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First record of the subfamily Brenthorrhininae (Coleoptera, Nemonychidae) in Cretaceous Kachin amber

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Abstract

A new tribe, Burmoptarthrini Legalov, **trib. nov.** from the subfamily Brenthorrhininae (Nemonychidae), with a new genus and species, *Burmoptarthrus storozhenkoi* Legalov, **gen. et sp. nov.**, is described and illustrated from late Cretaceous Kachin amber. This new tribe can be distinguished from the tribes Eccoptarthrini, Brenthorrhini and Distenorrhinini by its strongly constricted head capsule behind the eyes, which protrude strongly from the head. It also has a coarsely punctate and granulated pronotum and head, as well as granulated lateral pronotal margins. A key to the tribes and a list of described species of the subfamily Brenthorrhininae are compiled.

Key words: Curculionoidea, taxonomy, new tribe, new genus, new species, Myanmar, Cenomanian

Introduction

The Nemonychidae are the oldest and most primitive members of the superfamily Curculionoidea (Kuschel 1983; Legalov 2012; Gratshev & Legalov 2014). The earliest known species is known at the boundary between the Middle and Upper Jurassic (Callovian–Oxfordian) in Daohugou (Haifanggou Formation) (Legalov 2022).

The weevil beetle fauna of Burmese amber has been fairly well studied (Poinar 2006, 2008, 2009; Poinar & Bown 2009, 2021; Davis & Engel 2014; Legalov 2015, 2018, 2020, 2023; Legalov & Poinar 2015; Poinar *et al.* 2016, 2019, 2020, 2021; Clarke *et al.* 2019), but new specimens are constantly being discovered.

Nemonychidae were represented in the fauna of Burmese amber by three species from the subfamilies Rhinorhynchinae (Davis & Engel 2014; Legalov 2020; Clarke *et al.* 2019) and Cimberidinae (Poinar & Bown 2021). The systematic position of the subfamily Aepyceratinae remains controversial (Poinar *et al.* 2017; Clarke *et al.* 2019; Legalov 2020).

This paper describes a new fossil species belonging to a new genus and tribe of the subfamily Brenthorrhininae, found in Kachin amber. This is the latest record of the subfamily, and the first from Burmese amber.

Material and methods

The amber specimens were obtained from the Noije Bum Summit mine in the Hukawng Valley, which is located southwest of Maingkhwan in Kachin State (26°20′N, 96°36′E) in northern Myanmar. The site has been dated to the earliest Cenomanian stage of the late Cretaceous, giving an age of 98.79 ± 0.62 Ma (Shi *et al.* 2012). Images were taken with an AxioCam MRc5 (Zeiss) camera using a Carl Zeiss Stemi 2000 binocular microscope. The types are housed at the Institute of Systematics and Ecology of Animals, SB RAS, Novosibirsk, Russia (ISEA). The morphological terminology follows Lawrence *et al.* (2010).

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Results

Nemonychidae

Brenthorrhininae

Burmoptarthrini trib. nov.

urn:lsid:zoobank.org:act:06FDDE4B-8DAB-49AE-8308-DEC389BBE2FC

Type genus. *Burmoptarthrus* **gen. nov.**

Description. Body large (6.0 mm), subflatened dorsally, moderately sclerotized and covered with dense semierect hairs; head capsule strongly constricted behind eyes; rostrum thin and long; labrum subrectangular, transverse, free; mandibles small, not exodontous; place of antennal insertion not extended; antennae not geniculate, inserted laterally in basal part of rostrum; club not compact, its three segments free; eyes elliptical, strongly protruding from head; temples short; gular suture double; pronotum bell-shaped, weakly flattened, coarsely punctate and granulated; lateral margins of pronotum granulated; scutellum large and transverse; elytra quite wide, coarsely punctate and granulated, with greatest width behind middle; weakly punctostriate; striae indistinct; scutellar striole distinct; epipleura wide; precoxal portion of prosternum shorter than procoxal cavity length; postcoxal portion longer than precoxal portion; procoxal cavities located closer to apical margin, rounded and contiguous; mesocoxal cavities closed, rounded and separated; abdomen flattened, with ventrites free; ventrite 1 subequal to ventrite 2; trochanters not separating femora and coxae; femora without teeth; tibiae almost straight, without mucro and with two apical spurs; tarsi pseudoquadrisegmented; tarsomere 1 wide-conical; tarsomeres 2 and 3 conical-bilobed; tarsomere 5 long and narrow; claws free, strongly divergent, without teeth at base.

Diagnosis. The subfamily Brenthorrhininae consists of three Mesozoic tribes Eccoptarthrini, Brenthorrhinini and Distenorrhinini (Gratshev & Legalov 2014). The new tribe differs from three others in having the head capsule strongly constricted behind the eyes, eyes protruding strongly, the coarsely punctate and granulated pronotum and head, as well as granulated lateral margins of the pronotum. The procoxae are located closer to the apical margin of the prosternum similar to these in the tribe Eccoptarthrini. However, the tribe Burmoptarthrini also differs from the Eccoptarthrini in having small mandibles and bilobed tarsomeres 2 and 3. It can also be distinguished from the tribes Brenthorrhinini and Distenorrhinini by the location of the procoxae and the antennal insertion in the basal part of the rostrum.

Remarks. The new tribe has been placed in the family Nemonychidae based on the free labrum, the double gular suture, non-geniculate antennae, free abdominal ventrites and tibiae with spurs. It belongs to the subfamily Brenthorrhininae based on the procoxae being located closer to the apical margin of the prosternum.

Burmoptarthrus gen. nov.

urn:lsid:zoobank.org:act:0A109FBF-8DE2-4D97-A6BA-2014442D09AF

Type species. *Burmoptarthrus storozhenkoi* **sp. nov.**

Etymology. The name of the new genus is formed from the old name of Myanmar—"Burma" and part of the name "*Eccoptarthrus*", because of the relative similarity of the new genus to the aforementioned tribe members.

Diagnosis. As for tribe.

Burmoptarthrus storozhenkoi sp. nov.

urn:lsid:zoobank.org:act:B7CFF838-BBF8-48F2-8F03-20100708EE96
(Figs 1–4)

Material. Holotype, female, MA2024/1, Burmese amber, Myanmar, Cenomanian, late Cretaceous. Paratype, male, MA2018/18, Burmese amber, Myanmar, Cenomanian, late Cretaceous. The paratype is damaged. Only the front part of its body is well preserved.

Description. Body black-brown, moderately sclerotized, subflattened dorsally. Integument covered with dense semierect pale hairs.

MALE. Head capsule strongly constricted behind eyes. Labrum well developed, separated from rostrum, subrectangular. Maxillary palpi 4-segmented, flexible. Rostrum elongated, weakly curved, densely punctate, slightly thickened at apex, about 6.4 times as long as wide at apex, about 7.4 times as long as wide at mid length, about 6.7 times as long as wide at base, 1.2 times as long as pronotum. Dorsal surface of rostrum without carinae. Ventral surface of rostrum with two weak carinae. Antennae long, thin, non-geniculate, inserted laterally in basal part of rostrum, with quite long pale setae. Place of antennal insertion not extended. Distance from rostrum apex to antennal insertion 6.7 times as long as distance from rostrum base to antennal insertion. Antennomeres subconical. Antennomere 1, about 2.1 times as long as wide at mid length. Antennomere 2, about 1.3 times as long as wide at apex, about 0.5 times as long as and about 0.8 times as narrow as antennomere 1. Antennomeres 2-6 subequal. Antennomere 3, about 2.2 times as long as wide at apex, about 1.4 times as long as and about 0.8 times as narrow as antennomere 2. Antennomere 7, 1.4 times as long as wide at apex, 0.7 times as long as and slightly wider than antennomere 6. Antennomere 8, about 1.5 times as long as wide at apex, about 1.2 times as long as and 1.1 times as wide as antennomere 7. Antennal club not compact, its three segments free. Antennomere 9, about 1.7 times as long as wide at apex, about 1.2 times as long as and about 1.1 times as wide as antennomere 8. Antennomere 10, 1.5 times as long as wide at apex, 1.2 times as long as and about 1.3 times as wide as antennomere 9. Antennomere 11, 2.8 times as long as wide at base, about 1.2 times as long as and about 0.6 times as narrow as antennomere 10. Eyes elliptical, distinctly protruding from head. Temples short, about 0.8 times as long as eye length. Forehead wide, flattened, densely punctate. Pronotum bell-shaped, with arcuate sides. Disc weakly flattened, coarsely punctate and

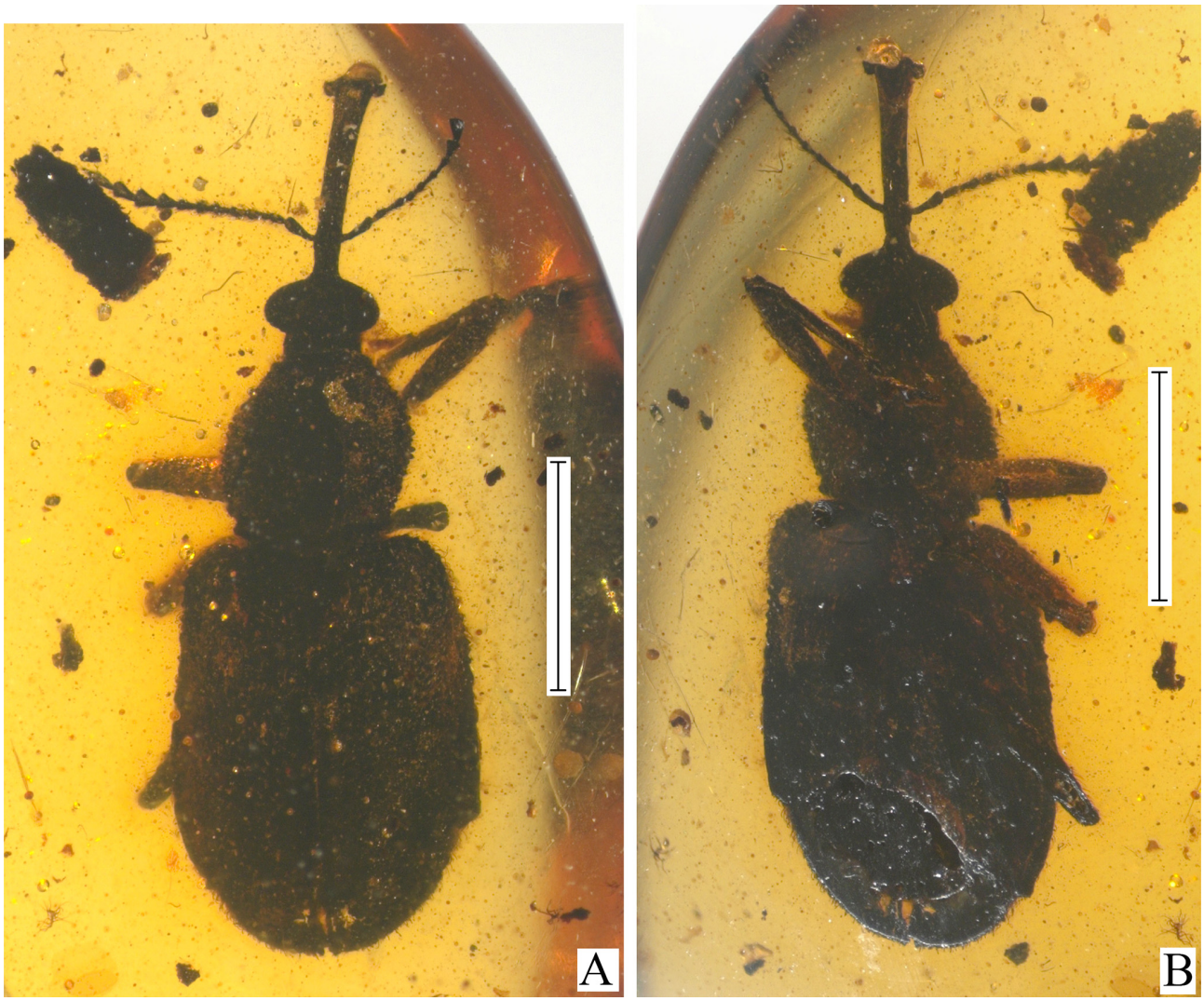

FIGURE 1. *Burmoptarthrus storozhenkoi* **gen. et sp. nov.**, holotype, female, habitus: A—dorsal view; B—ventral view. Scale bar = 2.0 mm.

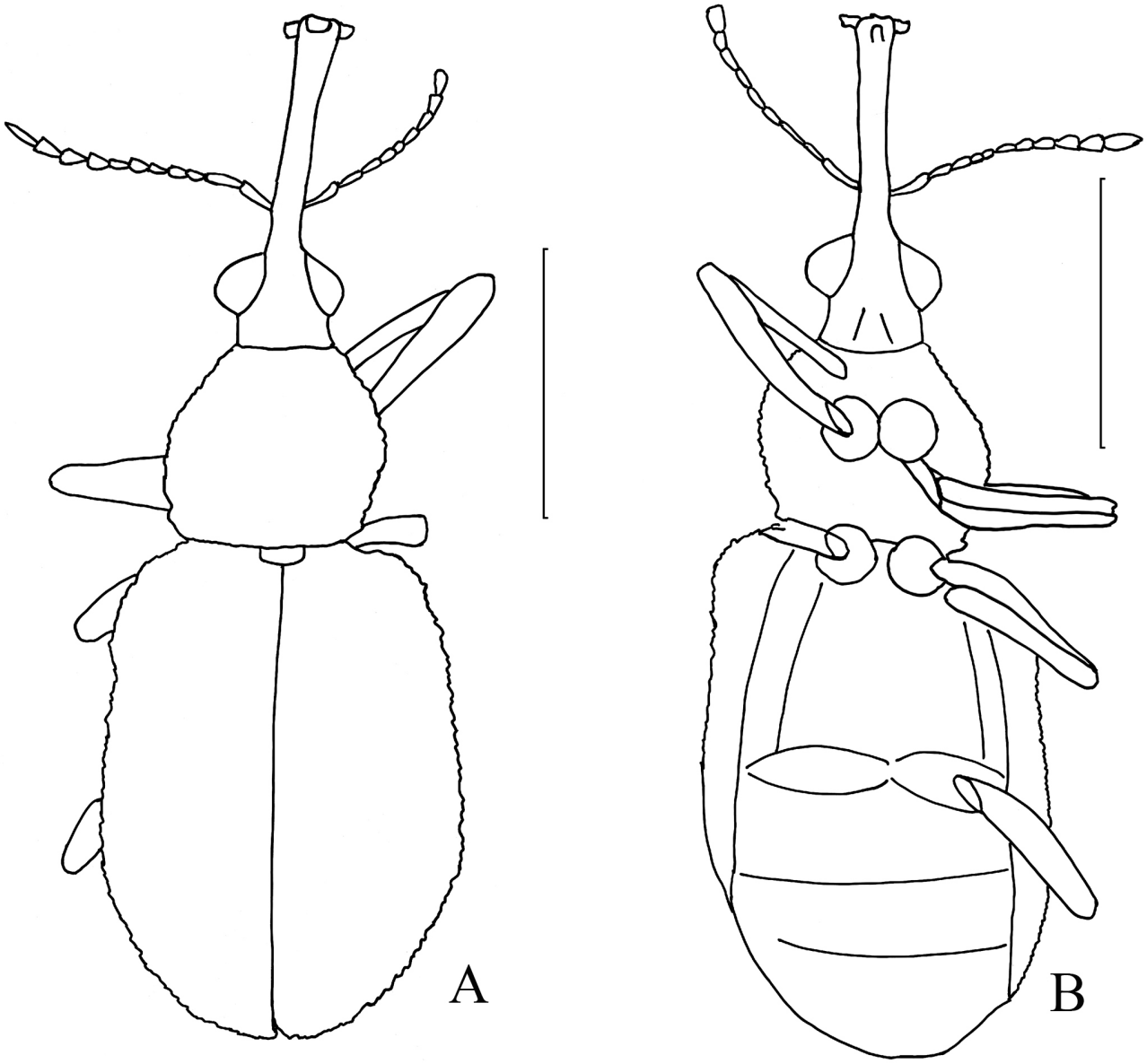

FIGURE 2. *Burmoptarthrus storozhenkoi* **gen. et sp. nov.**, holotype, female, body outline: A—dorsal view; B—ventral view. Scale bar = 2.0 mm.

granulated. Greatest width at mid length. Lateral margins of pronotum granulated. Scutellum large, subtrapezoid, about 0.7 times as long as wide. Elytra with slightly smoothed humeri. Scutellar striole distinct. Precoxal portion of prosternum about 0.8 times as long as procoxal cavity length. Postcoxal portion of prosternum about of same length to procoxal cavity length and about 1.2 times as long as precoxal portion. Procoxal cavities located near middle of prosternum, rounded and contiguous. Mesocoxal cavities rounded, narrowly separated. Legs long. Trochanters oblique. Femora quite slender, slightly incrassating subapically, covered with tubercles. Tibiae almost straight, widened at apex, covered with tubercles, without mucro; with two apical spurs. Tarsi wide, pseudoquadrisegmented. Tarsomeres 1–3 with pulvilli on lower surface. Tarsomere 1 wide-conical. Tarsomeres 2 and 3 conical-bilobed. Tarsomere 5 long and narrow. Claws free, strongly divergent, without teeth at base. Protarsi: tarsomere 1 about, 0.4 times as long as wide at apex; tarsomere 2, about 0.4 times as long as wide at apex, slightly shorter and narrower than tarsomere 1; tarsomere 3, about 0.9 times as long as wide at apex, 2.6 times as long as and about 1.3 times as wide as tarsomere 2; tarsomere 5, about 3.7 times as long as wide at apex, about 1.7 times as long as and about 0.4 times as narrow as tarsomere 3. Head and pronorum length 2.5 mm; rostrum length 2.0 mm.

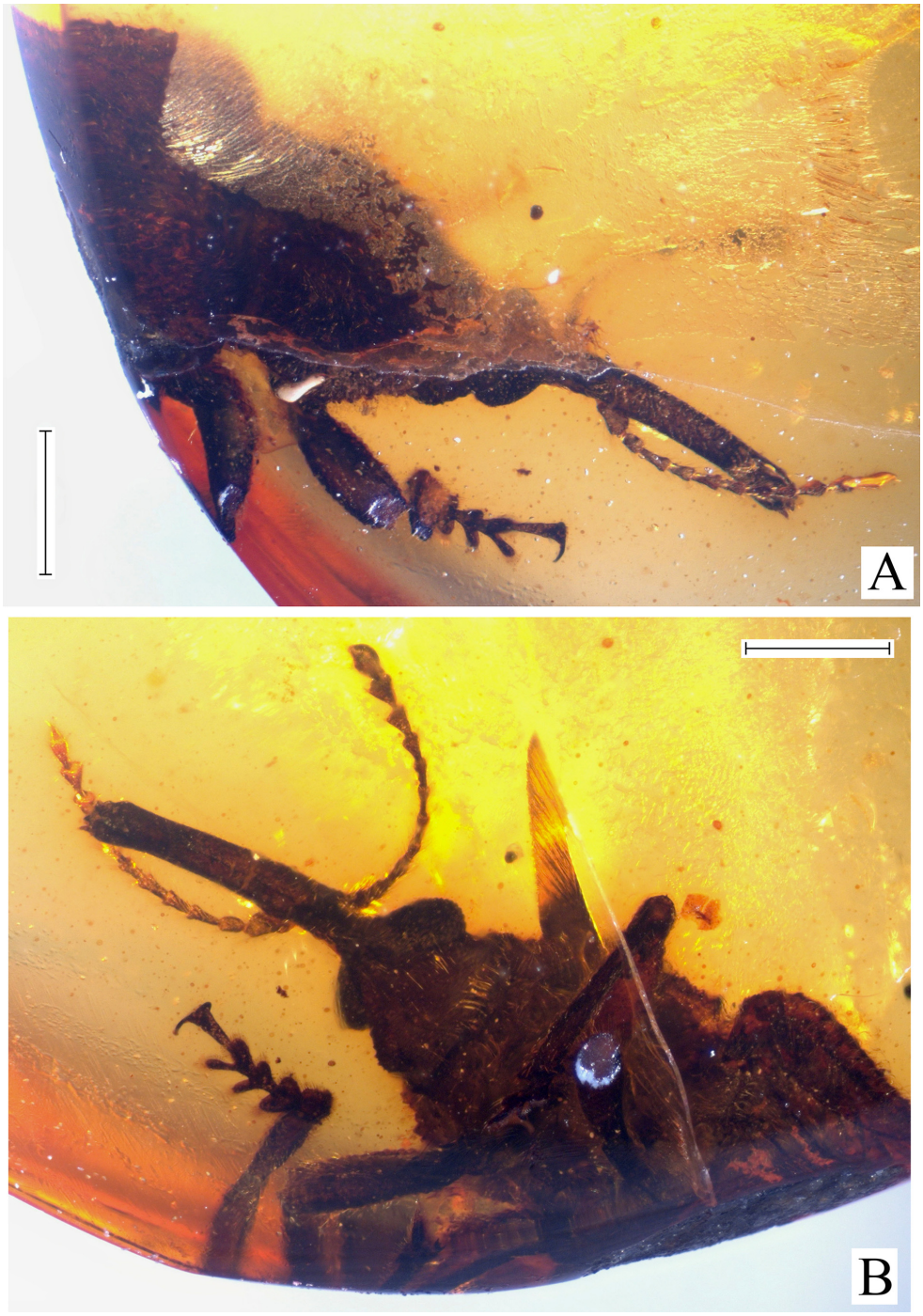

FIGURE 3. *Burmoptarthrus storozhenkoi* **gen. et sp. nov.**, paratype, male, habitus: A—dorsal view; B—ventral view. Scale bar = 1.0 mm.

FEMALE. Labrum about 0.5 times as long as wide. Mandibles small, not exodontous. Rostrum 5.0 times as long as wide at apex, about 8.3 times as long as wide at mid length, about 7.1 times as long as wide at base, 1.2 times as long as pronotum. Antennae extend beyond middle of pronotum, inserted in basal part of rostrum. Distance from rostrum apex to antennal insertion 5.6 times as long as distance from rostrum base to antennal insertion. Antennomere 1, 1.8 times as long as wide at mid length. Antennomere 2, 1.5 times as long as wide at apex, about 0.7 times as long as and 0.8 times as narrow as antennomere 1. Antennomere 3, about 3.3 times as long as wide at apex, about 2.2 times as long as and of same width to antennomere 2. Antennomere 4, about 1.3 times as long as wide at apex, about 0.5 times as long as and slightly wider than antennomere 3. Antennomere 5, about 1.3 times as

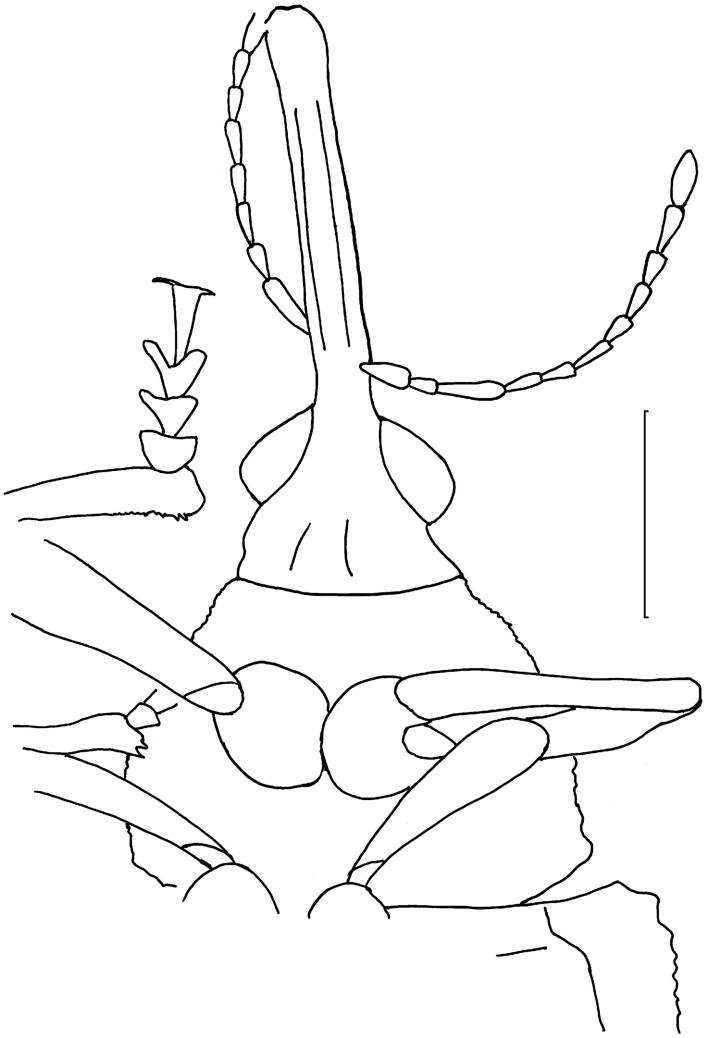

FIGURE 4. *Burmoptarthrus storozhenkoi* **gen. et sp. nov.**, paratype, male, body outline, ventral view. Scale bar = 1.0 mm.

long as wide at apex, about 0.8 times as long as and slightly narrower than antennomere 4. Antennomere 6, about 1.6 times as long as wide at apex, slightly shorter and wider than antennomere 5. Antennomere 7, about 1.6 times as long as wide at apex, slightly longer and wider than antennomere 6. Antennomere 8, about 1.1 times as long as wide at apex, of same length and about 1.4 times as wide as antennomere 7. Antennal club not compact, its three segments free. Antennomere 9, about 1.3 times as long as wide at apex, about 1.3 times as long as and about 1.1 times as wide as antennomere 8. Antennomere 10, 1.5 times as long as wide at apex, of same length and slightly wider than antennomere 9. Antennomere 11, about 3.1 times as long as wide at base, about 1.6 times as long as and about 0.8 times as narrow as antennomere 10. Eyes distinctly protruding from head. Temples about 0.4 times as long as eye length. Forehead about 1.9 times as wide as rostrum base width, flattened, densely punctate. Pronotum bell-shaped, with arcuate sides, about 2.0 times as long as wide at apex, slightly longer than wide at mid length, about 1.2 times as long as wide at base. Disc weakly flattened, coarsely punctate and granulated. Greatest width at mid length. Lateral margins of pronotum granulated. Scutellum 0.7 times as long as wide. Elytra quite wide, about 1.6 times as long as wide at base and at apical fourth, about 1.3 times as long as wide at mid length, about 2.0 times as long as pronotum; weakly punctostriate, with slightly smoothed humeri and distinct wide epipleura. Greatest width behind middle. Disc coarsely punctate and granulated. Striae indistinct. Scutellar striole distinct. Prosternum , covered with tubercles. Precoxal portion of prosternum about 0.8 times as long as procoxal cavity length. Postcoxal portion of prosternum about of same length to procoxal cavity length and about 1.6 times as long as precoxal portion. Procoxal cavities located near middle of prosternum, rounded and contiguous. Mesocoxal cavities rounded, narrowly separated. Metacoxal cavities transverse. Metaventrite convex, long, about 2.2 times as long as metacoxal

cavity. Metanepisterna about 5.7 times as long as wide at mid length, finely punctate. Abdomen weakly convex. Ventrites free. Ventrite 1, about 1.5 times as long as metacoxal cavity. Ventrite 2, slightly shorter than ventrite 1. Femora covered with tubercles, without teeth. Tibiae almost straight, widened at apex, covered with tubercles, without mucro; with two apical spurs. Tarsi wide, pseudoquadrisegmented. Tarsomeres 1–3 with pulvilli on lower surface. Tarsomere 1 wide-conical. Tarsomeres 2 and 3 conical- bilobed. Tarsomere 5 long and narrow. Claws free, strongly divergent, without teeth at base. Body length without rostrum 6.0 mm; rostrum length 1.9 mm.

Etymology. The species is named in honour of Dr. Sergei Yu. Storozhenko (Vladivostok, Russia).

Remarks. In females, the rostrum is more strongly expanded at the apex (5.0 times as long as wide at apex) and narrower in the middle (about 8.3 times as long as wide at mid length), whereas in males, it is less expanded at the apex (6.4 times as long as wide at apex) and wider in the middle (about 7.4 times as long as wide at mid length).

Key to tribes of the subfamily Brenthorrhininae

1. Procoxae located closer to apical margin of prosternum **2**
- Procoxae located at middle of prosternum **3**
2. Head capsule strongly constricted behind eyes. Eyes strongly protrude from head. Pronotum and head coarsely punctate and granulated. Lateral margins of pronotum granulated. Tarsomeres 2 and 3 bilobed. Mandibles small . . . . . **Burmoptarthrini trib. nov.**
- Head capsule not behind eyes. Eyes weakly projecting beyond head contour. Body not granulated. Lateral margins of pronotum carinate. Tarsomeres 1–3 or 3 bilobed. Mandibles large and narrow . . . . . **Eccoptarthrini**
3. Antennae inserted subapically. Rostrum weakly elongated . . . . . **Brenthorrhinini**
- Antennae inserted at middle or beyond middle of rostrum. Rostrum long . . . . . **Distenorrhinini**

A list of the subfamily Brenthorrhininae

Tribe **Distenorrhinini** Arnoldi, 1977

Genus *Distenorrhinus* Arnoldi, 1977

Subgenus *Distenorrhinus* s. str. (=*Paroxycorynoides* Arnoldi, 1977)

D. (*D*.) *angulatus* Arnoldi, 1977—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*D*. *arnoldii* Gratshev & Zherikhin, 1995)

D. (*D*.) *antennatus* Arnoldi, 1977—Karatau, Karabastau Formation, Upper Callovian–Oxfordian

D. (*D*.) *pallidirostris* Gratshev & Zherikhin, 1995—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*D*. *rotundicollis* Gratshev & Zherikhin, 1995)

D. (*D*.) *ocularis* Soriano, Gratshev & Delclòs, 2006—Montsec, Calcaires lithographiques a Plantes et Vertebres de la Pedrera de Rubies Formation, Berriasian–Barremian

Subgenus *Parabrenthorrhinus* Gratshev & Zherikhin, 1996

D. (*P*.) *sinuatipes* Gratshev & Zherikhin, 1995—Karatau, Karabastau Formation, Upper Callovian–Oxfordian

D. (*P*.) *xavieri* Zherikhin & Gratshev, 2003—Las Hoyas, Hauterivian–Barremian, La Huerguina Formation

Subgenus *Buryatnemonyx* Legalov, 2010

D. (*B*.) *gratshevi* (Legalov, 2010)—Khasurty, late Barremian

D. (*B*.) *ovatus* Gratshev & Legalov, 2014—Khasurty, late Barremian

Genus *Megabrenthorrhinus* Gratshev & Zherikhin, 1996

M. *grandis* Gratshev & Zherikhin, 1996—Karatau, Karabastau Formation, Upper Callovian–Oxfordian

M. *longicornis* Gratshev & Zherikhin, 1996—Karatau, Karabastau Formation, Upper Callovian–Oxfordian

Genus *Talbragarus* Oberprieler & Oberprieler, 2012

T. *averyi* Oberprieler & Oberprieler, 2012—Talbragar, Purlawaugh Formation, Oxfordian–Tithonian

Genus *Microbrenthorrhinus* Gratshev & Zherikhin, 2000

M. *martinezi* Gratshev & Zherikhin, 2000—Montsec, Calcaires lithographiques a Plantes et Vertebres de la Pedrera de Rubies Formation, Berriasian–Barremian

Tribe **Brenthorrhinini** Arnoldi, 1977

Subtribe **Brenthorrhinoidina** Legalov, 2003
Genus *Brenthorrhinoides* Gratshev & Zherikhin, 1996
B. mandibulatus Gratshev & Zherikhin, 1996—Karatau, Karabastau Formation, Upper Callovian–Oxfordian
B. robustus Gratshev & Zherikhin, 1996—Karatau, Karabastau Formation, Upper Callovian–Oxfordian

Subtribe **Brenthorrhinina** Arnoldi, 1977
Genus *Abrenthorrhinus* Legalov, 2009
A. brevirostris (Gratshev & Zherikhin, 1996)—Karatau, Karabastau Formation, Upper Callovian–Oxfordian
Genus *Brenthorrhinus* Arnoldi, 1977
B. mirabilis Arnoldi, 1977—Karatau, Karabastau Formation, Upper Callovian–Oxfordian
Genus *Gobibrenthorrhinus* Gratshev & Legalov, 2009
G. gigas Gratshev & Legalov, 2009—Khutuliyn-Khira, Ulugei Formation, Upper Jurassic, Tithonian

Tribe **Eccoptarthrini** Arnoldi, 1977 (=Procurculionini Arnoldi, 1977; =Eccoptothoracini Arnoldi, 1977)

Genus *Eccoptarthrus* Arnoldi, 1977 (=*Pseudobrenthorrhinus* Gratshev & Zherikhin, 1996)
E. crassipes Arnoldi, 1977—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*Pseudobrenthorrhinus crassicornis* Gratshev et Zherikhin, 1996)
E. magnus (Gratshev & Zherikhin, 1996)—Karatau, Karabastau Formation, Upper Callovian–Oxfordian
E. tenuicornis (Gratshev & Zherikhin, 1996)—Karatau, Karabastau Formation, Upper Callovian–Oxfordian
Genus *Astenorrhinus* Gratshev & Zherikhin, 1995 (=*Eccoptarthroides* Legalov, 2010)
A. elongatus (Gratshev & Zherikhin, 1995)—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*Eccoptarthroides longirostris* Legalov, 2010)
A. major (Gratshev & Zherikhin, 1995)—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*Eccoptarthroides ponomarenkoi* Legalov, 2010)
A. martynovi (Legalov, 2010)—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*Eccoptarthroides nikitskyi* Legalov, 2010)
Genus *Procurculio* Arnoldi, 1977 (=*Eccoptothorax* Arnoldi, 1977)
P. fortipes Arnoldi, 1977—Karatau, Karabastau Formation, Upper Callovian–Oxfordian (=*Eccoptothorax latipennis* Arnoldi, 1977)
P. pallens Gratshev & Zherikhin, 1995—Karatau, Karabastau Formation, Upper Callovian–Oxfordian
Genus *Cratonemonyx* Legalov, 2014
C. martinsnetoi Legalov, 2014—Santana, Santana Formation, Aptian–Albian

Tribe **Burmoptarthrini trib. nov.**

Genus *Burmoptarthrus* **gen. nov.**
B. storozhenkoi **sp. nov.**—Kachin (Burmese) amber, earliest Cenomanian

Discussion

The subfamily Brenthorrhininae comprises 25 species belonging to four tribes: Eccoptarthrini, Brenthorrhinini, Distenorrhinini, and the newly described Burmoptarthrini **trib. nov.** (Arnoldi 1977; Gratshev & Zherikhin 1995, 1996, 2000; Zherikhin & Gratshev 2003; Soriano *et al.* 2006; Gratshev & Legalov 2009, 2014; Legalov 2009, 2010a, 2010b, 2012; Oberprieler & Oberprieler 2012). This Mesozoic group is known from the Middle-Late Jurassic boundary to the beginning of the late Cretaceous.

The first representatives of the group were found in the Jurassic in Karatau (Gratshev & Legalov 2014; Legalov 2012, 2015). This is the richest Mesozoic site for the family Nemonychidae, including the subfamily Brenthorrhininae, possessing three tribes comprising 16 species from eight genera, the 64 % of the subfamily's species diversity. The

monotypic genus *Talbragarus* has been identified in the late Jurassic Purlawaugh Formation (Oxfordian–Tithonian) in Australia (Oberprieler & Oberprieler 2012; Legalov 2015). The species *Gobibrenthorrhinus gigas*, belonging to the tribe Brenthorrhinini, has been found in the Mongolian Ulugei Formation (Gratshev & Legalov 2009), which dates from the Upper Jurassic (Tithonian).

Only seven species belonging to the subfamily Brenthorrhininae have been described from the Cretaceous. Several species have been found in the late Barremian of Transbaikalia (Legalov 2010; Gratshev & Legalov 2014). The tribe Distenorrhinini is represented by three species from the genera *Distenorrhinus* and *Microbrenthorrhinus* in the Early Cretaceous (Berriasian–Barremian) of Spain (Gratshev & Zherikhin 2000; Soriano *et al.* 2006; Zherikhin & Gratshev 2003). The most recent Early Cretaceous discovery is *Cratonemonyx martinsnetoi*, which belongs to the tribe Eccoptarthrini and was found in the Aptian–Albian of Brazil (Santana Formation) (Gratshev & Legalov 2014). *Burmoptarthrus storozhenkoi* **gen. et sp. nov.** is the only species of the subfamily Brenthorrhininae dating from the earliest Cenomanian of the late Cretaceous.

The trophic links of the Jurassic Nemonychidae are of great interest. Crowson (1975) and Gratshev and Legalov (2014) have suggested an association between Jurassic Nemonychidae and Bennettitales based on the co-occurrence of their remains (Kuschel 1983). Burmese amber indicates the presence of Araucariaceae and Cupressaceae (Grimaldi *et al.* 2002; Poinar *et al.* 2007; Zhang 2017), but there are no macroremains of Bennettitales. However, pollen possibly belonging to Bennettitales has been noted (Peñalver *et al.* 2015). We can assume that *Burmoptarthrus storozhenkoi* **gen. et sp. nov.** developed on a Bennettitales representative.

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