tergum) with patch of distinct, erect and suberect setae [as in *G. agapa* (Kozlov and Rasnitsyn)]; a few, short setae evident at extreme apex of metasoma; ovipositor slightly longer than gaster (Fig. 7).

Male. As described for the female except for typical sex differences and with the following modifications: Total body length 0.51 mm; forewing length 0.46 mm. Claval segments not as expanded as in female.

Type material

Holotype – female, Bu-0107 (Fig. 6), Cretaceous (latest Albian-earliest Cenomanian) amber, Myanmar, Kachin, Tanai Village (on Ledo Road 105 km NW Myitkyna). Specimen deposited in the Amber Fossil Collection, Division of Invertebrate Zoölogy, American Museum of Natural History, New York. Paratypes – one male, Bu-0107, same amber piece as holotype; one

male, Bu-160, same data as holotype.
Specimens in same repository as holotype.

Etymology

The specific epithet is based on the State of Kachin (Union of Myanmar), the region from which the amber originates.

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