Cretaceous Research 69 (2017) 113–118

Contents lists available at ScienceDirect

Cretaceous Research

journal homepage: www.elsevier.com/locate/CretRes

Bizzare wingless parasitic wasp from mid-Cretaceous Burmese amber (Hymenoptera, Ceraphronoidea, Aptenoperissidae fam. nov.)

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ARTICLE INFO

Article history:
Received 28 June 2016
Received in revised form
6 September 2016
Accepted in revised form 15 September 2016
Available online 15 September 2016

Keywords:
Aptenoperissus burmanicus sp. et gen. nov.
Mid-Cretaceous
Burmese amber
Bizarre hymenopteran

ABSTRACT

A strange wingless female parasitic wasp from mid-Cretaceous Burmese amber is described as *Aptenoperissus burmanicus* sp. et gen. nov. in the new family Aptenoperissidae (Hymenoptera, Ceraphronoidea). Diagnostic characters of the female *Aptenoperissus burmanicus* sp. et gen. nov. include its wingless, streamlined and heavily sclerotized body lacking any apparent trace of a wasp waist, and geniculate antenna composed of a long, thin, stick-like scape, standard pedicel and 22 uniform flagellomeres. Also the body has 9 externally visible segments with no evidence of segment fusion implying the presence of a completely hidden segment. All tibiae have paired spurs and the hind femora are saltatory and incrassate. The double fore-tibial spur combined with unquestionable diagnostic features of Apocrita (primarily an internalized needle-like thin and acute ovipositor) suggest placement within the superfamily Ceraphronoidea s.str. with the Maimetshidae as a sister group of the crown Ceraphronoidea, composed of the Ceraphronidae, Megaspilidae, Stigmaphronidae, and Radiophronidae. The fossil is hypothesized to live semicryptically on the forest floor or tree trunk and to parasitize immature holometabolous insects. Diagnostic features of a respective male are suggested to test the hypothesized position of the new taxon.

1. Introduction

Mid-Cretaceous amber from the Hukawng Valley in Myanmar has provided a variety of fascinating invertebrates and plants from that important period in the earth's history. In fact, the arthropods found in that amber presently, which includes 252 families, is the richest known assemblage in all Cretaceous amber. Its taxonomic composition forms, along with the Levantine assemblage, a focal center of arthropod diversity in the warmer part of the Cretaceous non-marine realm, as opposed to the more temperate northern amber assemblages (Rasnitsyn et al., 2016). Interestingly, the Cretaceous amber arthropod assemblages demonstrate no clear trend of taxonomic composition in comparison to their age. Possible causes of this phenomenon are discussed in Rasnitsyn et al. (2016).

While many fossils from Burmese amber can be placed in extant families, many others are unique. Some are very bizarre creatures, such as *Haidamyrmex* Dlussky and related ants with grotesquely modified mandibles and lower head capsules (Perrichot et al., 2016), the scorpionfly *Parapolycentropus* Grimaldi & Rasnitsyn with a long piercing beak and a completely missing hind wing (Grimaldi and Johnston, 2014), and the lacewing *Paradoxosisyra* Makarkin, 2016 with a long sucking beak (Makarkin, 2016). Some of these aberrant fossils have no close descendants and must be placed in new families. That is the case with the present insect fossil that we describe below as *Aptenoperissus burmanicus* Rasnitsyn & Poinar, sp. et gen. nov. in the new family, Aptenoperissidae fam. nov. We ascribe the new family to the order Hymenoptera and to the superfamily Ceraphronoidea s.str. and treat it preliminary as a sister to the clade embracing the four families, Ceraphronidae, Megaspilidae, Stigmaphronidae, and Radiophronidae. Based on its wingless, streamlined body, we suspect that the fossil was a cryptic parasitoid that attacked insect stages hidden in narrow crevices.

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http://dx.doi.org/10.1016/j.cretres.2016.09.003
0195-6671/

2. Materials and methods

The specimen originated from the Noije Bum 2001 Summit Site mine excavated in the Hukawng Valley in 2001 and located southwest of Maingkhwan in Kachin State (26°20′N, 96°36′E) in Myanmar. Based on paleontological evidence this site was dated to the late Albian of the Early Cretaceous (Cruickshank and Ko, 2003), placing the age at 97 to 110 Ma. A more recent study using U–Pb zircon dating determined the age to be 98.79 ± 0.62 Ma or at the Albian/Cenomanian boundary (Shi et al., 2012). Nuclear magnetic resonance (NMR) spectra and the presence of araucaroid wood fibers in amber samples from the Noije Bum 2001 Summit Site indicate an araucarian tree source for the amber (Poinar et al., 2007).

Observations and photographs were made with a Nikon SMZ-10 R stereoscopic microscope and Nikon Optiphot compound microscope with magnifications up to 800×. Helicon Focus Pro ×64 was used to stack photos for better depth of field. Line drawings were made with CorelDRAW software based on photographs.

LSID urn:lsid:zoobank.org:pub:135AD641-E78B-4DCB-B094-6549042F0636

3. Systematic paleontology

Order: Hymenoptera Linné, 1758
Suborder: Vespina Laicharting, 1781
Superfamily: Ceraphronoidea Haliday, 1833
Family: Aptenoperissidae Rasnitsyn & Poinar, fam. nov.
LSID urn:lsid:zoobank.org:act:49CA442E-6556-4341-9DE0-0988C9DA34C6
Type genus *Aptenoperissus* Rasnitsyn & Poinar, gen. nov.

Diagnosis. Female wingless, saltatory, streamlined (with no apparent trace of a wasp waist), heavily sclerotized and somewhat depressed, with ovipositor internalized. Antenna polymerous (with more than 15 flagellomeres), geniculate with scape long and thin, stick-like, attached on elevation(s) above mandibles. Eyes well developed, ocelli present, mouthparts as preserved with no peculiarities. Pronotum deeply excised posteriorly, short at midline, propleuron not elongate (not forming neck). Mesonotum preserved as simple semicircular plate with no suture/carina visible, all following terga uniform simple quadrangular plates except for apical long triangular metasomal tergum. Body with 9 externally visible segments with no evident trace of segment fusion, thus implying one completely hidden segment, putatively 1st metasomal. Legs ordinary except that all (!) tibiae with paired apical spurs, hind femur saltatory, incrassate, no trochantellus present except for small rudiment in hind leg; fourth tarsomere with modified plantula in all legs. Antennal cleaner (modified inner fore tibial spur and fore basitarsus) well developed. Apical metasomal tergum and sternum fit together enclosing ovipositor in repose. Male unknown.
Genera included. Type genus only.
Remarks. The new family displays a number of unusual or atypical combination of characters that prevents its straightforward assignment to a higher taxon. It is ascribed to the order Hymenoptera based primarily on the characteristic antenna cleaner formed with a specifically modified inner (fore) protibial apical spur, and the internalized, needle-like thin, sharp barbed ovipositor. Protibial cleaner occurs in Lepidoptera and some beetles but in a different form (with protibial apex rather than basitarsus employed opposing the spur) and are never combined with needle-like internalized ovipositor.

The most striking feature of the new family as a hymenopteron is a polymerous long-geniculate antenna of ant-like appearance but with numerous flagellomeres. In Hymenoptera, both polymerous and long-geniculate antennae are regular features, but these features only occur separately and never together. Being so unique, this character combination is not considered indicative of its taxonomic position and was not considered while seeking a sister taxon(s). Instead, as a key feature, we use the unique character of the fore tibia containing two apical spurs, one being modified as a calcar. Lower Symphyta hymenopterans equally possessing the double protibial spurs (Xyeloidea, Tenthredinoidea, and Pamphiliodea) are not considered to be closely related because of the internalized needle-like ovipositor in the fossil. The internalized ovipositor implies that the Aptenoperissidae is deeply rooted within Apocrita. This makes it hardly possible that it retained the outer (hind) protibial spur directly from basal Hymenoptera. That spur has been already lost by the common ancestor of the clade embracing Cephoidea, Siricoidea s.l., Orussoidea and Apocrita (Rasnitsyn, 1988). This implies that Aptenoperissidae could re-gain the double protibial spurs as a reversal. With this limitation, two fore tibial spurs are strongly indicative of crown Ceraphronoidea s.str. (Ceraphronidae, Megaspilidae, Stigmaphronidae, and Radiophronidae, but not Maimetshidae). Considering this similarity as a putative synapomorphy, we ascribe the new family to the superfamily Ceraphronoidea and treat it tentatively as a sister to the crown group Ceraphronoidea. Remaining as a putative synapomorphy of the entire superfamily Ceraphronoidea s.str. is the small, reduced first metasomal segment forming an articulatory ring between the meso- and remaining metasoma, which is hidden between the propodeum and second metasomal segment and invisible externally. The putatively sister position of Aptenoperissidae in respect to the crown Ceraphronoidea is supported by the oligomerous geniculate antenna of the latter groups as opposed to the polymerous geniculate antennae in the new family.

The only available alternative to Ceraphronoidea in possessing the double protibial spurs is possibly several advanced genera of Braconidae, *Bathyaulax* Szepligeti (including some *Bicentra* Achterberg & Sigwalt as a synonym) and *Rhamnura* Enderlein (Quicke, 1987 and Kaartinen and Quicke, 2007, respectively). However, the above braconid genera have no other characters in common with Aptenoperissidae, and so it is unlikely they have any phylogenetic relationship to the new family.

However the braconid genus *Streblocera* Westwood (of the subfamily Euphorinae and hence only distantly related to *Bathyaulax* and *Rhamnura* of the subfamily Braconinae) is unique for all the superfamily Ichneumonoidea in having the scape elongate, often very much so. However, this is only a superficial similarity with Aptenoperissidae, because these two adaptations are contrasting. The long geniculate antenna of the new family is unquestionably sensory, even though details of its function is expectably obscure in the fossil. In contrast, antenna of *Streblocera* represents a catching device aimed to grasp and manipulate the adult host (Chrysomelidae beetles) to secure a position for oviposition (Belokobylskij, 1996). As a result, the antennae of *Streblocera* represent a homoplasy in respect to the raptorial legs of praying mantida and dryinid wasps rather than to the geniculate antenna of Aptenoperissidae.

Genus *Aptenoperissus* Rasnitsyn & Poinar, gen. nov.
LSID urn:lsid:zoobank.org:act:991884F3-1A1E-424A-94BC-D135604E4463
Type species: *Aptenoperissus burmanicus* Rasnitsyn & Poinar, sp. nov.

Derivation of name. The generic name is derived from the Greek "aptenos" = wingless and the Greek "perissos" = strange.
Diagnosis. As for family (by monotypy).
Included species. Type species only.