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A re-description of the fossil damselfly *Eolestes syntheticus* Cockerell, 1940 (Odonata: Zygoptera: Eolestidae n. fam.) with description of new taxa from the Eocene of North America

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Abstract

The enigmatic species *Eolestes syntheticus* Cockerell, 1940, from the Early Eocene of North America, previously attributed to the lestoid family Synlestidae, is re-examined in light of the discovery of new material from the Middle Eocene Kishenehn Formation in northwestern Montana. *E. syntheticus* and a new species, *Eolestes ramosus* **sp. n.**, are attributed to a new family Eolestidae **fam. n.**. In addition, a new genus and species very closely related to Lestidae but assigned to family unknown, *Lutetialestes uniformis* **sp. n.**, is described from the Kishenehn Formation.

Key words: taxonomy, fossil insects, Lestoidea, Middle Eocene, Montana, Kishenehn Formation, Green River Formation

Introduction

Damselflies (suborder Zygoptera) constitute approximately half of all Odonata with about 3,000 described extant species as of 2014 (Schorr & Paulson, 2014). The suborder has repeatedly been demonstrated to be monophyletic, in both molecular and morphological analyses (Bechly, 1996; Rehn, 2003; Bybee *et al.*, 2008; Carle *et al.*, 2008; Dumont *et al.*, 2010; Dijkstra *et al.*, 2014). Trueman (1996, 2007) however has argued to the contrary in proposing that Zygoptera is paraphyletic and ancestral to all other modern odonates. Within the suborder, the basal superfamily Lestoidea *sensu* Dijkstra *et al.* (2013) (= Lestomorpha *sensu* Bechly, 1996) appears to be the sister group to all other Zygoptera and has been shown to be monophyletic. The phylogenetic relationships of the constituent families of Lestoidea, the monotypic Hemiphlebiidae and Chorismagrionidae, Perilestidae, Synlestidae, Megalestidae and Lestidae, are still a matter of much discussion (Bybee *et al.*, 2008; Carle *et al.*, 2008; Dumont *et al.*, 2010; Davies *et al.*, 2011; Dijkstra *et al.*, 2014).

The fossil record of Lestoidea is relatively poor. In an extensive review of the extinct members of the superfamily, defined then as including the additional extant family Megapodagrionidae and the extinct families Sieblosiidae and Pseudolestidae, Nel & Paicheler (1994) listed a total of 74 fossil species and/or specimens although approximately a third of them were of "uncertain systematic position" due largely to their fragmentary condition. Sixteen described species and 14 specimens not assigned to a species belonged to the family Lestidae. No fossils of Perilestidae existed and only one, *Eolestes syntheticus*, was assigned to Synlestidae.

Subsequent to Nel and Paicheler's review, many additional fossil species of Lestoidea have been described. Five new genera of Hemiphlebiidae, all from the early Cretaceous when this family is thought to have been widespread, have been described (Bechly 1998; Jarzembowski *et al.* 1998; Vasilenko 2005; Lak *et al.* 2009). Three new extinct monotypic families, Cretacoenagrionidae, Priscalestidae, and Austroperilestidae have been assigned to Lestoidea (Bechly 1995; Wappler & Petrulevicius 2007; Petrulevicius & Nel 2005) and three new extinct monotypic genera, *Cretalestes*, *Libanolestes*, and *Promegalestes*, assigned to either ?Lestoidea or Lestoidea, but

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