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A new genus and species of polypore fungus beetle in Upper Cretaceous Burmese amber (Coleoptera, Tetratomidae, Eustrophinae)

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ABSTRACT

A new polypore fungus beetle is described and figured from an individual preserved in Upper Cretaceous (Cenomanian, ca. 99 Ma) amber from northern Myanmar. *Cretosynstrophus archaicus* gen. et sp. nov. is confidently placed in the extant subfamily Eustrophinae based on its elongate oval body and pronotum with two basal, sublinear impressions. It shares several characters belonging to two Recent tribes (Eustrophini and Holostrophini), but it cannot be attributed to either of them. Together with other tetratomid genera from the Cretaceous, the new discovery implies that the Recent small family Tetratomidae is much more diverse and more widespread than previously documented. In addition, a morphological similarity between *Cretosynstrophus* and extant *Synstrophus* suggests a similar fungi feeding habit for *Cretosynstrophus*, highlighting an ancient association between tetratomid beetles and fungi in the Mesozoic.

1. Introduction

The tenebrionoid family Tetratomidae, also known as polypore fungus beetles, consists of three subfamilies, 13 genera and over 150 species, occurring in Holarctic, Neotropical, Afrotropical and Madagascan regions (Lawrence and Leschen, 2010). Tetratomidae are usually associated with fresh or softer fruiting bodies of various wood-rotting fungi, and their larvae feed internally on hyphal tissue (Lawrence and Leschen, 2010). Their hosts include a wide variety of Basidiomycetes mainly in the family Polyporaceae (Leschen, 1990; Lawrence, 1991; Nikitsky and Schigel, 2004). Very few comprehensive phylogenetic analyses for Tenebrionoidea have been completed; the study by Lawrence et al. (2011), based on morphological characters of adults and larvae of the entire Coleoptera, used three exemplar taxa from Tetratomidae. Monophyly of Tetratomidae was not supported in this analysis. An earlier study by Beutel and Friedrich (2005) hypothesized Tetratomidae as part of a very large, unresolved branch of basal Tenebrionoidea. Higher level molecular phylogeny of darkling beetles (Tenebrionidae) suggests that Tetratomidae was paraphyletic (Kergoat et al., 2014).

The systematic position of the Eustrophinae Gistel, 1856 has been controversial for a long time. Some taxonomists suggested it as a part of Melandryidae (Arnett, 1968; Lawrence and Newton, 1995), and some proposed it is an element of Tetratomidae (Crowson, 1964; Viedma, 1971; Hayashi, 1975; Nikitsky, 1998). Nikitsky (1998) regarded it as a subfamily of Tetratomidae based on both adult and larval characteristics, although the morphology-based phylogeny by Lawrence et al. (2011) did not supported the monophyly of this classification and proposed the genus *Eustrophopsis* Champion (Eustrophinae) as the sister taxon to *Orchesia* Latreille (Melandryidae). The world fauna of Eustrophinae comprises 5 genera and 86 species, distributed worldwide except for Australia and New Zealand (Pollock, 2012). The members of Eustrophinae are characterized by an elongate oval body, often strongly narrowed posteriorly; simple and narrow tarsi; antennomeres 3–7 somewhat broadened or at least some antennomeres transverse; metanepisternum distinctly subdivided into two sections; metendosternite without laminae (Pollock, 2012). Nikitsky

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(1998) divided this subfamily into the two tribes Eustrophini and Holostrophini. The former can be easily distinguished from the latter by outer faces of meso- and metatibiae with numerous oblique, comb-like ridges (*Eustrophus* and *Eustrophopsis*) or contiguous eyes (*Synstrophus*). The natural history of larvae and adults are associated with fungi on dead trees (Lawrence, 1991; Pollock, 2008).

Compared to other fossil tenebrionoids, fossil tetratomids are very rare. To date, only two tetratomid fossils are known from the Mesozoic. Nikitsky (1977) described a new genus and species (*Pseudohallomenus cretaceus* Nikitsky) from the Late Cretaceous amber of Kheta Formation, Taimyr Peninsula, Russia. *Pseudohallomenus* Nikitsky was placed in Eustrophinae, which was regarded as a subfamily of Melandryidae (Nikitsky, 1977). Wang and Zhang (2011) listed the genus as a member of Tetratomidae (subfamily Eustrophinae), while Soriano et al. (2014) still leave it in Melandryidae. Recently, Alekseev (2014) transferred *Pseudohallomenus* from Melandryidae to the extant subfamily Hallomeninae of Tetratomidae. The other Mesozoic tetratomid, *Synchrotronia idinineteena* Soriano and Pollock, is from the Lower Cretaceous (Albian) French amber, which closely resembles the extant *Pseudoholostrophus* Nikitsky (Soriano et al., 2014).

In the present paper, we describe a new genus and species of Tetratomidae based on an individual preserved in the Upper Cretaceous Burmese amber. The new genus belongs to the extant subfamily Eustrophinae. It shares several characters belonging to two Recent tribes (Eustrophini and Holostrophini), but it cannot be attributed to either of them (see Discussion section for details).

2. Material and methods

The single specimen is derived from amber deposits in the Hukawng Valley of northern Myanmar. The mining is done at a hill named Noije Bum, near Tanai. An overview of the amber deposit and its geological settings was made by Zherikhin and Ross (2000), Grimaldi et al. (2002) and Ross et al. (2010). Recent U–Pb zircon dating constrained the Burmese amber to a maximum age of 98.79 ± 0.62 Ma, which is equivalent to the Late Cretaceous (earliest Cenomanian; Shi et al., 2012). The fossil-containing amber was prepared using a mini table-saw, polished with emery papers with different grain sizes, and finally lustrated with polishing powder. Photographs were taken using a Zeiss Discovery V20 stereo microscope and a Zeiss Axio Imager 2 compound microscope with a digital camera attached respectively. Photomicrographs with green background were taken using a fluorescent light source attached to a Zeiss Axio Imager 2 compound microscope.

3. Systematic palaeontology

Order: Coleoptera Linnaeus, 1758
Family: Tetratomidae Billberg, 1820
Subfamily: Eustrophinae Gistel, 1856
Tribe: Unknown

Genus ***Cretosynstrophus*** gen. nov.
Type species: *Cretosynstrophus archaicus* gen. et sp. nov., here designated.

Etymology. The genus name is composed of the prefix *Creto-* derived from the Cretaceous and the extant genus *Synstrophus*. It is masculine in gender.

Diagnosis. The new genus can be separated from other tetratomid genera by the following combination of characters: body small-sized; eyes nearly contiguous; antennae long, extending to basal third of elytra; antennae with each antennomere elongate distinctly longer than wide; anterior pronotal margin protuberant; posterior pronotal edge with a strongly produced mesal lobe; elytra long, gradually pointed toward apex; elytral surface densely setose, without rows of punctures; meso- and metatibiae with scattered short spines, without distinct ridges; all tarsi elongate; empodia bisetose.

Description. Body small, fusiform. Both surfaces clothed with very fine, dense and decumbent hairs.

Head slightly declined, not constricted posteriorly. Eyes large, almost meeting dorsally, shallowly emarginate, coarsely facetted, with distinct interfacetal setae. Antennal insertions exposed from above; subantennal groove absent. Frontoclypeal suture absent. Labrum transverse, with anterior margin convex. Antennae 11-segmented, filiform. Mandible short and broad. Gular sutures widely separated.

Pronotum 0.6 times as long as wide, widest posteriorly, slightly narrower than elytral bases, sides narrowed anteriorly; lateral pronotal carinae complete, visible from above; posterior angles strongly acute; disc with paired, very weak, basal impressions. Prosternum in front of coxae shorter than shortest diameter of procoxal cavity. Prosternal process short, ending before posterior edges of coxae, apex rounded. Procoxal cavity strongly transverse, externally broadly to narrowly open. Scutellar shield anteriorly simple, posteriorly broadly rounded.

Eytra 1.7 times as long as combined width and 3.3 times as long as pronotum; without rows of punctures. Mesoventrite medially carinate, short. Mesocoxal cavities narrowly separated, open laterally. Metaventrite with very long discrimen. Metacoxae narrowly separated, obliquely oriented, not extending laterally to meet elytra.

Legs long and slender; femora elongate; tibiae elongate, without modifications; protibiae each with one spur at apex, meso- and metatibiae each with two spurs at apex; outer edges of meso- and metatibia with scattered spines, without ridges. Tarsi 5-5-4; tarsomeres without ventral lobes; pretarsal claws simple. Empodial setae present.

Abdomen with five ventrites; ventrite 1 not much longer than 2, without postcoxal lines; intercoxal process narrowly rounded.

Cretosynstrophus archaicus sp. nov.
(Figs. 1–3)

Etymology. The Latin word (adapted from Greek) "*archaicus*" means ancient.

Holotype. NIGP163303, earliest Cenomanian, Hukawng Valley, northern Myanmar; deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing, China.

Diagnosis. As for the genus (*vide supra*).

Description. Total length 3.42 mm. Body 2.25 times as long as wide; densely setose, black throughout, except several antennomeres.

Head small (Fig. 2A), 0.25 mm long and 0.48 mm wide. Eyes large, laterally protruding. Antennae densely setose (Figs. 2C and 3A), antennomere 1 elongate, twice as long as antennomere 2; antennomere 2 slightly narrower than antennomere 1; antennomeres 3–6 almost in the same shape and size; antennomeres 7–10 much darker than other antennomeres, antennomere 10 slightly shorter than antennomere 9; antennomere 11 elongate, oval-shaped.

Pronotum transverse (Fig. 3A), densely setose, 0.76 mm long and 1.26 mm wide; anterior fourth of pronotal disc with several faint longitudinal wrinkles; sides curved, with raised margin, extending onto anterior edge; lateral parts of posterior edge distinctly