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***Notoatherix antiqua* gen. et sp. nov., first fossil water snipe fly from the Late Jurassic of Australia (Diptera: Athericidae)**

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Abstract

The first water snipe fly (Diptera: Tabanomorpha) fossil discovered in the Late Jurassic Talbragar Fish Bed in Australia is described and illustrated. *Notoatherix antiqua* gen. et sp. nov., described from a single wing specimen, is assigned to the family Athericidae based on the diagnostic feature of this family: the vein R_{2+3} ending very near to R_1 (marginal cell closed). It is the first record of Athericidae from Australia and the oldest adult record of this family worldwide.

Key words: Brachycera, Tabanomorpha, Talbragar Fish Bed, new genus, new species, fossil insects

Introduction

The Talbragar Fish Bed near Gulgong, New South Wales, was first discovered by Arthur Lowe in 1889. While best known for its fossil fish (Woodward 1895; Wade 1941; Bean 2006) and conifers (Walkom 1921; White 1981), in recent years a considerable number of invertebrate fossils has also been recovered from the site (Beattie 2007; Beattie & Avery 2012). SHRIMP (Sensitive High Resolution Ion Microprobe) analysis of zircon crystals obtained from the site dated the bed as Kimmeridgian in age, 151.55 ± 4.27 Ma (Bean 2006). The Talbragar Fish Bed is one of only two insectiferous fossil sites of Jurassic age in Australia, the other being the older Early Jurassic (Sinemurian–Toarcian, 196.5–175.6 Ma) Mintaja (Hill River) in Western Australia (Martin 2008). The Talbragar Fish Bed lies at the junction of a terrestrial and an aquatic ecosystem of southern Gondwana and, like the Mintaja lagerstätte, its stratigraphy indicates a shallow freshwater environment (Dulhunty & Eadie 1969; Percival 1979; White 1981; Beattie & Avery 2012). It appears to have formed as a lake infilling a depression in underlying Hawkesbury Sandstone (Selden & Beattie 2013). In contrast to Mintaja, most insect specimens of the Talbragar Fish Bed are fully articulated and often well preserved.

Over 500 insect specimens have been collected from the Talbragar Fish Bed to date. The first was found more than a century ago, a homopteran named *Griphologus lowei* (Etheridge & Olliff 1890). It was originally interpreted as a cicada but is currently treated as Auchenorrhyncha: Cicadomorpha *incertae sedis* (Handlirsch 1906). Further exploration of the site between 2006 and 2014 yielded numerous additional insect specimens and enabled a palaeo-environmental reconstruction of the area (Beattie & Avery 2012). The entomofauna is dominated by Hemiptera (largely undescribed Protopsyllidiidae), followed by Coleoptera (Oberprieler & Oberprieler 2012; Cai *et al.* 2013; Fikáček *et al.* 2014). Other orders found are Odonata (Beattie & Nel 2012), Plecoptera, Orthoptera, Hymenoptera (Oberprieler *et al.* 2012), Mecoptera, Diptera (Oberprieler & Yeates 2012; Oberprieler *et al.* in prep.), Raphidioptera and Neuroptera. Other invertebrates recovered include gastropods, bivalves and arachnids (Selden & Beattie 2013). The fly described here represents the third dipteran specimen from the site but the first adult fossil of its family.

The Athericidae are a small, cosmopolitan family of Tabanomorpha comprising nine extant and six extinct genera, most previously placed in Rhagionidae (Bisby *et al.* 2011; Nugent *et al.* 2011; Zhang 2012; Evenhuis 2014). The family is poorly represented in the fossil record, with only 12 species known to date. Three fossils are described from the Cenozoic: *Atrichops hesperius* Cockerell, 1914 (Oligocene, USA), *Succinatherix avita* Stuckenberg, 1974 (Eocene, Baltic Region) and *Succinatherix setifera* Stuckenberg, 1974 (Eocene, Baltic Region)

Tasmania, two in northern Queensland (one undescribed) and one in Western Australia (Stuckenberg 2000). *Suraginella* may be Gondwanan due to its close resemblance to the Brazilian genus *Xeritha* Stuckenberg, 1966, although Stuckenberg (2000) treated it as an autochthonous faunal element of Australia.

To date there is no fossil record of Athericidae in Australia, and *Notoatherix antiqua* is the first fossil representative of this family from the southern hemisphere. Its finding shows that this family was indeed present in Gondwana as early as the Jurassic period, and to have existed in Australia throughout the Cenozoic as the Gondwanan landmass broke apart. However, its taxonomic relation to the modern genera *Dasyomma* and *Suraginella* is unclear. *Notoatherix antiqua* is not remarkably similar to any extinct or extant genus. The fossil exhibits the diagnostic wing venation feature of Athericidae described by Stuckenberg (1973), the close terminal convergence of veins R_1 and R_{2+3} , and shares two other features with other athericid genera, the cross-vein r-m meeting d further from its basal end and R_4 ending before the wing apex (noting that R_4 and R_5 are fused in *Notoatherix*). Given the distinctive venation of *Notoatherix antiqua* we have been unable to affiliate it with any other known genera of Athericidae. It is somewhat similar to some species of *Dasyomma* (e.g. *Dasyomma basale* Malloch, 1932), in that the base of R_{4+5} is just beyond crossvein r-m, and also to some species of *Suragina* in that cross-vein r-m almost meets the discal cell at its mid-point (e.g. *Suragina monogramma* Bezzi, 1926 and *S. milloti* Séguy, 1951).

The discovery of *Notoatherix antiqua* adds to the diversity of aquatic insect taxa already identified from the Talbragar Fish Bed (see Beattie & Avery 2012). The palaeo-environment of this locality appears suitable for athericids. Larvae of modern species occur in freshwater streams and typically prey on chironomid larvae and other smaller invertebrates such as Ephemeroptera nymphs (Mostovski *et al.* 2003; Nel *et al.* 2014). Indeed, small culicimorph larvae have been found in the Talbragar Fish Bed (Beattie & Avery 2012). Adults of extant athericids fly among vegetation bordering streams and feed on nectar, and some species (only females) also feed on the blood of mammals or frogs (Stuckenberg, 2000; Mostovski *et al.* 2003; Nel *et al.* 2014). *Notoatherix antiqua* is the third dipteran known from the Talbragar Fish Bed to date (Oberprieler & Yeates 2012; Oberprieler *et al.* in prep.), and its discovery holds hope for further findings of Diptera that may broaden our understanding of dipteran evolution and diversification throughout the Jurassic.

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