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A revision of Chrysopidae (Neuroptera) from the late Eocene Florissant Formation, Colorado, with description of new species

VLADIMIR N. MAKARKIN[1*], GWEN S. ANTELL[2] & S. BRUCE ARCHIBALD[3,4,5]

[1]*Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of the Russian Academy of Sciences, Vladivostok, 960022, Russia*
[2]*Department of Earth Sciences, University of Oxford, Oxford OX1 3AN, United Kingdom*
gwenantell@gmail.com; *https://orcid.org/0000-0002-1948-6624*
[3]*Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, British Columbia, V5A 1S6, Canada*
sba48@sfu.ca; *https://orcid.org/0000-0002-4397-2497*
[4]*Museum of Comparative Zoology, 26 Oxford Street, Cambridge, Massachusetts, 02138, United States of America*
[5]*Royal British Columbia Museum, 675 Belleville Street, Victoria, British Columbia, V8W 9W2, Canada*
[*]*Corresponding author.* *vnmakarin@mail.ru;* *https://orcid.org/0000-0002-1304-0461*

Abstract

The green lacewings (Neuroptera: Chrysopidae) of the late Eocene Florissant Formation (Colorado, USA) are revised. Thirteen species in six genera of Nothochrysinae are recognized, including four new species: *Archaeochrysa cockerelli* **sp. nov.**, *Cimbrochrysa americana* **sp. nov.**, *C. major* **sp. nov.**, and *Lithochrysa meyeri* **sp. nov.** The validity of the genus *Dyspetochrysa* Adams, 1967 is tenuous; it might be a synonym of *Archaeochrysa* Adams, 1967. *Lithochrysa* Carpenter, 1935 and *L. ferruginea* (Cockerell, 1909) are considered a valid genus and species. A lectotype and paralectotype of *Tribochrysa firmata* Scudder, 1890 are designated. The genus *Cimbrochrysa* Schlüter, 1982 is recorded from North America for the first time. Eocene chrysopid assemblages are briefly analyzed. The late Eocene Florissant assemblage is less diverse than those of early Eocene North America, and greatly differs from late Eocene European assemblages.

Key words: Chrysopidae, Nothochrysinae, Florissant Formation, late Eocene

Introduction

Green lacewings (Chrysopidae) are today one of most speciose families of Neuroptera with *ca*. 1100 species (Oswald 2022). They are widely accepted to consist of four subfamilies, the Apochrysinae, Nothochrysinae, Chrysopinae, and the extinct Limaiinae (*e.g*., Archibald *et al*. 2014; Winterton *et al*. 2019). Its fossil record is rich, with 71 species in 26–29 genera extending from the Middle Jurassic to the Pliocene (see Archibald *et al*. 2014; and Archibald & Makarkin 2015, 2017; Khramov *et al*. 2016; Khramov 2018; Lu *et al*. 2018; Ngô-Muller *et al*. 2019; Zhang *et al*. 2020; Huang *et al*. 2021).

The Chrysopidae of the Priabonian (late Eocene) Florissant Formation (Colorado, U.S.A.) was extensively examined in the late Nineteenth Century through early Twentieth Century, but has received little attention since (Scudder 1883, 1885, 1890; Cockerell 1908a,b, 1909a,b, 1913, 1914; Bather 1909; Carpenter 1935; Rodeck 1938; Adams 1967). Eight species of five genera are currently recognized. According to Adams (1967) these are: *Archaeochrysa fracta* (Cockerell, 1914); *A. paranervis* Adams, 1967; *Dyspetochrysa vetuscula* (Scudder, 1890); *Palaeochrysa stricta* Scudder, 1890; *P. concinnula* Cockerell, 1909; *P. wickhami* Cockerell, 1914; *Tribochrysa inaequalis* Scudder, 1885, and *T. firmata* Scudder, 1890. Adams (1967) considered the genus *Lithochrysa* Carpenter, 1935 to be a synonym of *Palaeochrysa* Scudder, 1883, but it was recently treated as valid (Archibald & Makarkin 2017). Many of these species were described incompletely or inadequately, and their revision is long overdue.

All of these belong to the subfamily Nothochrysinae, which is considered to comprise 20–22 extant and extinct genera. Twelve are known only from the Eocene (see Discussion below) and *Pronothochrysa* Peñalver *et al*., 1995 only from the Miocene. The extant *Nothochrysa* McLachlan, 1868 and *Hypochrysa* Hagen, 1966 are also known from

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