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An unusual new fossil genus probably belonging to the Psychopsidae (Neuroptera) from the Eocene Okanagan Highlands, western North America

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Abstract

The new genus and species *Ainigmapsychops inexspectatus* **gen. et sp. nov.** is described from the early Eocene Okanagan Highlands locality at Republic, Washington, U.S.A. We preliminarily assign it to the Psychopsidae; however, its venation is unusual within this family, particularly by its pectinate branches of AA1 originating at a steep angle, a character state more suggestive of the Osmylidae.

Key words: Neuroptera, Psychopsidae, Osmylidae, Okanagan Highlands

Introduction

A rich assemblage of fossil Neuroptera has been reported in the last several decades from early Eocene Okanagan Highlands lacustrine shales, recovered from depositional basins scattered across about a thousand kilometers of southern British Columbia, Canada, into Washington State, U.S.A. (Archibald *et al*. 2011). These include 26 described species, 18 named and a further 8 unnamed, belonging to a diverse suite of families: Ithonidae (including Polystoechotidae), Chrysopidae, Hemerobiidae, Nymphidae and Berothidae (Makarkin & Archibald 2003, 2009, 2013; Makarkin *et al*. 2003; Archibald & Makarkin 2004, 2006; Archibald *et al*. 2009). We have examined about 120 Neuroptera specimens, many preserved in very fine levels of detail. Undescribed material amongst these includes new taxa of Osmylidae and Hemerobiidae, more Chrysopidae, and many more specimens of Ithonidae (Archibald & Makarkin, pers. obs.). New material emerges every field season; the Okanagan Highlands continues to reveal an increasingly important assemblage for understanding the evolution of the order in the Eocene, a critical time in the development of its modern nature.

The single Okanagan Highlands species ascribed to the silky lacewing family, Psychopsidae, was later shown to be an ithonid (Andersen 2001; later assigned to the Polystoechotidae by Makarkin & Archibald 2003, a family that was subsequently synonymized with Ithonidae by Winterton & Makarkin 2010). Here, we describe an enigmatic new neuropteran genus and species from the Okanagan Highlands locality at Republic, Washington, U. S. A., that we preliminarily assign to the family Psychopsidae—preliminarily, as its venation is very unusual within it.

Today, the Psychopsidae is composed of only 27 species, distributed in southern to central Africa, Southeastern Asia, and Australia (Tjeder 1960; New 1989; Oswald 1993b, 1994; Wang & Bao 2006). Their Mesozoic fossil record is rich (see a list of described species in Peng *et al.* 2011), but remains poorly resolved taxonomically. The oldest fossil placed in the family is the Late Triassic *Triassopsychops superbus* Tillyard, 1922 from Australia. Psychopsid fossils are rare in the Cenozoic; only five species in two genera have been described, all from the brief late Eocene–early Oligocene interval: *Propsychopsis* Krüger, 1923 from late Eocene Baltic amber (*P. helmi* Krüger, 1923; *P. hageni* MacLeod, 1971; *P. lapicidae* MacLeod, 1971) and *Miopsychopsis* Makarkin, 1991 from the late Eocene/early Oligocene (age after Archibald *et al*. 2005) locality at Amgu, in the Russian Far East (*M. relicta* Makarkin, 1991; *M. sikhotensis* Makarkin, 1991). While the forewing of *Propsychopsis* is typical for modern psychopsids, the rather unusual wing morphology of the younger *Miopsychopsis* species indicates a more distant relationship with extant members of the family.

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angle as well, similar to the condition seen in *Ainigmapsychops* (e.g., *Psychopsis mimica* Newman, 1842: New 1989: Fig. 43; *P. barnardi* Tillyard, 1925: Oswald 1993b: Fig. 32). In the Baltic amber *Propsychopsis*, the single fossil Cenozoic psychopsoid genus represented by specimens where the cubical and anal veins are preserved, this angle is slightly lower than in most extant species.

Also noteworthy, the relatively narrow cubital/anal area as found in this genus is characteristic of all extant genera of Psychopsidae and the Baltic amber *Propsychopsis*.

The costal space in most psychopsid species possesses crossveins connecting subcostal veinlets, contrary to *Ainigmapsychops*. However, the absence of costal crossveins is found in some Mesozoic genera similar to *Purbepsychopsis parallela* Jepson *et al*., 2012 (Fig. 8) and *Undulopsychopsis alexi* Peng *et al*., 2011 (Fig. 3; three crossveins are present only very proximally).

Thus, of the three character states in the *Ainigmapsychops* diagnosis distinguishing it from all Cenozoic and extant psychopsids (above), states (1) and (2) occur in some genera of the Mesozoic psychopsids. Other conditions are present either in extant (states 3, 4, 6, 7) or Mesozoic taxa (state 5). The branching mode of AA1 is the only state not yet found in this family.

For a more confident family determination of this genus we ideally need the basal and apical portions of both the forewing and the hind wing. Here, we attribute it to the Psychopsidae by the venation available on its single known fossil, which makes a better fit with this family than any other. Our placement, however, is preliminary; *Ainigmapsychops* possesses venation that is unusual for the Psychopsidae.

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