



# The first Oriental protorhyssaline wasp (Hymenoptera: Braconidae): A new genus and species in Upper Cretaceous amber from Myanmar



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## ARTICLE INFO

### Article history:

Received 31 December 2015

Received in revised form

23 February 2016

Accepted in revised form 25 February 2016

Available online 26 February 2016

### Keywords:

Apocrita

Cenomanian

Euhymenoptera

Ichneumonoidea

Parasitoid

Taxonomy

## ABSTRACT

The exclusively Cretaceous braconid wasp subfamily Protorhyssalinae is reported from the Upper Cretaceous deposits of northern Myanmar. *Archaeorhyssalus subsolanus* Engel, gen. et sp. nov., is represented by a well-preserved female in Burmese amber and is similar to other protorhyssalines, but differs in numerous details of forewing venation and flagellomere number. This species is the first definitive Oriental occurrence for protorhyssalines, expanding their palaeogeographic distribution from the Lower Cretaceous of Spain, and the Upper Cretaceous of France and New Jersey, USA. A key to the known genera of protorhyssalines is provided.

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## 1. Introduction

Parasitoid wasps of the family Braconidae are among the most diverse lineages in the Hymenoptera, with nearly 20,000 described species (Huber, 2009; Engel and Krombein, 2012; Aguiar et al., 2013) and perhaps more than 42,000 species worldwide (Jones et al., 2009; Quicke, 2015). As parasitoids of diverse insect hosts, and of all life stages, braconids have featured in successful biological control efforts, albeit from comparatively few species (Wharton, 1993). Despite their considerable diversity today, the fossil record for braconids has been less than revealing about their past. There are a considerable number of Cenozoic compressions, and while many can be assigned to a particular subfamily and even various modern genera (e.g., Brues, 1906, 1910), they do not preserve sufficient details to allow more refined evaluations of their phylogenetic placement or palaeobiological implications. Amber

inclusions from the Neogene (Zuparko and Poinar, 1997; van Achterberg, 2001; Engel and Bennett, 2008) and Palaeogene (Brues, 1933, 1939; van Achterberg, 1982; Tobias, 1987) have been more informative, but all are placed easily within comparatively modern clades and do not provide tremendous insight into the earliest history of the family. This is not surprising as Braconidae, like the related Ichneumonidae, are known to extend well into the Early Cretaceous, and it is from Mesozoic deposits that we find taxa that are not as easily classified into modern groups (e.g., Rasnitsyn, 1983; Rasnitsyn and Sharkey, 1988; Perrichot et al., 2009). It is just such fossils that have the potential to provide the greatest insights into basal diversification events within the clade, as well as robust estimates for their divergence from related lineages. Unfortunately, the number of available Cretaceous fossils for Ichneumonoidea is meager (e.g., Grimaldi and Engel, 2005; Kopylov et al., 2010; Kopylov, 2011, 2012a; Quicke, 2015). There are a variety of compression fossils attributable to the Braconidae, but like their Cenozoic counterparts, they often preserve few characters for detailed comparison and their placements are often best considered as *incertae sedis* (e.g., Rasnitsyn and Sharkey, 1988; Belokobylskij, 2012). Inclusions in amber from the Cretaceous are few but these nonetheless have provided the most informative

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glimpses into early ichneumonoid evolution (Brues, 1937; Townes, 1973a, 1973b; Zherikhin, 1978; Kopylov, 2012b; McKellar et al., 2013), particularly various representatives of the Braconidae (Basibuyuk et al., 1999; Ortega-Blanco et al., 2009, 2011; Perrichot et al., 2009).

Here we report the discovery of a remarkably well-preserved female braconid in the Cenomanian amber of northern Myanmar (Fig. 1), a deposit that has revealed a considerable diversity of Hymenoptera and other insects (Grimaldi et al., 2002; Ross et al., 2010). The fossil is significant as not only the first braconid described from Burmese amber, but as it is of the extinct subfamily Protorhyssalinae, a group exclusively known from Cretaceous amber (Basibuyuk et al., 1999; Perrichot et al., 2009; Ortega-Blanco et al., 2011). We provide a description of the species and brief discussion of its similarities with other protorhyssalines.

## 2. Material and methods

The single female protorhyssaline wasp was discovered in a rounded piece of amber from a mine located near the village of Noiye Bum, near Tanaing, Myanmar (Kania et al., 2015: their figure 1). The piece is 21 mm long and 16 mm at its maximum width, with one long surface polished comparatively flat and the opposing surface strongly rounded, reaching a maximum depth centrally of about 7.5 mm. The wasp is positioned along the upper edge, nearest the rounded surface and somewhat away from the flattened plane. The wasp's dorsum is oriented toward the curved margin of the piece and slightly oblique, permitting views of the dorsal sclerites. A direct facial view is not possible as prepared, but owing to the slight angle of the wasp's long axis relative to the surface, the face can be observed obliquely, and the antennae are preserved complete. The wings are extended posterodorsally from the body, although the extreme apices of the forewings are a bit torn and their posterior portions are slightly twisted. The legs are extended alongside and ventrally from the body and the ovipositor is fully

extended, running obliquely away from and below the wasp's longitudinal axis. There are some bubbles in the piece and a few, minor internal fractures and flows, but none of these obscure views of the wasp.

For the descriptive work, the morphological terminology of Huber and Sharkey (1993), van Achterberg (1993), and Sharkey and Wharton (1997) is generally followed, with some minor modification of wing vein terms. Measurements of the holotype were taken with an ocular micrometer on an Olympus SZX12 stereomicroscope and line drawings were made using a camera lucida on the same microscope. The photograph for figure 1 was taken with a Canon 7D digital camera attached to a K-2 Infinity lens. The amber-bearing deposits in Kachin State have been mapped in detail by Cruickshank and Ko (2003), and the sediments have been dated to approximately 98.8 Ma (earliest Cenomanian) using U-Pb radiometric estimates (Shi et al., 2012). All taxonomic actions established herein have been registered in ZooBank LISC urn:lsid:zoo-bank.org:pub:1374DB82-87DF-44EE-95F7-74F1C81DC5F5.

## 3. Systematic palaeontology

Family Braconidae Nees von Esenbeck  
Subfamily Protorhyssalinae Basibuyuk et al.

*Comments.* Presently there are three genera assigned to Protorhyssalinae, each monotypic — *Protorhyssalus* Basibuyuk and Quicke in Turonian amber from New Jersey, U.S.A. (Basibuyuk et al., 1999); *Protorhyssalodes* Perrichot, Nel, and Quicke in Cenomanian amber from Charente-Maritime, France (Perrichot et al., 2009); and *Protorhyssalopsis* Ortega-Blanco, Delclòs, and Engel in Albian amber from Burgos, Spain (Ortega-Blanco et al., 2011). Belokobylskij (2012) attributed two further genera from the Cenomanian Ola Formation in Magadan, Russia to Protorhyssalinae, both based on compression fossils of varying degrees of completeness. None of these compression fossils preserve diagnostic traits of the subfamily, such as the combination of multiporous plate sensilla of the antennae, the cyclostome condition of the lower face, and the



Fig. 1. Microphotograph of holotype (NIGP 163432) female of *Archaeorhyssalus subsolanus* Engel, gen. et sp. nov., in Cenomanian amber from Myanmar (scale bar = 1 mm).

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