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Palaeohelicopsyche netnetdaida sp.n., a first species of Helicopsychidae (Insecta: Trichoptera) from Eocene Rovno amber

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Abstract
A new caddisfly species *Palaeohelicopsyche netnetdaida* sp. nov. (Helicopsychidae) is described and illustrated from Rovno amber (Priabonian). The family Helicopsychidae is recorded for Rovno amber for the first time. The list of caddisflies known from Rovno amber includes 43 named species.

Key words caddisflies, *Palaeohelicopsyche*, paleontology, taxonomy, Priabonian.

Introduction

The collections of caddisflies from the Rovno amber were studied for the first time in the early second decade of the 21st century (Melnitsky & Ivanov 2010, 2013, 2016a, 2016b, 2023a, 2023b; Ivanov et *al. 2016*; Perkovsky 2017; Melnitsky *et al*. 2021a, 2021b, 2021c, 2024a, 2024b). More than forty species of caddisflies are known from Rovno amber (Melnitsky *et al*. 2024b).

The family Helicopsychidae (snail-case caddisflies) comprises some 300 species in the world fauna, of which ten species reported from amber (Morse 2024; Wichard & Pankowski 2024). Species of this family live mostly in the warm streams where their larvae construct peculiar shelters resembling the shells of small snails. Five species from extant genus *Helicopsyche* and four species from the extinct genera *Electrohelicopsyche* (one species) and *Palaeohelicopsyche* (three species) were known from Eocene Baltic amber. The oldest known representative of the family is *Cretahelicopsyche liuyani* Wichard et al., 2018 found in Cretaceous Burmese amber (Wichard *et al*. 2018). Single undescribed larval case was reported from lower Eocene Wilcox Formation (south of USA) (Rasnitsyn

& Quicke 2002). Members of the family are distributed worldwide, with the greatest diversity in the tropics. The species of this family described here is the first one described from the Rovno amber. Other amber deposits are not rich in this family.

The genus *Palaeohelicopsyche* is represented by only 3 extinct species in Baltic amber: *Palaeohelicopsyche serricornis* Ulmer, 1912, *Palaeohelicopsyche grotae* Johanson et Wichard, 1997 and *Palaeohelicopsyche marki* Wichard et Pankowski, 2024. The described species is a female individual of the genus *Palaeohelicopsyche* traditionally described by males. The only female of this genus known previously was *P. serricornis* Ulmer, 1912. The authors understand that the males are most suitable for descriptions as is the rule for the extant species. Nonetheless, we describe the female of a new species because it has some bias from the *P. serricornis* in wing venation and the specimen is the first Helicopsychidae known from the Ukrainian fossil resins important for the assessment of the fauna and reconstruction of the paleoenvironment.

Material and methods

Rovno amber is the coeval of Baltic (Jenkins Shaw *et al*. 2024), Bitterfeld amber (Radchenko & Perkovsky 2021) and Danish amber (Lyubarsky *et al*. 2024), originated on Volhynian Uplift (Chemyreva *et al*. 2024a). Material was collected in former Vladimirets District (now part of the Varash District), Rovno Region (Fedotova *et al*. 2024). The specimen was entombed in the clear piece of amber (weight 4.4 grams).

We have used the conventional methods for studying the insects in ambers (Rasnitsyn & Quicke 2002). Photographs were made with a Nikon SMZ1500 microscope; drawings were traced by these photographs with corrections based on microscope observations. The wing venation is interpreted as in Wichard (2013). The holotype is deposited in the Schmalhausen Institute of Zoology, Kiev (SIZK).

Systematic paleontology

Order Trichoptera Kirby, 1813
Suborder Integripalpia Martynov, 1924
Infraorder Brevitentoria Weaver, 1984
Superfamily Sericostomatoidea Stephens, 1836
Family Helicopsychidae Ulmer, 1906
Genus *Palaeohelicopsyche* Ulmer, 1912

Palaeohelicopsyche netnetdaida **Melnitsky, Ivanov et Perkovsky sp. n.**
https://zoobank.org/urn:lsid:zoobank.org:act:686530B7-E844-4A51-9FCF-95EDA9EE6031
(Figs 1 – 2)

Type material: Holotype**.** Female. SIZK W–75, Rovno amber, late Eocene. Syninclusions absent.

Description. Body length 3.5 mm; forewing length 4.1 mm. Coloration almost uniformly brown, antennae yellowish. Wings with sparse light hairs. Antennae consist of 33 flagellomeres, scapus almost as long as the head. Length of the maxillary palp segments decreases towards the apex of palp. Lateral surface of the 1Mxp with long dark hairs, 2Mxp and 3Mxp with fewer hairs, 4Mxp and 5Mxp with numerous short chaetoid sensilla.

Wing venation: discoidal (DC) and thyridial (TC) cells are closed in forewing; DC long, 2/5 the length of the wing and 1/4 shorter than TC, F1 and F2 present; F1 wide and long, r-m cross vein long. In the hindwing, the fork 1 is present, as long as 3/2 of its stalk; forks F2, F3, and F4 absent.

Comparison. The new species differs from female of *Palaeohelicopsyche serricornis* Ulmer, 1912 in the long r-m cross vein, presence wide F5 in forewing and absence of the vein entering from behind into M_{3+4} in hindwing. The fork F1 in the hindwing in the new species is longer than in the

Palaeohelicopsyche serricornis: ratio length RS_2 to its stalk is 3/2 in new species whereas its length ratio in female *P. serricornis* is 2/3.

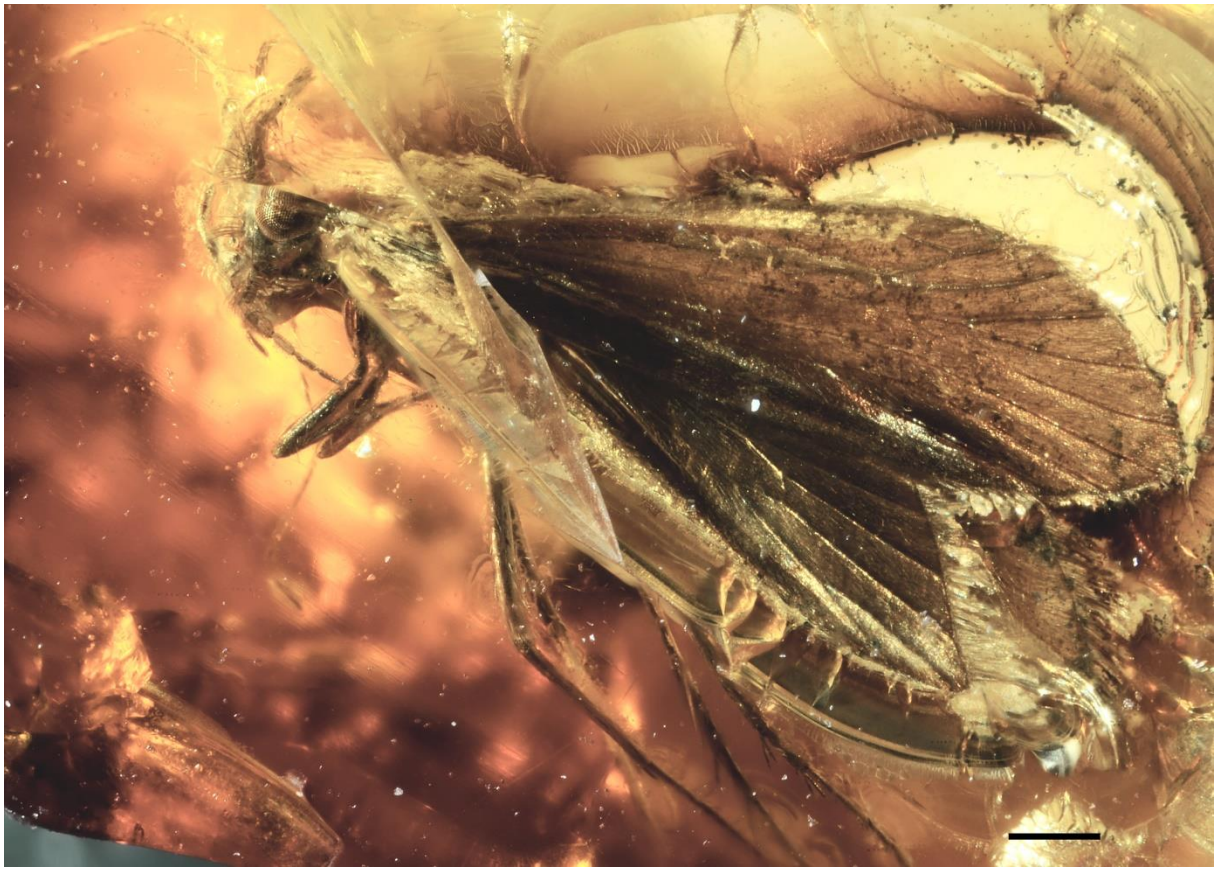

Figure 1. *Palaeohelicopsyche netnetdaida* sp. nov. Female type, general view, lateral. Scale bar = 0.5 mm.

Etymology. The specific name *netnetdaida* is indeclinable and must not agree in gender with its generic name; it derives from Russian and means "no-no, yes and yes", idiomatic expression close in meaning to the expression "very rare event".

Distribution. Priabonian Rovno amber.

Remarks. Male unknown.

Discussion

The modern fauna of the family Helicopsychidae is represented by two genera, *Helicopsyche* von Siebold, 1856 and *Rakiura* McFarlane, 1973. The bulk of the species belongs to the former genus, whereas the latter one includes a single species, *R. vernale* McFarlane, 1973, known only from New Zealand and believed to be the more archaic than *Helicopsyche*. The species of this family known from Europe have the separated areals without occurrence of several species in the same territory. Contrary, the fossil resins of Europe have several species found together in the Baltic amber. This difference might be caused by wider ecological differences in the extinct species permitting them to occupy diverse habitats. The family is not known from the Bitterfeld and the Danish fossil resin. Thus, Helicopsychidae were found only in the Baltic (3 genera, 9 species) and in the Rovno amber (1 species). Totally, some 35 helicopsychid fossils were treated by Ulmer (1912); 10 of them were *Palaeohelicopsyche serricornis.* Two more species of this genus were described in the later times (Johanson & Wichard 1997; Wichard & Pankowski 2024). This abundance of Helicopsychidae suggests that the family was rather common the fossil environments.

Some structural variations of the wing venation are notable. The length of the discoidal cell (DC) varies in great extent species to species in the fossil Helicopsychidae: in females of *Helicopsyche typica* Ulmer, 1912 ratio of DC to fore wing length is 22%, in *H. confluens* Ulmer, 1912 – 27%, in *P. serricornis* Ulmer, 1912 – 45%, and in the new species – 40%. The female structures are uniform in most of Helicopsychidae contrary to male ones showing various head projections and aberrations of wing venation. Small differences in female structures species to species make the female specimens unpopular in the taxonomy. The descriptions of the fossil females are less reliable because of poor understanding of characters suitable for the recognition of species.

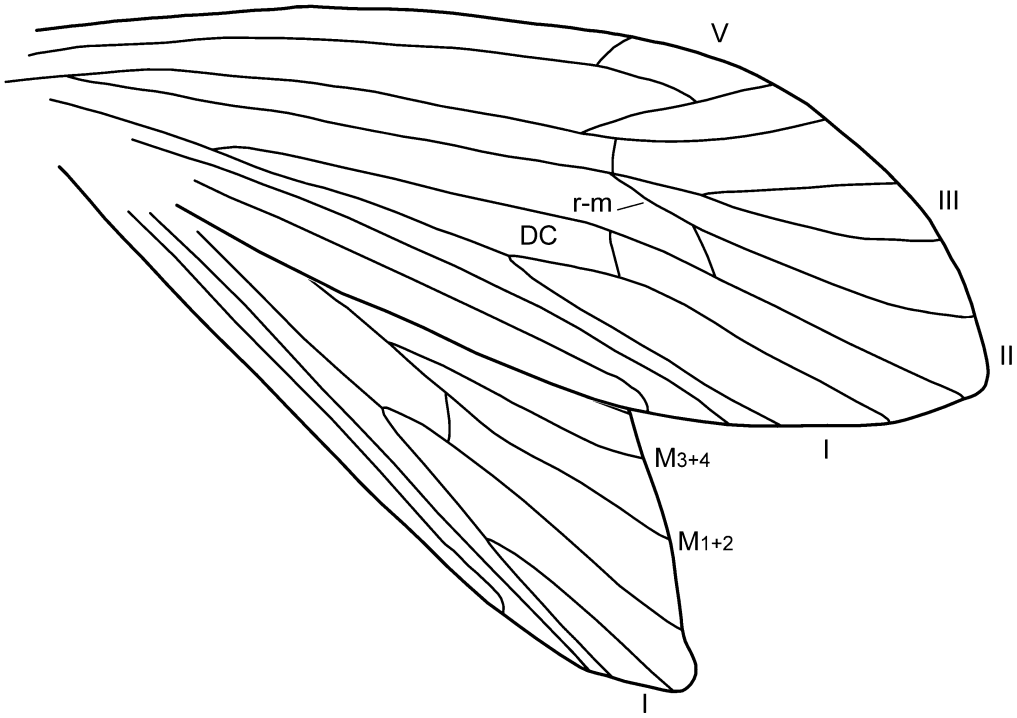

Figure 2. *Palaeohelicopsyche netnetdaida* sp. nov. Female type, wings, lateral. Designations of forks and venation are standard.

Extant *Helicopsyche* are cryophobic; this family have the northernmost limit of distribution in the Northern Hemisphere at 46 parallel in the Southern Switzerland. The southern limit of family areal in the Southern Hemisphere does not exceed 47º C in New Zealand on Stewart Island (Rakiura Island). The majority of modern fauna species inhabit the tropical streams in lowlands, although the New Zealand species *Rakiura vernale* McFarlane, 1973 lives only on Stewart Island and in cold Waikoropupu Springs on the north of South Island (largest cold springs in New Zealand) in permanently cool water (11.7º C) (Michaelis 1973). The fragmented distribution within Europe (Neu *et al*. 2018) and the high diversity in the tropics earmark Helicopsychidae as relics of a once species-rich Tertiary fauna, most probably from Eocenic forest habitats (Malicky 2005). This finding of the tenth species of Helicopychidae in the European amber confirms the Malicky's (2005) opinion on the richness of the Eocene European fauna of Helicopsychidae in amber forests. Similar to other cryophobic taxa (e. g. Legalov *et al*. 2023; Nabozhenko & Perkovsky 2023; Chemyreva *et al*. 2024b; Jenkins Shaw *et al*. 2024), the warm-adapted caddisflies consists the majority of the taxa endemic for the Rovno amber (Melnitsky *et al*. 2024a, 2024b).

Together with the new species, only 27.9% Trichoptera material identified to species are known from the Baltic amber. The newly described species is the first non-polycentropodid caddisfly species from the Varash District. More findings from this region would bring new species to be compared with more explored fauna of the Klesov deposit. The new material obtained from Varash District in last decade (e.g., Perkovsky *et al*. 2020; Matalin *et al*. 2021; Yamamoto *et al*. 2021; Olmi & Perkovsky 2022; Belokobylskij *et al*. 2023) with very interesting findings of other orders stresses the importance of continuing sampling in this area.

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