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Burmusculidae, a new and basal family of pompiloid wasps from the Cretaceous of Eurasia
(Hymenoptera: Pompiloidea)

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Abstract

A group of aculeate wasps from mid-Cretaceous Burmese amber is described as *Burmusculus* Zhang and Rasnitsyn, gen. nov. in Burmusculidae Zhang and Rasnitsyn, fam. nov. The type genus *Burmusculus* contains three species: *Burmusculus nuwae* Zhang and Rasnitsyn sp. nov., *Burmusculus fuxii* Zhang and Rasnitsyn, sp. nov., and *Burmusculus shennongii* Zhang and Rasnitsyn, sp. nov. It does not fit any described families and therefore is referable to a new family. The family displays some features in common with the living family Pompilidae but can be easily distinguished from Pompilidae in having the mesopleuron lacking an oblique suture. Hence it is assigned to the superfamily Pompiloidea (monotypical as yet in our understanding) as the second member.

Keywords: Hymenoptera, Pompiloidea, Burmusculidae, mid-Cretaceous, Burmese amber

1. Introduction

The system and phylogeny of the aculeate wasps are currently to be attested as being in a chaotic state. Before the time of molecular phylogenetics, students were in broad disagreement from each other in various aspects, and yet there was a general consensus in respect to some important points including the monophyly of superfamilies Chrysidoidea and Apoidea, and the position of Chrysidoidea as a sister of the aculeate clade, and of Apoidea as a sister of non-chrysidoid Aculeata, either alone or accompanied with Pompilidae (sometimes also with Rhopalosomatidae) (Brothers, 1975; Rasnitsyn, 1980, 1988, 2002; Brothers and Carpenter, 1993; Ronquist et al. 1999). However, molecular data has turned the aculeate clade into a complete mess. Even the newest results published after 2010 (Heraty et al., 2011; Peters et al., 2011, 2017; Sharkey et al., 2012; Johnson et al., 2013; Klopstein et al., 2013; Smith et al., 2015, Braunstetter et al., 2017) never display Chrysidoidea as monophyletic, and show Apoidea usually monophyletic but rooted deep within the cladogram and each time with different sister groups. The above results often show Pompilidae as monophyletic with Mutillidae, either together with Sapygidae or not (Peters et al., 2011, 2017; Sharkey et al., 2012; Johnson et al., 2013; Klopstein et al., 2013 (except for a tree on fig. 2 with Pompilidae shown as monophyletic with Tiphiidae); Smith et al., 2015; Braunstetter et al., 2017). However, other results show Pompilidae as monophyletic with other taxa, namely Rhopalosomatidae (Vilhelmsen and Turrissi, 2011), Scoliidae (Heraty et al., 2011, figs. 1, 3), or with Chrysididae next to a part of Apoidea (Heraty et al., 2011, fig. 2). The reasons for this failure are debatable and lie outside the scope of the present publication (the opinion of one of the authors is presented by Rasnitsyn, 1996, 2006, 2010). These circumstances force us to rely on the comparative morphological and paleontological data when dealing with the accumulated and not assimilated yet abundant Cretaceous fossils of Aculeata.

The primary aim of the present paper is to describe a group of mid-Cretaceous aculeate wasps from the Burmese amber which does not fit any described family even though it displays some features in common with the living family Pompilidae that is in turn of questionable taxonomic position and has an unusually short fossil record (Rodriguez et al., 2016, 2017).

To define the pompiloid clade of Aculeata, we rely on the features identified as indicative by Brothers (1975) and Rasnitsyn (1980, 1988). These include, the first, the sexually dimorphic antenna (12-segmented in female and 13-segmented in male), the only synapomorphy of the non-chrysidoid aculeates (Aculeata s.str. sensu Rasnitsyn, 1980) available in fossils, usually combined with the hind wing with the jugal lobe retained (a plesiomorphy of Aculeata s.str., apomorphically lost in Chrysidoidea). Within Aculeata s.str., Pompiloidea (= Pompilidae s.l. that is, including Ceropalidae) are unique in retaining in their ground-plan (and in vast majority) a plesiomorphic metapostnotum which is fully external, ribbon-like and not impressed (apomorphically impressed and rather narrow in some disparate genera, e.g. *Machaerotherix* Haupt, *Nipponopogon* Ishikawa, *Homonotus* Dahlbom, but in known cases not as invaginated and as hidden as in any Vespoidea s.l.). In contrast, Apoidea have a far widened metapostnotum posteriorly forming a propodeal enclosure, whilst in the remaining non-chrysidoid Aculeata (Vespoidea other than Pompilidae) it is narrow, groove-like and impressed (in Sierolomorphidae) or completely invaginated between the metanotum and the propodeum and scarcely or, usually, not at all visible externally. This unique pompilid autaplesiomorphy is combined with the non-unique synapomorphy that the mid coxa is narrowly attached to the mesosoma. Until the molecular data are as contradictory as it is referred to above, we feel it possible to limit ourselves with morphological information. This makes it possible to consider Pompiloidea tentatively a monophyletic clade in unresolved sister relation to both Apoidea and the remaining Vespoidea s.l. (excluding Pompilidae). Pompilidae is known to have more putative non-unique synapomorphies such as mesopleuron with oblique suture traversing it towards the fore margin of mesoventropleuron, and using spiders as larval food. The latter feature is unfortunately

inapplicable to fossils, and the former one is not found in the fossils under description below and so is considered here as defining Pompilidae in contrast to our fossils. The line found in one of these (Figs 3A, 4B) runs much more ventral and so probably represent a different structure than the oblique suture of Pompilidae.

The principal material of the present work comes from the mid-Cretaceous Burmese amber, now the richest source of knowledge of Cretaceous insects (Rasnitsyn et al., 2016). The Burmese amber assemblage of Hymenoptera is found to be particularly rich in non-chrysidoid and non-ant aculeate wasps and opens a unique way to consider the Cretaceous diversity of these insects. The present publication is one of a series planned to pursue this aim.

2. Material and methods

All the specimens described in this paper were collected from the amber mines sited in the Hukawng Valley of Kachin State, Myanmar (locality in Kania et al., 2015: fig. 1). The rock containing the Burmese amber was radiometrically dated at 98.79 ± 0.62 Ma (Shi et al., 2012). However, we prefer to refer to the amber age informally as mid-Cretaceous, because the amber could be re-deposited (Smith and Ross, 2018) and hence older than the enclosing rocks.

All the materials are deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPAS). The ambers were studied under a Nikon SMZ-10 R stereoscopic microscope and a Nikon Optiphot compound microscope with magnifications up to $800\times$ at the State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, and using a Leica M165C stereomicroscope with a Leica DFC 420 camera at the A.A. Borissiak Paleontological Institute, Russian Academy of Sciences, in Moscow. Helicon Focus Pro $\times 64$ was used to stack photos for better depth of field. Line drawings were done using image-editing software (CorelDraw X7 and Adobe Photoshop CS6) on the basis of digital photographs. All taxonomic acts established in the present work have been

registered in ZooBank (see below), together with the electronic publication LSID:

urn:lsid:zoobank.org:pub:C638CADF-40A4-406C-8176-88D1950C3CC0

3. Systematic paleontology

Order Hymenoptera

Infraorder Vespomorpha Laicharting, 1781

Superfamily Pompiloidea Latreille, 1804

Emended diagnosis (addressed primarily to fossils). Antenna sexually dimorphic:

12-segmented in female and 13-segmented in male. Pronotum with hind margin scarcely to moderately emarginate, thin, freely overlapping mesonotum (not fitting to a respective transverse groove there), with lateral lobe reaching tegula. Metapostnotum visible externally throughout, often ribbon-like and not at all or very slightly impressed, sometimes impressed and narrow but never hidden (except rarely overhung with metascutellum), never extended far backward (as in Apoidea). Mid coxa with basal articulating orifice narrow. Hind tibial inner (hind) spur and base of hind basitarsus forming preening device. Usual and ground-plan wing venation of standard aculeate type, forewing with 1m-cu entering 2rm cell (not 1+2r cell) usually well distant from end of RS+M. Hind wing with jugal lobe present, with cu-a crossvein oblique (vertical only, and putatively secondarily, in *Homonotus* Dahlbom), and with vein A lost distally as tubular vein of cu-a crossvein (except in *Homonotus* and in one of the new species). Female metasoma with 7th tergum completely internalized, with no deep excavation between 1st and 2nd sterna.

Families included. Pompilidae Latreille, 1804 (Eocene through now, worldwide) and Burmusculidae fam. nov. (Cretaceous of Eurasia).

Remarks. We agree with Rodriguez et al. (2016) that Bryopompilidae described from the Burmese amber (Engel and Grimaldi, 2006) are not closely related to Pompilidae. The group is

insufficiently known and needs much deeper study, but for the moment we can add at least one piece of additional evidence for Rodriguez et al.'s inference. Engel and Grimaldi (2006: fig. 5) show the mesosomal dorsum essentially flat from pronotum through propodeum leaving no place for the exposed metapostnotum, which contradicts the diagnosis of Pompiloidea.

Family Burmusculidae Zhang and Rasnitsyn, fam. nov.

LSID: urn:lsid:zoobank.org:act:D516F976-2012-4574-9F0C-8B582ACF61AD

Type genus *Burmusculus* Zhang and Rasnitsyn, gen. nov.

Diagnosis. Pronotum with lateral lobes not inflated. Mesopleuron with no oblique suture. Forewing with 2-M (section of M between RS+M and 1m-cu) moderately short (comparable to 2+3-R in length) and distinctly angled with RS+M. Hind wing with cu-a oblique, angled or aligned with A, A lost or very short distal to cu-a.

Genera included. Type genus only.

Remarks. The new family can be easily distinguished from Pompilidae in having the mesopleuron lacking an oblique suture and from most Pompilidae additionally in lateral pronotal lobes not inflated. The general habitus and some other characters of the new family (e.g., form of the hind wing cu-a) are very Pompilid-like even though not free of exceptions. However, the lack of mesopleural oblique suture, generally small body size (3-6 mm which is at a lower borderline of size range in Pompilidae), and particularly a long gap in their fossil records covering all the Late Cretaceous and Paleocene, suggests the family rank of Burmusculidae.

It is also worth mentioning that diagnostic characters of the pompilid subfamilies as outlined by Loktionov and Lelej (2014) occur in various combinations within Burmusculidae which makes it problematic to seek for affinities between the latter and a particular pompilid subfamily.

Genus *Burmusculus* Zhang and Rasnitsyn, gen. nov.

LSID: urn:lsid:zoobank.org:act:1C3270B2-63BF-4351-9DBB-7628F428B54B

Type species. *B. nuwae* Zhang and Rasnitsyn sp. nov.

Etymology. The genus name is a diminutive of Burma, the old name of Myanmar, alluding to the small body size of the respective fossils. Gender masculine.

Diagnosis. As for the family.

Species included. Three species.

Remarks. Each species described below is based on a holotype only, one female and two others male. Conspecificity of the only female with one of these males cannot be excluded. However, given the revealed diversity of Burmusculidae in the Burmese amber, the conspecificity is far from being very likely. The features observed in the female do not repeat in any stable combination, even in the wing venation which is usually similar in both sexes of Pompilidae. This justifies our hypothesis of the species specifics of each fossil under description.

Burmusculus nuwae Zhang and Rasnitsyn, sp. nov.

LSID: urn:lsid:zoobank.org:act:1196B326-39D5-4868-B548-E8D7466FB58E

Fig. 1, 2

Etymology. Named after Nu Wa, a goddess in Chinese mythology; she created humans with mud and mended the sky with stones.

Holotype. Female, NIGP167950, mid-Cretaceous Burmese amber, kept at NIGPAS. Specimen well preserved, but bubbles and cracks attached to or near the body increase the difficulty of observation.

Diagnosis. Color not iridescent. Forewing cells 2rm and 3rm each longer than apical section of

RS. Temple very narrow throughout. Neither frontal lobes nor shelf above antennal base. Labrum bilobed. Maxillary palp long. Scutellum carinate laterally. Each tarsomere 1-4 of all legs with prominent plantulae.

Description. Color dark, not iridescent, surface shining, finely punctate, covered with very short hairs. Head thin with temple very narrow, occipital carina complete, circular, leaving moderately short occipital bridge. Eyes big, almost reaching mandibular base, widely emarginate medially. Ocelli in low triangle. Antennal attachment free, plain, with no frontal lobes nearby. Clypeus convex, with fore margin extending and short dentate. Antenna 12-segmented, thin, flagellomeres long (penultimate twice as long as wide), with small rounded sensilla. Labrum long and wide, bilobed; mandible thin, sickle-shaped, bidentate and cutting (with cutting edge in plane of rotation); maxillary palp long, with 4 distal segments long and thin. Hind pronotal margin moderately emarginate; notauli complete, linear, diverging cephalad; prescutellar groove wide, deep, smooth; metascutellum low; prepectus is visible as triangular plate attached to mesepisternum; propodeum moderately short. Forewing with 2-3_{rm} cells both long; cu-a antefurcal. Hindwing with 1-Cu much shorter than cu-a; cu-a long, aligned with A; basal hamuli absent but 4 medial and many distal ones present. Legs with fore tibial spur almost straight, with short comb growing basally; hind preening spur with inconspicuous comb of very short setae; each tarsomere 1-4 of all legs with prominent elongate terminal plantulae; claw long, straight and hairy ventrally before bent down short bifid apex; arolium big. Metasoma long, narrow, hypopygium not elongate, narrowly rounded apical (not visible from below).

Measurements. Total body length (original shape), 6.33 mm; head width, 0.50 mm; antennal length, 2.79 mm; mesosoma length, 2.44 mm; metasoma length, 4.17 mm; forewing length, 3.85 mm, width, 1.09 mm; hindwing length, 2.75 mm, width 0.70 mm; femur length: fore, 1.12 mm, mid, 1.29 mm, hind, 1.42 mm; tibia length: fore, 0.87 mm, mid, 1.19 mm, hind, 1.50 mm; tarsus length: fore, 1.58 mm, mid, 1.87 mm, hind, 2.23 mm.

Remarks. In the characters supposed to be less sex-dependent, the species differs from other congeners primarily in having a much larger body with both forewing rm cells long, the labrum bilobed, the scutellum carinate, and each tarsomere 1-4 of all legs with plantulae.

Fig. 1, 2

Burmusculus fuxii Zhang and Rasnitsyn, sp. nov.

LSID: urn:lsid:zoobank.org:act:97589E07-268D-44CA-8DAB-E600711D0FA6

Figs. 3, 4

Etymology. Named after Fu Xi, the first god of creation documented in Chinese history who created Eight Trigrams.

Holotype. Male, NIGP167951, mid-Cretaceous Burmese amber, kept at NIGPAS. The specimen is complete and well preserved. A small number of bubbles and debris distributed in the transparent amber piece, two large pieces of debris attached to the wings.

Diagnosis. Color iridescent. Forewing cell 3rm shorter than apical section of RS. Temple distinctly widened below. Neither frontal lobes nor shelf above antennal base. Labrum tongue-like. Maxillary palp long. Scutellum not carinate. Tarsomeres with no plantulae.

Description. Integument shiny, finely punctate, short pubescent, green and purple iridescent. Head rather thick, with temples very narrow above, widening below. Occipital carina complete, genae widely isolated. Upper frons irregularly transversely carinate (unless a deformation). Eye big, reaching mandibular base, not emarginate medially, ocelli not distinct. Antennal attachments close to each other, open, with no frontal lobes nearby except for short medial keel above them. Clypeus comparatively short, slightly convex, with fore margin rounded. Antenna 13-segmented, thick, with penultimate segment only slightly longer than wide, ultimate one acuminate. Mandible thin,

bidentate; labrum long and narrow, tongue-like; maxillary palp long, with 5 segments long and possibly basal one short (if any); labial palp short, 4-segmented, with 1st and 4th segments elongate, 2nd and 3rd almost round. Pronotum long, gently emarginate behind; notauli linear except impressed caudad, diverging cephalad; mesepipleuron with subvertical suture (thin line running downward far more ventral than oblique suture does and so not necessary represents its homolog); metanotum very high in side view; metapleural pit almost reaching meso-metapleural boundary; propodeum short. Forewing with 2rm cell long, 3rm cell short, cu-a interstitial. Hindwing with hamuli as in type species, 1-Cu much shorter than cu-a, cu-a not long, angled with A. Legs with fore tibial spur long, straight, with dense comb becoming longer toward apex; hind preening spur with inconspicuous comb of short setae meeting a row of long setae on basal basitarsus; tarsal segments apically with stronger setae (not plantulae); apical 3 fore tarsal segments strongly widened (unless deformation); claws ordinary (moderately long, acute) except fore leg claw thick, bifid. Metasoma short, fusiform in side view; sterna (at least 1-5) with subbasal transverse impression; visible parts of claspers narrow triangular in side view and very thin in upper view.

Measurements. Total body length (original shape), 3.0 mm; antennal length, 1.36 mm; mesosoma length (including neck), 1.27 mm; metasoma length, 1.63 mm; forewing length, 2.24 mm, width, 0.86 mm; hindwing length, 1.48 mm, width 0.41 mm; femur length: fore, 0.52 mm, mid, 0.54 mm, hind, 0.77 mm; tibia length: fore, 0.43 mm, mid, 0.54 mm, hind, 0.74 mm; tarsus length: fore, 0.51 mm, mid, 0.89 mm, hind, 1.15 mm.

Remarks. The species is unique in the genus in having an iridescent integument, a short forewing 3rm cell and a distinctly widened temple below.

Fig. 3, 4

Burmusculus shennongii Zhang and Rasnitsyn, sp. nov.

LSID: urn:lsid:zoobank.org:act:4058CBD1-F8A2-462B-AC96-256BFEAC0EE8)

Fig. 5

Etymology. Named after Shen Nong, the Chinese agriculture god and the inventor of Chinese medicine.

Holotype. Male, NIGP167952, mid-Cretaceous Burmese amber, kept at NIGPAS. Specimen well preserved, but the amber piece is quite disturbed with much debris.

Diagnosis. Color not iridescent. Forewing cell 2rm along RS shorter than apical section of RS. Temple moderately narrow throughout. Low shelf above antenna. Labrum tongue-like. Maxillary palp short. Scutellum not carinate. Tarsomeres with no plantulae.

Description. Integument dark, not iridescent, shiny, finely punctate, weakly leathery, short pubescent. Head not very thin, temple moderately narrow, occipital carina complete, genae widely distant leaving wide postgenal bridge. Eye big, reaching mandibular base, with inner orbits widely emarginate near and below midheight, closer to each other rostrally than caudally; ocellar triangle rather low. Antennal attachment open with adjacent low transverse shelf. Clypeus convex, extending forward, medially with three small lobes. Antenna 13-segmented, thick, with penultimate segment only slightly longer than wide, ultimate rounded. Labrum narrow tongue-like; mandible thin, bidentate; maxillary palp short, with 5 visible segments elongate; labial palp with 4 segments visible, basal one elongate and three others short, oval; pronotal hind margin rather deeply emarginate; notauli complete, linear except impressed caudad, diverging cephalad; fine adlateral lines distinct; prescutellar impression wide, deep, smooth; scutellum elongate, convex, not carinate; postscutellum not high, propodeum short. Forewing with 2rm cell short; 3rm cell medium length; cu-a slightly postfurcal. Hindwing with 1-Cu as long as cu-a; cu-a short, straight, oblique, meeting Cu distant from M for almost cu-a length, angled with A; A with short free apex; hamuli with 5 medial and 7 distal ones; jugal lobe small. Legs with claws rather long and apically short bifid

(similar to that in type species except shorter and narrowing toward bent apex, not parallel-sided); fore tibial spur short, gently bent, obliquely truncate (rudimentary bifid), with inconspicuous comb; tarsomeres apically with stronger setae (not with plantulae); hind preening spur with very short comb; metasomal sterna 1-5 simple (without transverse subbasal line); 6th with hind margin excised showing small rounded 7th one; hypopygium (8th sternum) tongue-like as visible; gonostyles narrow, narrowly rounded apical; two pairs of comparatively short, rounded lobes between hypopygium and gonostyles possibly represent volsellae and parapenial lobes; penis valves not distinct.

Measurements. Total body length, 3.71 mm; head length, 0.74 mm, width, 0.94 mm; antennal length, 1.32 mm; mesosoma length, 1.45 mm; metasoma length, 1.50 mm; forewing length, 2.46 mm, width, 1.05 mm; hindwing length, 1.66 mm, width 0.48mm; femur length: fore, 0.60 mm, mid, 0.70 mm, hind, 0.80 mm; tibia length: fore, 0.49 mm, mid, 0.77mm, hind, 0.91 mm; tarsus length: fore, 0.80 mm, mid, 1.12 mm, hind, 0.94 mm.

Remarks. The species is unique in the genus in having a short forewing 3rm cell, a frons with a low shelf above the antenna, and a short maxillary palps.

Fig. 5

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4. Concluding remarks

Burmusculidae are considered here as a basal group of Pompiloidea. Its family rank is certainly a matter of discussion, and yet we prefer to use this level of taxonomic distinction which is supported, in our eyes at least, besides the morphological differences outlined above, with a long gap in their fossil record (embracing all the Late Cretaceous and Paleocene) until the first occurrence of Pompilidae in the Early Eocene (Archibald et al., 2018).

We describe the three above fossils as three species of one and the same genus *Burmusculus*

gen. nov. in spite that the two of them based on males are different morphologically enough to merit different genus name, at least under standards developed in Pompilidae. However we can see no reason to join the sole female fossil to any of the described males and so to attribute it to any of the two possible genera. It is possible to resolve the puzzle and to create the third genus for that female, and yet we feel description of three genera for three specimens as not the best solution, the more so that one of the three would be diagnosed with characters all bond to sexual and not to taxonomic differences. Until more material is accumulated and studied, it looks safe to leave the three species as congeneric.

Unfortunately we are able to reveal no characters of *Burmusculus* indicative of a particular adaptation of these wasps. This makes it possible for us only to hypothesize the general biological features characteristic of non-chrysidoid aculeate wasps, such as a hunting behavior and provisioning the progeny in a shelter by the mother wasp. Additionally, based on the lack any of digging adaptation in the described wasps and similarity their habitus to that of Pompilidae, we hypothesize that they were not underground but surface hunters like many Apoidea, most Vespidae and Formicidae and unlike Scoliidae and Tiphidae. Unfortunately we are aware of no indication concerning the prey selection of Burmusculidae: whether they have acquired or not yet the most characteristic adaptation of Pompilidae, that is, feeding their larvae with spiders.

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Figure captions

Fig. 1. *Burmusculus nuwae* Zhang and Rasnitsyn, sp. nov., female holotype, NIGP167950. A.

Lateral aspect, line drawing. B. Wing venation displaying vein nomenclature. C. Lateral aspect, photograph. Explanation of symbols: cly – clypeus, cx₁, cx₂, cx₃ – fore, mid and hind coxae, ge – gena, lt₁ – metasomal laterotergite 1, lb – labium, md – mandible, N₁, N₃ – pro- and metanotum, pl₁, pl₂ – pro- and mesopleuron, plb – labial palp, pmx – maxillary palp, pN₃ – metapostnotum, pp – prepectus, ppd – propodeum, spi – spiracle, S – sternum, T – tergum, v₁₊₂ – ovipositor (sting), v₃ – ovipositor sheath. Venation symbols are standard. Scale bar 1 mm.

Fig. 2. *Burmusculus nuwae* Zhang and Rasnitsyn, sp. nov., male holotype, NIGP167950,

photographs. A. Dorsal aspect. B. Head and antenna, frontal aspect. C. Head and mesosoma, lateral aspect. D. Fore tarsus, lateroventral aspect. Scale bar 1 mm.

Fig. 3. *Burmusculus fuxii* Zhang and Rasnitsyn, sp. nov., male holotype, NIGP167951. A.

Lateral aspect, line drawing. B. Wing venation displaying cell nomenclature. C. Lateral aspect, photograph. Explanation of symbols: al – adlateral line, cd – cardo, cocc – occipital carina, cx₁ – procoxa, go – gonostylus, N₁ – pronotum, N₃ – metanotum, no – notaulus, pl₁, pl₂, pl₃ – pro-, meso and metapleuron, plb – labial palp, pme – prementum, pmx – maxillary palp, pN₃ – metapostnotum, ppd – propodeum, scl – scutellum, spi – spiracle, sti – stipes, tgl – tegula, * – narrow base of midcoxa, ** – subvertical suture. Wing cell symbols are standard.

Fig. 4. *Burmusculus fuxii* Zhang and Rasnitsyn, sp. nov., holotype, NIGP167951, photographs.

A. Dorsolateral aspect. B. Head and mesosoma, lateral aspect. Scale bar 1 mm.

Fig. 5. *Burmusculus shennongii* Zhang and Rasnitsyn, sp. nov., holotype, NIGP167952. A.

Dorsal aspect, line drawing. B. Wing venation displaying vein nomenclature. C. Dorsal aspect, photograph. D. Ventral aspect, photograph. E. Head and antenna, frontal aspect, photograph. F. Fore tarsus, lateral aspect, photograph. G. Mid tarsus, lateral aspect, photograph. H. Metasoma, ventral aspect. Explanation of symbols: al – adlateral line, cly – clypeus, go – gonostylus, lr – labrum, N₁, N₃

420 – pro- and metanotum, no – notaulus, pN₃ – metapostnotum, scl – scutellum, III-VIII – metasomal
421 sterna, * – possible parapenial lobe, ** – possible volsella. Venation symbols are standard. Scale bar
422 1 mm (A-D), 0.5 mm (E-H).