

## Short communication

## Family Kambaitipsychidae (Insecta, Trichoptera) in mid-Cretaceous Burmese amber

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## ABSTRACT

The rare family Kambaitipsychidae (Trichoptera, Annulipalpia) is now reported from mid-Cretaceous Burmese amber with *Kambaitipsyche malaisei* sp. nov., distinguished by two-segmented inferior appendages in combination with five-segmented maxillary palps, the terminal segments both annulated and flexible, tibial spurs 3/4/4 and apical forks I and II sessile at crossvein s and the median fork at crossvein m-cu in fore- and hind wings. The two extant species of this family live in northeastern Burma and in Thailand. The Cretaceous fossils bridge a long geological time gap of about 100 million years and the related extant species are still endemic in Myanmar and Thailand nowadays.

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## 1. Introduction

The trichopteran family Kambaitipsychidae Malicky, 1991 is one of the smallest families in the order Trichoptera (Chamorro & Holzenthal, 2011). The only genus *Kambaitipsyche* is currently represented by two species, *K. hykriion* Malicky & Chantaramongkol, 1991 and *K. schmidi* Malicky, 1991, and has only been found in Burma (Kambaiti) and Thailand.

It is unusual and yet to be expected that the extinct ancestors of the genus *Kambaitipsyche* are also found in Cretaceous Burmese amber with an age of almost 100 Ma (Cenomanian): a caddisfly adult has been found which undoubtedly belongs to this genus. In this paper, we describe the fossil species and try to clarify the phylogenetic relationship with the extant representatives of the family Kambaitipsychidae.

## 2. Materials and methods

The amber piece bearing the caddisfly inclusion in Burmese amber originating from the northern districts of Myanmar. Most Burmese amber comes from the amber mine located near Noije Bum Village, Tanaing Town (Kania et al., 2015; Fig. 1; Jarzembowski et al., 2017). The age provided by U–Pb dating of zircons from the volcanoclastic matrix of the amber is early Cenomanian (98.8 ± 0.6 Ma) (Shi et al., 2012).

The fossil specimen represents a nearly complete male adult, visible in ventral and dorsal view. The hindwings are partially covered by the forewings. On the fore- and hind wings, not all crossveins are clearly visible. The male genitalia are only visible in oblique ventral view.

Photographs were taken using a Leica stereomicroscope M 420 apozoom in combination with a Canon EOS 80D, EOS utility software, and Zerene Stacker software. All images and figures were processed with Adobe Photoshop CS4 and Photoshop Elements 15.

Abbreviations: Wing venation terminology generally follows Holzenthal et al. (2007):

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Fig. 1. *Kambaitipsyche malaisei* sp. nov., holotype (NIGP170801). A. Adult in dorsal view. B. Adult in ventral view. C. Forewing venation. D. Hindwing venation. The scale in B applies to all pictures (A–D).

I – apical fork I; II – apical fork II; III – apical fork III; IV – apical fork IV, V – apical fork V; R – radius, Rs – radius sector, M – media, DC – discoidal cell, MC – median cell, TC – thyridial cell.

In the male genitalia: inf ap – inferior appendages, harp – harpago, coxo – coxopodite.

**3. Systematic palaeontology**

Order Trichoptera Kirby, 1815.  
Suborder Annulipalpia Martynov, 1924.  
Family Kambaitipsychidae Malicky, 1991.

Type genus: *Kambaitipsyche* Malicky, 1991.

**Family diagnosis** (modified from Malicky, 1991 and Chamorro & Holzenthal, 2011). The family Kambaitipsychidae is clearly distinguished from all extant and extinct families of Trichoptera by the two-segmented inferior appendages in combination with the following characters: five-segmented maxillary palps consisting of 1st and 2nd segments uniformly short and 5th segment longest, annulated and flexible; tibial spur formula 3/4/4; in fore- and hindwings, apical forks I and II sessile at crossveins and median fork at crossvein m-cu.

**Remarks.** The comparison of genus *Kambaitipsyche* with the genera of the family Polycentropodidae shows that *Kambaitipsyche* has a similar wing venation as *Neureclipsis*: in the forewing, apical forks I–IV complete, in the hindwing apical fork IV lacking (Johanson et al., 2012). *Kambaitipsyche* and the dipseudopsid *Phylocentropus* have also some similar characteristics, e.g. fore- and hindwings with venation forks I and II sessile (Weaver, 2019). However genus *Kambaitipsyche* clearly differs from the Polycentropodidae and Dipseudopsidae by the two-segmented inferior appendages.

Genus *Kambaitipsyche* Malicky, 1991.

Type species: *Kambaitipsyche schmidi* Malicky, 1991.

Genus diagnosis. Same as family diagnosis.

***Kambaitipsyche malaisei* sp. nov.**

(urn:1sid:zoobank.org:act:2CE40912-0808-43F9-9A27-E70E0F90D706).

Figs. 1, 2.

**Holotype.** Male NIGP170801, deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences. Burmese amber, Upper Cretaceous, Cenomanian; from a mine near Noije

Bum Village, Tanaing Township, Myitkyina District, Kachin State, Myanmar. Fossil well preserved in amber, forewings in dorsal view, hindwings covered dorsally by the forewings. Antennae and legs present. Male genitalia visible in ventral view.

**Etymology.** *Kambaitipsyche malaisei* sp. nov. is dedicated to the Swedish entomologist Rene Malaise (1892–1978), the inventor of the “Malaise trap”. During the 1934 expedition to Kambaiti in northeastern Burma, Malaise collected caddisflies, which helped establish the trichopteran family Kambaitipsychidae.

**Diagnosis.** New *Kambaitipsyche* species characterized by the male genitalia with the two-segmented inferior appendages consisting of a long coxopodite and an elongate harpago, apically enlarged and formed as a toothed disc.

**Description.** Head without ocelli. Flagellum shorter than forewing, consisting of about 24 flagellomeres plus a stronger scapus and a small pedicellus. Flagellomere elongated, each with a dark ring in the middle. Five-segmented maxillary palps, consisting of 1st and 2nd segments, almost equally short and hairy (bristled), 5th segment longest, annulated and flexible. Labial palps three-segmented, terminal segment longer than 1st and 2nd segments, annulated and flexible.

Wings (Figs. 1 C, D). Forewing about 5 mm in length. Hindwing about 4 mm in length, little broader than the forewing. In forewings, apical forks I – V present, forks I, II sessile, forks III, IV and V petiolate. Discoidal cell short, closed with crossvein s at forks I and II, median cell closed with the crossvein m, not clearly visible and thyridial cells large, closed with crossvein m-cu at median fork. Cubitus Cu2 and anus A1 coinciding at arcus. In hindwing, apical forks I, II, III and V present, fork IV lacking, forks I and II sessile, forks III and V petiolate. Discoidal cell closed with crossvein s at forks I

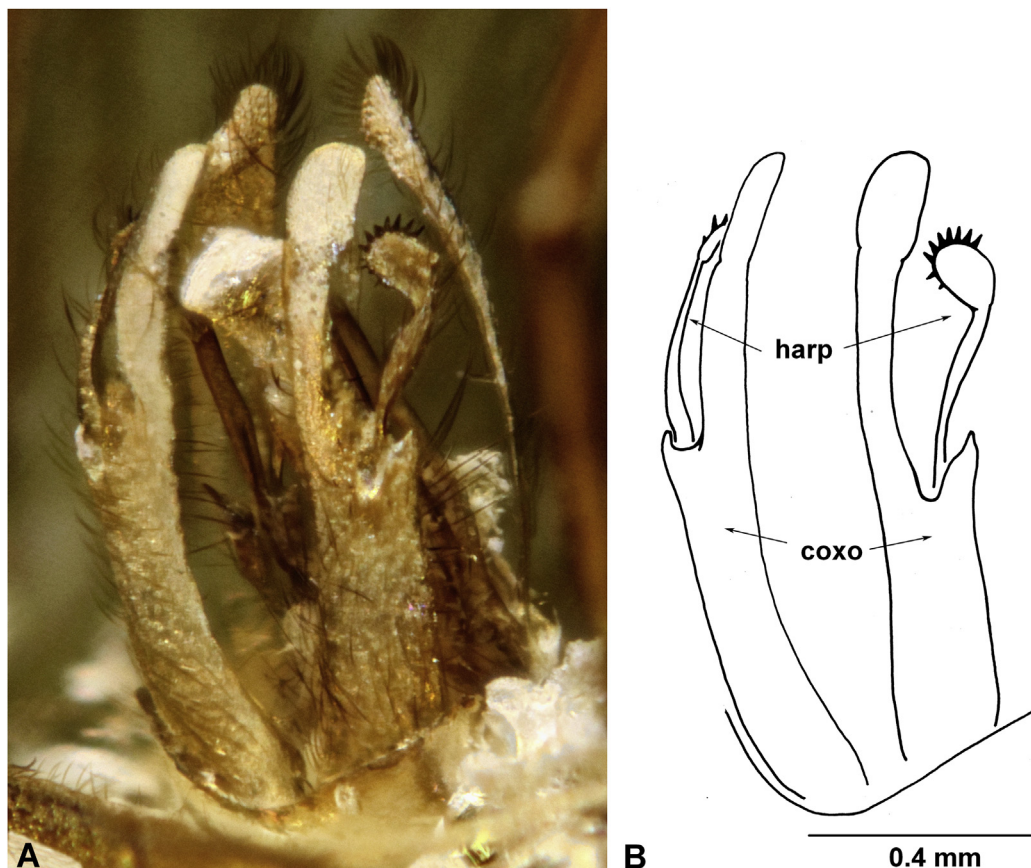


Fig. 2. *Kambaitipsyche malaisei* sp. nov., holotype (NIGP170801). A. Male genitalia in ventral view. B. Inferior appendages in ventral view.

and II and thyridial cells closed with crossvein m-cu at median fork; median cell open.

Male genitalia (Fig. 2). Inferior appendages two-segmented, consisting of the basal coxopodite and the harpago. About halfway along the inferior appendage, the basal coxopodite forming two distal extensions, a small frayed lobe and a finger-shaped prolongation, as long as the second half of the inferior appendage and distally thickened. Apical harpago inserted between the extensions, stalked and apically extended to a disc, looking like a toothed wheel, a disc surrounded by about ten triangular black teeth. So far as visible in oblique ventral view: sclerotized preanal appendages long, narrow and pointed, curved inwards, at base probably forked; intermediate appendages also long and narrow, gradually subtriangularly extended, apically broad, the longest appendages in the male genitalia. Phallic apparatus centrally located, shorter than the inferior appendages, inclined ventrally, details not visible.

#### 4. Discussion

The entomologist Rene Malaise undertook an expedition to Burma in 1934 and collected interesting insects, including caddisflies, in the northeastern Kambaiti region on the border with China (Vardal & Taeger, 2011). Malicky (1991) described *Kambaitipsyche schmidi* found in Kambaiti and established the subfamily Kambaitipsychinae within the family Polycentropodidae. Chamorro & Holzenthal (2011) analyzed the morphological characters and erected the family Kambaitipsychidae Malicky, 1991, close to the Polycentropodidae. It is amazing that in Burma, Myitkyina District, only few hundred kilometres west of Kambaiti, the fossil caddisfly *Kambaitipsyche malaisei* sp. nov. was found in mid-Cretaceous Burmese amber.

Another adult caddisfly was found in Cretaceous Lebanese amber, *Ecnomus cretacia* Wichard & Azar (2017) and belongs to the extant African *natalensis*-group of *Ecnomus*, indicated by the tibial spurs 2/4/4 as opposed to the usual 3/4/4 in *Ecnomus*, and in the male genitalia by inferior appendages with an apical elongate finger-like lobe. The *natalensis*-group of *Ecnomus* includes about 23 extant species exclusively distributed in Africa (Barnard & Clark, 1986), found in South Africa, in central Africa, in the Ethiopian region and northwards up to Palestine, and to Galilee in northern Israel (Botosaneanu, 1992). The northernmost representative of the *natalensis*-group is *E. galilaeus* Tjeder (1946) which lives very close to the location where the extinct *Ecnomus cretacia* was also found in Lebanese amber, older than 130 million years.

#### 5. Concluding remarks

The genus *Kambaitipsyche* remains in the native Burma as well the *natalensis*-group of *Ecnomus* lives endemically in Africa (Wichard & Azar, 2017). The extant Kambaitipsyche continuously bridges a long geological period of about 100 million years, which corresponds to a series of about 100 million generations of the

univoltine insects. The occurrence of extant Kambaitipsyche in mid-Cretaceous amber provides evidence for long-time persistence and biogeographic philopatry within the endemic Trichopteran family Kambaitipsychidae.

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