

# Revision of the genus *Eotrechus* Kirkaldy (Hemiptera, Heteroptera, Gerridae), with descriptions of six new species

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## Abstract

Species of the Asian genus *Eotrechus* Kirkaldy, 1902 (Hemiptera, Heteroptera, Gerromorpha, Gerridae, Eotrechinae) are atypical water striders because they live on the near-vertical rock surfaces of waterfalls. The taxonomy of the genus is revised and six new species are described: *E. steineri* sp. nov., *E. kerberos* sp. nov., *E. thai* sp. nov., *E. konkakinh* sp. nov., *E. boukali* sp. nov., and *E. anderseni* sp. nov. Supplementary descriptions of the apterous female and macropterous male of *E. fuscus* Basu, Chandra & Venkatesan, 2017 are provided. Additional and updated distribution data of species of *Eotrechus* are reported. *Eotrechus fuscus* is reported from Myanmar for the first time; *E. brevipes* is reported from Nepal for the first time; *E. hygropetricus* Andersen, 1982 is reported from southern Thailand for the first time, which extends the southernmost limit of the known distribution of the genus. A revised key to the species of *Eotrechus* is also provided.

## Key Words

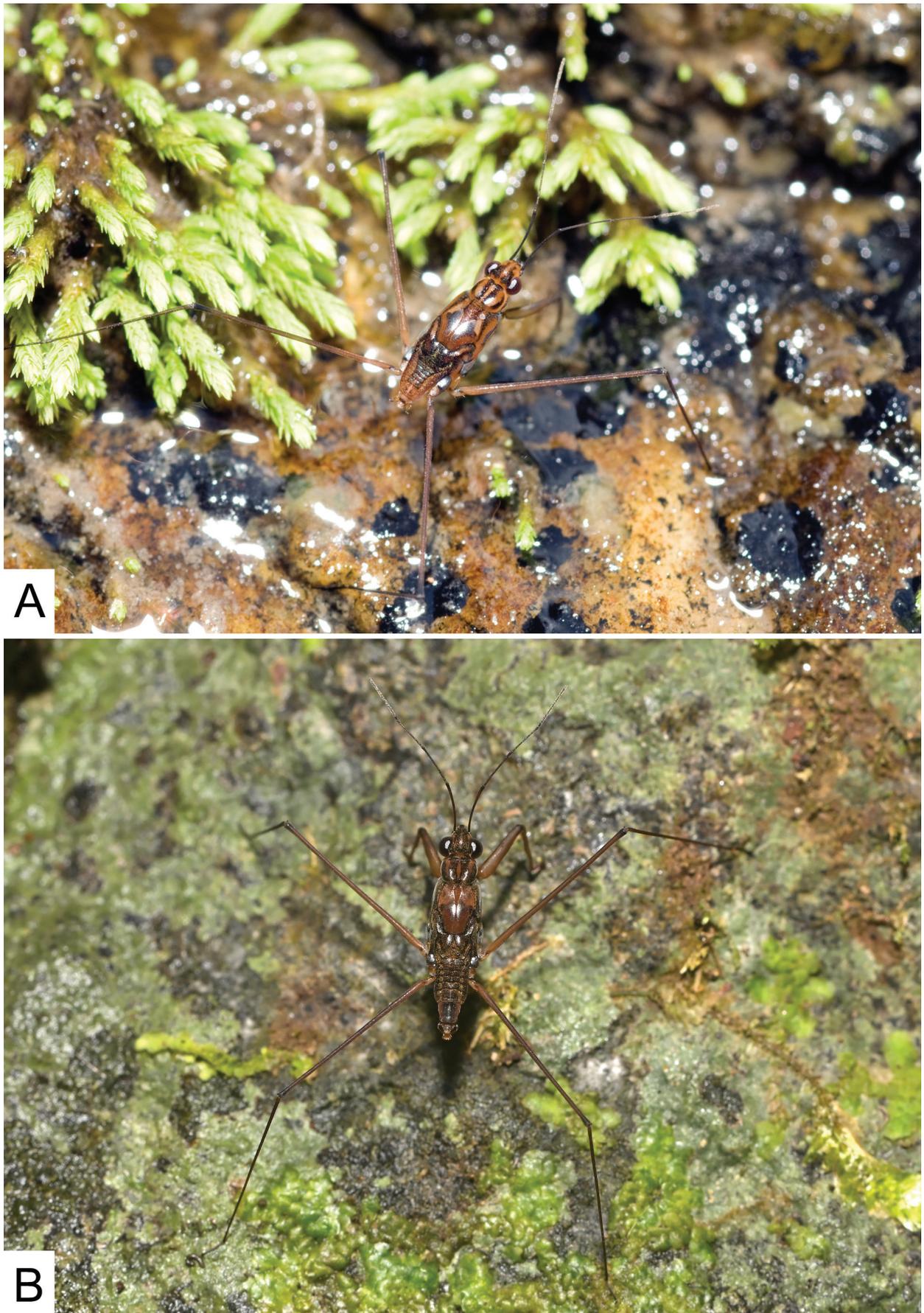
*Eotrechus*, Gerridae, Gerromorpha, new species, taxonomy

## Introduction

Species of the genus *Eotrechus* Kirkaldy, 1902, belonging to the subfamily Eotrechinae of the family Gerridae (Hemiptera, Heteroptera), are “special skaters” because they do not inhabit the water surface of streams or rivers. They are among the few insect groups that inhabit the nearly vertical rock cliffs of the waterfall splash zone or surrounding area (Fig. 1), although they still retain the ability to skate swiftly on the water surface when being chased out of their habitats (Andersen 1982; Tran, pers. obs.). Among six genera currently recognised in Eotrechinae, four are known to inhabit hygropetric or semi-terrestrial habitats, including *Chimarrhometra* Bianchi, 1896, *Eotrechus* Kirkaldy, 1902, *Onychotrechus* Kirkaldy, 1903, and *Tarsotrechus* Andersen, 1980, whereas the remaining two genera, *Amemboa* Esaki, 1925 and *Amemboides* Polhemus & Andersen, 1984, although living on the water surface, tend to stay very near the water’s edge and often

rest on the banks of water bodies (Andersen 1980, 1982; Polhemus and Andersen 1984; Tran and Polhemus 2009).

Species of *Eotrechus* are relatively small (body length rarely more than 10 mm), usually dark-coloured, and with patches of reflective silvery or golden pubescence on the dorsum and lateral surfaces (e.g., Figs 1, 3, 8, 11, 16). These features help them camouflage well into the background of waterfalls. Probably due to their cryptic behaviour, this genus has received little attention by entomologists and remained monotypic for a long time since it was first described. Only after the studies by Andersen (1982, 1998), which provided more information about their ecology and described seven new species, this genus has received attention from subsequent entomologists. Tran and Yang (2006), Tran and Zettel (2006), Vitthepradit and Sites (2007), Polhemus et al. (2009), and Basu et al. (2017) reported nine additional new species from across southern and southeastern Asia. With the descriptions of six new species in the present paper, the number of described species in this genus is now 23.



**Figure 1.** In-situ photographs of *Eotrechus*. **A.** *E. vietnamensis*, apterous male, from Ha Giang Province, Vietnam; **B.** *E. konkakhin* sp. nov., apterous male, from Gia Lai Province, Vietnam.

Our present paper revises the classification of *Eotrechus* and provides a revised key to species. Seven species groups are recognised based on similarities of key morphological characters, i.e., the ratio of mesosternal length to metasternal length, structure of the fore femur, structures of the abdominal segments, and male genitalia.

## Materials and methods

The material examined in the present study included dry-mounted and alcohol-preserved specimens, which are deposited in the following collections.

<b>BMNH</b>	Natural History Museum, London (UK), formerly the British Museum (Natural History)
<b>NHMW</b>	Natural History Museum Vienna (Austria)
<b>NME</b>	Natural History Museum Erfurt (Germany)
<b>NMPC</b>	National Museum, Prague (Czech Republic)
<b>UMC</b>	Enns Entomology Museum, University of Missouri, Columbia (USA)
<b>ZMUC</b>	Zoological Collection, Natural History Museum of Denmark (formerly Zoological Museum), University of Copenhagen (Denmark)
<b>ZRC</b>	Zoological Reference Collection, Lee Kong Chian Natural History Museum, National University of Singapore (Singapore)
<b>ZSM</b>	Bavarian State Collection, Munich (Germany)
<b>ZVNU</b>	Zoological Collection of Biological Museum, VNU University of Science, Hanoi (Vietnam)

Morphological terminology follows Andersen (1982, 1998) and Polhemus et al. (2009). All measurements are given in millimetres. Body length is measured in dorsal view; in the apterous form from the apex of the head to the tip of the proctiger; in the macropterous form from the apex of the head to the tip of the wings (unless otherwise specified, i.e., exclusive of wings, from apex of the head to tip of the proctiger in specimens with broken wings). Length of the fore wing is measured from the humerus of the pronotum to the tip of the wing. Body width is measured across the broadest part of the body, usually across the metacetabula. Head width is measured at the widest part across the eyes. Interocular width is the smallest distance between the compound eyes on the dorsal surface of the head. Eye length is measured in dorsal view, from the anterior to posterior margin of the eye. Lengths of body segments (thoracic or abdominal segments, e.g., pronotum, mesonotum, mesosternum, etc.) are measured along the midline of the segment. Specimens were examined using stereomicroscopes. Line drawings were made with the help of a camera lucida attached to the stereomicroscopes. In-situ photographs were taken with Nikon D300 and Nikon Z6 II cameras using 105 mm macro lens. Photographs of habitus and body parts were taken with a Leica DFC490 camera attached to Leica Z16 APO lens (for holotype of

*E. petraeus* and specimens deposited in NHMW), Leica MZ16 stereomicroscope coupled with the Leica Application Suite V4.10 Extended Depth of Focus module (for specimens deposited in UMC), and Nikon Z6 II camera using a 180 mm lens attached to a reversed 50 mm lens via a coupling ring (for specimens deposited in ZVNU). Photographs were subsequently processed using Adobe Photoshop. The distribution maps were prepared using Simplemapp (Shorthouse 2010).

## Results

### Genus *Eotrechus* Kirkaldy, 1902

*Eotrechus* Kirkaldy, 1902: 137 (type species: *Eotrechus kalidasa* Kirkaldy, 1902, by monotypy).

*Eotrechus*: Distant (1903: 182); Matsuda (1960: 249–251); Andersen (1982: 5–8) (revision).

**Diagnosis.** Body length: apterous males 5.5–10.3, macropterous males 6.7–11.6, apterous females 6.3–11.7, macropterous females 7.1–11.3. Body colouration: dorsum dark-brown, or yellowish with dark-brown markings; ventral side either dark or pale. Antennae long, slender, usually subequal to body length: segment I slightly longer than segment II and usually with 1–8 dark spines subapically (spines absent in the *E. kalidasa* species group); segments II and IV subequal in length; segment III shortest. Rostrum long and slender, reaching anterior third of mesosternum. Pronotal lobe: reduced in apterous form (e.g., Fig. 1); strongly produced in macropterous form, with rounded posterior margin (e.g., Fig. 11C). Ratio of lengths of mesosternum: metasternum variable, around 1.7–5.3: 1.0. Scent orifice small. Fore leg variable, either moderately incrassate or slender. Hind legs longer than middle legs; hind tibia longer than or subequal to middle tibia; claws inserted at apex of tarsal segment II, with long ventral arolium. Pregenital abdominal venter of male 0.2–0.4× body length; posterior margin of sternum VII either concave or emarginated medially. Male genitalia of variable size; pygophore usually modified, either with dense setae or with posterior projection(s) or both; paramere relatively small. Abdominal venter of female at most one-half of body length.

**Remarks.** Among the genera of the subfamily Eotrechinae, only *Eotrechus* has claws that are inserted at the apex of tarsal segment II (Andersen 1982). The comparative morphology and relationship between *Eotrechus* and other eotrechine genera have been reviewed and discussed by Andersen (1982) and Polhemus and Andersen (1984). According to these studies, *Eotrechus* is most closely related to *Chimarrhometra*.

Based on the comparative examination of morphological features among species of *Eotrechus*, e.g., relative lengths of the mesosternum and metasternum, structure of the fore femur, structures of the abdominal sterna, and

modification of the male genitalia, we propose the classification of this genus into seven species groups, as in the Taxonomic account section below. The assumption of monophyly of each species group and the relationship among species of *Eotrechus* still needs to be tested by future phylogenetic analyses.

Note that *E. sinensis* Andersen, 1982 cannot be assigned to any species group. The only known specimen of this species is a female and was not available for this study; thus, it was not possible to assess the relationship of this species with its congeners (see Remarks for *E. sinensis*).

### Revised key to species of *Eotrechus*

- 1 Mesosternum clearly less than twice as long as metasternum. Fore femur slender, basal part as slender as that of other femora ..... 2
- Mesosternum more than twice as long as metasternum. Fore femur incrassate ..... 4
- 2 Antennal segment III only slightly shorter than each other segment. Paramere slender, proximal part not clearly wider than distal part, apex narrow (Figs 4C, 5F) ..... *E. kalidasa* Kirkaldy, 1902
- Antennal segment III distinctly shorter than other segments, at most 0.9× the length of each other segment. Proximal part of paramere about twice wider than distal part, apex rounded..... 3
- 3 Fore leg: tarsal segment I shorter, ca. 0.7× the length of segment II. Paramere: proximal half twice as wide as distal half, distal half stout, slightly twisted (Fig. 2C)..... *E. fuscus* Basu, Chandra & Venkatesan, 2017
- Fore leg: tarsal segment I longer, 1.10–1.25× the length of segment II. Paramere: proximal third twice as wide as distal part, distal two-thirds slender, directed slightly dorsad (Figs 4F, 5E)..... *E. steineri* sp. nov.
- 4 Male specimens ..... 5
- Female specimens [identification is more reliable with associated male specimens] ..... 23
- 5 Fore femur with broad basal tubercle or with a spot of dense minute black setae. Pygophore with one caudal projection, but without posterolateral projections..... 6
- Fore femur simple, without basal tubercle. Pygophore with a pair of posterolateral projections, but without caudal projection..... 15
- 6 Basal tubercle of fore femur produced into tooth-like elevation or a small nodule. Caudal projection of pygophore expanded posterolaterally ..... 7
- Basal tubercle of fore femur simple, without tooth-like elevation or nodule. Caudal projection of pygophore not modified as above..... 8
- 7 Basal tubercle of fore femur produced into tooth-like elevation (Fig. 15F). Caudal projection of pygophore with concave posterior margin and two angular posterolateral tips (Fig. 15H) ..... *E. siamensis* Vittheepradit & Sites, 2007
- Basal tubercle of fore femur with a small nodule bearing minute black setae (Fig. 17A, B). Caudal projection of pygophore with almost straight posterior margin and two lateral lobes (Fig. 17D–F) ..... *E. konkakinh* sp. nov.
- 8 Pygophore produced caudally into triangular or narrowly pointed projection ..... 9
- Pygophore produced caudally into broad plate-like projection ..... 12
- 9 Caudal projection of pygophore very long and slender, with length of projection distinctly greater than width of pygophore ..... 10
- Caudal projection of pygophore shorter, with length of projection clearly less than width of pygophore ..... 11
- 10 Caudal projection of pygophore gradually tapering towards apex (in ventral view), evenly curved dorsad (in lateral view) (Fig. 7A–D). Lateral process of proctiger rectangular (Fig. 7F). Paramere elongated, length >2.0× width (Fig. 7D) ..... *E. petraeus* Andersen, 1982
- Caudal projection of pygophore very slender (in ventral view), strongly bent dorsad at apical part (in lateral view) (Fig. 9B, C). Lateral process of proctiger acute, pointing posteriorly (Fig. 9D). Paramere small and with conical apex, length ca. 1.5× width (Fig. 9E) ..... *E. kerberos* sp. nov.
- 11 Pygophore: lateral tubercles less distinct; caudal projection slender, with pointed apex (Figs 12, 13G, H). Proctiger, in dorsal view: posterolateral tubercle indistinct, apex of proctiger rounded (Figs 12B, 13I) ..... *E. thai* sp. nov.
- Pygophore: lateral tubercles prominent, pointing laterad; caudal projection broad, with rounded apex (Fig. 13C, D). Proctiger, in dorsal view: posterolateral tubercle strongly swollen, apex of proctiger angular (Fig. 13E)..... *E. romglao* Vittheepradit & Sites, 2007
- 12 Lateral tubercles of pygophore distinct, situated near narrowest part of pygophore ..... 13
- Lateral tubercles of pygophore absent or indistinct..... 14
- 13 Pygophore: with dense long and soft setae on ventrolateral surface; lateral tubercles small. Proctiger: with patch of long setae on ventrocaudal surface; posterolateral lobes small, angular ..... *E. fansipan* J. Polhemus, Tran & D. Polhemus, 2009
- Pygophore: without dense setae on ventrolateral surface; lateral tubercles large (Fig. 14B, C). Proctiger: without patch of long setae on ventrocaudal surface; posterolateral lobes large, rounded (Fig. 14D) ..... *E. pingae* Andersen, 1998

- 14 Caudal projection of pygophore about as long as wide. Posterolateral lobes of proctiger large, directed caudad, reaching median apex of proctiger (in dorsal view) ..... *E. luae* Tran & Zettel, 2006
- Caudal projection of pygophore clearly longer than wide (Fig. 15C, D). Posterolateral lobes of proctiger smaller, directed posterolaterad, distinctly not reaching median apex of proctiger (in dorsal view) (Fig. 15E).....  
..... *E. elongatus* Vitthepradit & Sites, 2007
- 15 Pygophore without posterolateral projections, usually with only long setae posterolaterally ..... 16
- Pygophore with a pair of well-developed posterolateral projections ..... 18
- 16 Fore femur with a row of four long, stiff setae on flexor side; fore tibia with a row of long, stiff setae on extensor side. Pygophore simple, not modified posteriorly, with long, soft setae ..... *E. hygropetricus* Andersen, 1982
- Fore femur without long, stiff setae on flexor side; fore tibia without long, stiff setae. Pygophore with very dense setae or posterolaterally modified..... 17
- 17 Fore femur strongly incrassate at basal part, length ca. 4.3× maximum width. Pygophore and proctiger with very dense, bristle-like, black setae; posterolateral processes of pygophore short, bearing a tuft of tightly packed, thick setae .....  
..... *E. pilicaudatus* Tran & Zettel, 2006
- Fore femur moderately incrassate, length about ca. 6.2× maximum width. Pygophore and proctiger with sparser and shorter, soft, brownish setae; posterolateral corners of pygophore rounded or produced into small lobes, without a tuft of tightly packed, thick setae (Figs 18C, D, 19D–F) ..... *E. boukali* sp. nov.
- 18 Posterolateral projections of pygophore slender, simple, directed caudad, apex of projection narrowly rounded or pointed ..... 19
- Posterolateral projections of pygophore broad, usually flat, directed posterolaterally, apex of projection more modified ..... 21
- 19 Posterolateral projections of pygophore thick, with rounded apices, and distal part swollen, covered with dense, long, bristle-like setae ..... *E. anderseni* sp. nov.
- Posterolateral projections of pygophore tapering towards narrow apices, without long, bristle-like setae..... 20
- 20 Posterolateral projections of pygophore in lateral view with a notch on lower margin and with broader distal part (Fig. 21B)..... *E. longipes* Andersen, 1982
- Posterolateral projections of pygophore in lateral view without notch and with slender distal part .....  
..... *E. terrestris* Andersen, 1982
- 21 Posterior margin of sternum VII with a broad, shallow median notch. Posterolateral projections of pygophore with finger-like process near apex ..... *E. brevipes* Andersen, 1982
- Posterior margin of sternum VII deeply emarginated, length of median notch about half of the length of sternum VII. Posterolateral projections of pygophore without finger-like process ..... 22
- 22 Posterolateral projections of pygophore thickened and broadened at distal part, with tubercles on both sides of each projection ..... *E. pumat* J. Polhemus, Tran & D. Polhemus, 2009
- Posterolateral projections of pygophore plate-shaped and without such tubercles ..... *E. vietnamensis* Tran & Yang, 2006
- 23 Fore femur without a row of stiff setae on flexor side ..... 24
- Fore femur with a row of stiff setae on flexor side ..... 27
- 24 Body length greater than 10.5. Sternum VII about as long as two preceding sterna combined ..... 25
- Body length clearly less than 8.5. Sternum VII clearly longer than two preceding sterna combined ..... 26
- 25 Third rostral segment curved and swollen at base (Fig. 23B). Tergum VIII with tuft of long, bristle-like setae on each posterolateral corner (Fig. 23C)..... *Eotrechus* sp. A
- Third rostral segment almost straight and not swollen at base. Tergum VIII simple, without tuft of long, bristle-like setae..... *E. anderseni* sp. nov.
- 26 Sternum VII 1.2–1.3× as long as two preceding sterna combined. Genitalia totally enclosed by tergum VIII and sternum VII, proctiger not visible in lateral view..... *E. brevipes* Andersen, 1982
- Sternum VII ca. 1.5× as long as two preceding sterna combined. Genitalia not totally enclosed, proctiger visible in lateral view ..... *E. longipes* Andersen, 1982 and *E. terrestris* Andersen, 1982
- 27 Dorsal surface of head with a yellowish stripe on midline. Fore femur with 4–5 long, stiff setae on flexor side. Length of mesosternum at least 4.0× length of metasternum ..... 28
- Dorsal surface of head mainly brown, without yellowish stripe on midline. Fore femur with at least nine long, stiff setae on flexor side. Length of mesosternum less than 3.6× length of metasternum ..... 29
- 28 Sternum VII ca. 1.2× as long as two preceding sterna combined..... *E. vietnamensis* Tran & Yang, 2006
- Sternum VII ca. 1.6× as long as two preceding sterna combined..... *E. pumat* J. Polhemus, Tran & D. Polhemus, 2009
- 29 Tergum VIII produced posterolaterally (Figs 10G, 13F)..... 30
- Tergum VIII not as above, posterior margin almost straight ..... 31
- 30 Sternum VII slightly longer (ca. 1.1×) than two preceding sterna combined..... *E. romglao* Vitthepradit & Sites, 2007
- Sternum VII clearly longer (ca. 1.3×) than two preceding sterna combined..... *E. thai* sp. nov. and *E. kerberos* sp. nov.

- 31 Stiff setae on flexor side of fore femur as long as greatest width of fore femur..... 32  
 – Stiff setae on flexor side of fore femur distinctly shorter than greatest width of fore femur ..... 33
- 32 Fore trochanter with a distinct row of long, stiff setae. Combined median length of sterna II to VII ca. 0.4× body length. Sternum VII about as long as two preceding sterna combined (Fig. 19K)..... *E. hydropetricus* Andersen, 1982  
 – Fore trochanter usually with only 2–3 stiff setae (Fig. 19C). Combined median length of sterna II to VII ca. 0.3× body length. Sternum VII distinctly longer (ca. 1.5×) than two preceding sterna combined (Fig. 19J) ..... *E. boukali* sp. nov.
- 33 Combined median length of sterna II to VII ca. 0.4× body length. Sternum VII ca. 1.4× as long as two preceding sterna combined; posterior margin of sternum VII produced medially ..... *E. sinensis* Andersen, 1982  
 – Combined median length of sterna II to VII less than 0.4× body length. Sternum VII at most 1.3× as long as two preceding sterna combined; posterior margin of sternum VII not produced medially ..... 34
- 34 Pronotum without sublateral yellow markings ..... *E. siamensis* Vitheepadit & Sites, 2007  
 – Pronotum with sublateral yellow markings extending from anterior part..... 35
- 35 Sublateral yellow markings of pronotum longer, about two-thirds of pronotal length. Mesonotum of apterous morph mostly yellowish on anterior half ..... *E. konkakin* sp. nov.  
 – Sublateral yellow markings of pronotum shorter, less than half of pronotal length. Mesonotum of apterous morph mainly brown..... 36
- 36 Sternum VII 1.0–1.1× as long as two preceding sterna combined..... *E. luaae* Tran & Zettel, 2006  
 – Sternum VII ca. 1.3× as long as two preceding sterna combined.....  
 ..... *E. elongatus* Vitheepadit & Sites, 2007 and *E. fansipan* J. Polhemus, Tran & D. Polhemus, 2009

## Taxonomic account

### *Eotrechus kalidasa* species group

**Diagnosis.** Fore leg long and slender. Mesosternum short, only 1.5–1.7× length of metasternum. Male: sternum VII shorter than two preceding sterna combined, posterior margin concave or slightly emarginated. Male genitalia: pygophore with long and slender posterolateral projections; paramere well-developed, longer than wide; proctiger with broadly rounded apex. Female: sternum VII shorter than two preceding sterna combined.

**Species included.** *E. kalidasa* Kirkaldy, 1902, *E. fuscus* Basu, Chandra & Venkatesan, 2017, and *E. steineri* sp. nov.

### *Eotrechus kalidasa* Kirkaldy, 1902

Figs 4A–C, 5F, 25

*Eotrechus kalidasa* Kirkaldy, 1902: 137 (type locality: Carin Cheba, Myanmar).

*Eotrechus kalidasa*: Distant (1903: 182, fig. 130) (redescription); Paiva (1919: 364) (record “Garo Hills, Assam” [Meghalaya]); Andersen (1982: 8–11, figs 8, 15, 28) (descriptive notes); Tran and Zettel (2006: 46–48, figs 17–20) (descriptive notes).

**Material examined.** *Paratype*: MYANMAR • 1 ♀ (macropterous); “Carin Cheba, 900–1100m, L. Fea, 1889 / Distant Coll. 1911–383”; BMNH.

**Other material.** INDIA • 1 ♂ (macropterous); Meghalaya, 3 km E Tura; 25°30'N, 94°14'E; 1150 m a.s.l.; 18 Apr. 1999; L. Dembický & P. Pacholátko leg.; NHMW.

**Diagnosis.** Size: macropterous male, length 9.50, width 2.06; macropterous female, length 10.80, width 2.30. Antennal segments subequal in length, segments I and IV slightly longer than segments II and III; segment III shortest. Mesosternum ca. 1.5× length of

metasternum (1.72: 1.13). Fore femur slender in both sexes. Male: abdominal sterna III–VII with longitudinal median groove; sternum VII ca. 0.75× length of two preceding sterna combined, posterior margin slightly emarginated. Male genitalia: pygophore with two long, relatively slender posterolateral projections (Fig. 4A); paramere long and slender, sinuate in dorsal view, proximal part strongly curved (convex dorsad) in lateral view, distal part straight, apex rounded (Figs 4C, 5F); proctiger slightly expanded posterolaterally, posterior margin rounded (Fig. 4B). Female: abdomen long and slender, genitalia concealed in the abdomen in lateral view.

**Remarks.** The record of *Eotrechus kalidasa* from India has been discussed and confirmed by Tran and Zettel (2006: 47–48), and comparative notes have been presented in detail by Andersen (1982: 10–11).

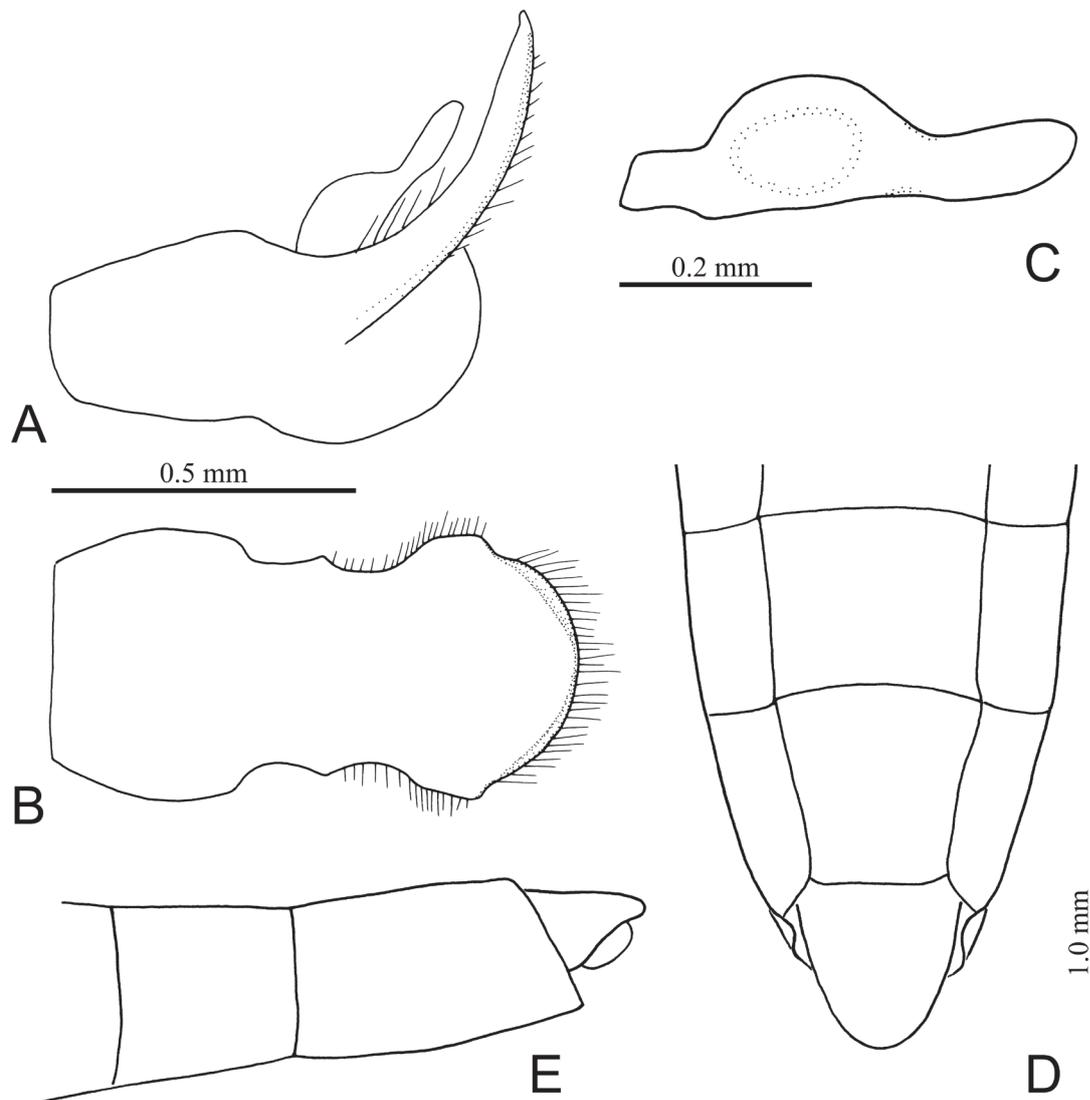
**Distribution.** Myanmar (Kirkaldy 1902), India: Meghalaya (Paiva 1919) (Fig. 25). Note that the male specimen from Thailand reported as *E. kalidasa* by Vitheepadit and Sites (2007) and Nakthong et al. (2014) actually belongs to a new species, *E. steineri* sp. nov. (see below).

### *Eotrechus fuscus* Basu, Chandra & Venkatesan, 2017

Figs 2, 25

*Eotrechus fuscus* Basu, Chandra & Venkatesan, 2017: 392–397, figs 1–12 (type locality: Sikkim, India).

**Material examined.** MYANMAR • 1 ♂, 3 ♀♀ (apterous); Sagaing Div., Alaungdaw Katthapa NP, Pagoda stream; 22°19.113'N, 94°28.518'E; 350 m a.s.l.; 5 May 2003; Boukal et al. leg.; (105); NHMW • 1 ♂ (macropterous); Sagaing Div., Alaungdaw Katthapa NP, Pagoda stream; 22°19.094'N, 94°28.823'E; 350 m a.s.l.; 6 May 2003; Boukal et al. leg.; (110); NHMW.



**Figure 2.** *Eotrechus fuscus*. **A.** Pygophore, lateral view; **B.** Proctiger, dorsal view; **C.** paramere, lateral view; **D, E.** Posterior part of abdomen, female, dorsal and lateral views (**A, B.** Same scale; **D, E.** Same scale).

**Diagnosis.** Size: apterous male, length 10.30, width 2.64 (apterous); macropterous male, length 11.60, width 2.78; apterous females, length 10.80–11.70, width 2.72–2.82. Antenna: segments I and II, each distinctly longer than segments III, IV; segment III shortest, ca. 0.5–0.6× length of each of segments I, II, and ca. 0.9× length of segment IV. Mesosternum ca. 1.6–1.7× length of metasternum (male: 2.07: 1.19; female: 2.07: 1.30). Fore femur slender in both sexes. In apterous morph, posterior three quarters of mesonotum raised into a hump. Male: abdominal sterna III–VII with longitudinal median groove; sternum VII ca. 0.8× length of two preceding sterna combined, posterior margin median notch ca. 0.25× length of sternum VII. Male genitalia: pygophore with two long, relatively slender posterolateral projections (Fig. 2A); paramere with proximal half wider, twice as wide as distal half, distal half stout, slightly twisted, tapering to rounded apex (Fig. 2C); proctiger posterolaterally produced into rounded processes, posterior margin broadly rounded (Fig. 2B). Female: abdomen long and slender;

genitalia visible in lateral view, proctiger slightly longer than wide, directed ventrad (Fig. 2D, E).

**Supplemental description of apterous female.** Head width across eyes 1.99; interocular width 0.80; eye kidney-shaped in dorsal view, length 0.85. Antennae subequal to body length (12.14: 11.40), lengths of segments I–IV: 3.67: 3.38: 2.17: 2.92; segment I without black spines. Pronotum shorter than head length (1.40: 1.89). Posterior three quarters of mesonotum strongly swollen, forming a hump. Lengths of mesosternum and metasternum: 2.07 and 1.30. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 4.75: 3.50: 0.62: 0.71; middle leg: 9.08: 8.83: 0.60: 0.91; hind leg: 10.0: 11.9: 0.68: 0.93. Fore trochanter with two or three long, fine setae on ventral side. Fore femur similar to males, length ca. 11.9× maximum width (4.75: 0.40). Fore tibia similar to males. Middle and hind legs similar to males: middle and hind femur with short spines scattered along ventral surface, middle and hind tibiae with scattered long, stout setae. Claws stout, lengths of fore, mid- and hind

claws: 0.32: 0.42: 0.41. Total length of abdominal sterna II–VII ca.  $0.4 \times$  body length (4.87: 11.4). Sternum VII ca.  $0.9 \times$  length of two preceding sterna combined (1.36: 1.53), posterior margin straight. Connexival corners of sternum VII pointed and slightly curved mesad (Fig. 2D).

**Supplemental description of macropterous male.**

Head chiefly black, with a transverse yellow mark on posterior margin; pronotum chiefly black, with yellow stripe on anterior part of midline, not extending onto pronotal lobe; wings chiefly black, membrane brown. Pronotum length (including pronotal lobe) 3.66, humeral width 2.28. Fore wing length 7.25, wing veins similar to *E. kalidasa* (see Matsuda 1960: fig. 553; Andersen 1982: fig. 8). Other characteristics similar to apterous male.

Macropterous female: Unknown.

**Remarks.** The original description by Basu et al. (2017) was based on only a single apterous male. Thus, supplementary descriptions of apterous female and macropterous male are provided as above.

*Eotrechus fuscus* can be confused with *E. kalidasa*, and the two species have greatly overlapping distributions. The combination of differences in the relative lengths of antennal segments, the relative lengths of fore tarsal segments, and the shape of the parameres help to distinguish *E. fuscus* from *E. kalidasa*, and also from *E. steineri* sp. nov. (see Table 1).

**Distribution.** India: Sikkim (Basu et al. 2017); Myanmar (new record): Sagaing Region (Fig. 25).

***Eotrechus steineri* sp. nov.**

<https://zoobank.org/33671505-47A3-4991-B071-BF9A8042AB5D>

Figs 3, 4D–F, 5A–E, 25

*Eotrechus kalidasa* (non Kirkaldy, 1902): Vitheepradit and Sites (2007: 18–19) (diagnosis, notes); Nakthong et al. (2014: 59–60, fig. 42) (key, diagnosis, notes). Misidentifications.

**Material examined. Holotype:** LAOS • ♂ (apterous); Vieng Phoukha, Tham Kuat (F47-119/010); 20°45.950'N, 101°0.828'E; 10 Feb. 2006; H. Steiner leg.; 132/06; N-Lao-Europ. Cave Project 2006; NHMW.

**Paratypes:** LAOS • 3 ♂♂, 2 ♀♀ (apterous); same locality data as holotype; NHMW • 1 ♀ (apterous); Luang Prabang, Tham Suea, Tham Nam Lot; 19°26.928'N, 102°26.157'E; 3 Feb. 2005; H. Steiner leg.; 069/05; N-Lao-Europ. Cave Project 2005; NHMW • 1 ♀ (apterous); Luang Nam Tha Province, Vieng Phoukha; Tham A Pa (F47-119-026); 20°49.843'N, 101°3.733'E; 18 Jan. 2012; H. Steiner leg.; 027/12; Northern Lao-European Cave Project 2012; NHMW • 1 ♀ (apterous); Luang Nam Tha Province, Vieng Phouka, Um Chuck Njet (F47-119-029); 20°43.367'N, 101°0.963'E; 19 Jan. 2012; H. Steiner leg.; 138/12; Northern Lao-European Cave Project 2012; NHMW.

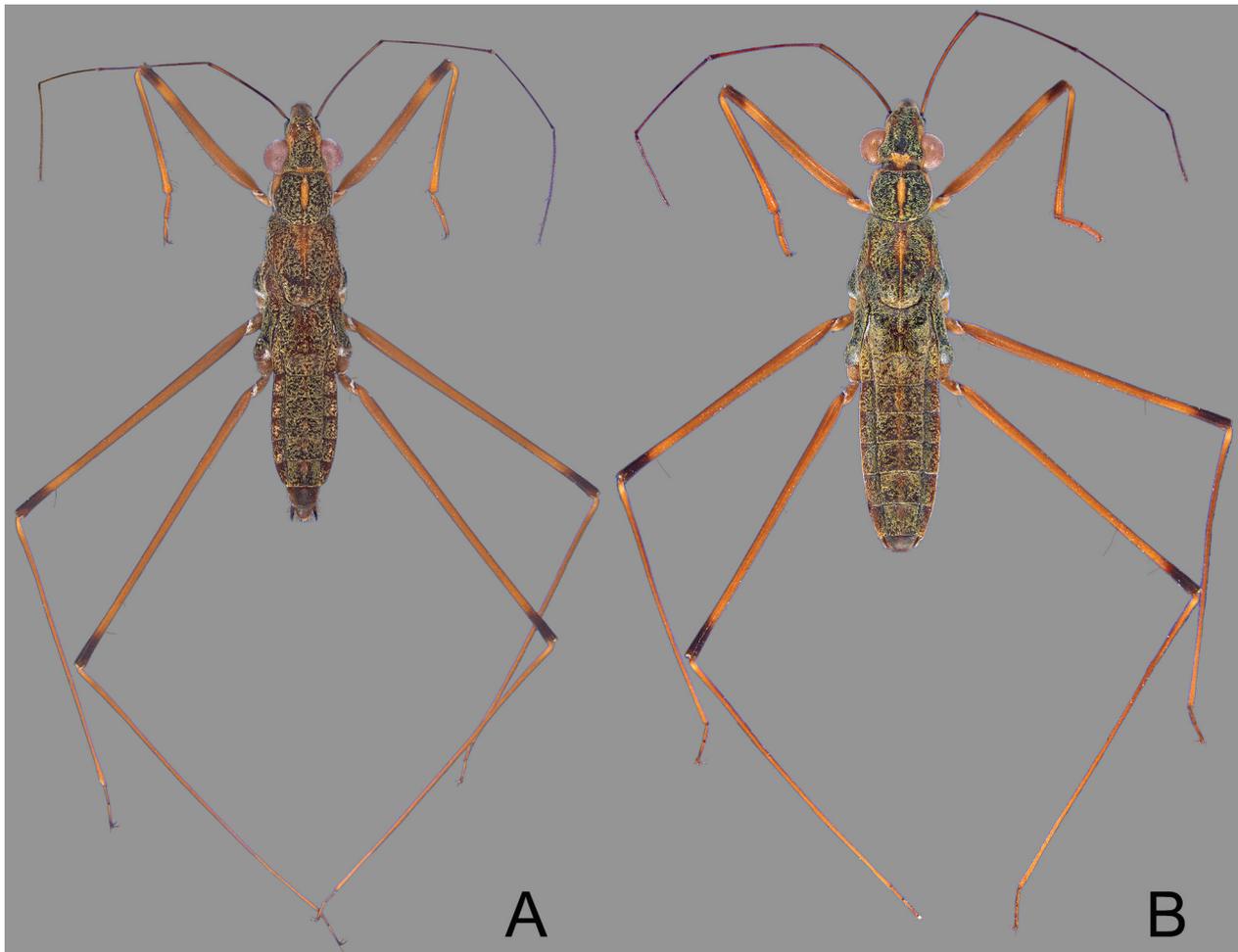
THAILAND • 1 ♂ (macropterous); Loei Province, Phu Hin Rongkla National Park, Man Daeng Noi at trail; 16°57'N, 101°03'E; 1600 m a.s.l.; 21 Sep.–21 Oct. 2002; coll: CMU team, leg.; *Eotrechus kalidasa* Kirkaldy,

det Vitheepradit 2005; UMC • 1 ♂ (macropterous); Nan Province, Namtok Sa Pan, stream with waterfall; 19°11.403'N, 101°11.850'E; 532 m a.s.l.; 17 Apr. 2009; Sites, Vitheepradit, Prommi leg.; L-1043; *Eotrechus kalidasa*, det Vitheepradit 2017; UMC.

**Description.** Size: apterous males, length 9.25–9.75 (holotype 9.25), width 2.07–2.28 (holotype 2.12); macropterous male, length 10.32, width 2.12; apterous females, length 9.92–10.50, width 2.25–2.36.

Colour (Fig. 3). Apterous form, dorsum of body chiefly brown to dark-brown or black, with yellow markings on head and thorax, covered with golden pubescence; venter chiefly pale-brown. Head with two lateral yellow marks at anterior section and a transverse yellow mark on posterior margin. Antennae yellowish-brown to brown. Pronotum with a yellow midline stripe. Mesonotum with yellow midline stripe thinner posteriorly and usually not reaching posterior margin. Metanotum and abdominal tergum mainly without yellow marking. Propleuron with a longitudinal yellow stripe. Meso- and metapleura black, without yellow marking. All pleura covered with golden pubescence. All coxae chiefly light-coloured (usually light-yellowish); all other leg segments yellowish-brown to brown; apical parts of all femora dark-brown to black.

Structural characteristics: Apterous male (holotype): Head width across eyes 1.76; interocular width 0.69; eye kidney-shaped in dorsal view, length of eye 0.76. Antennae ca.  $1.1 \times$  body length (9.94: 9.25), lengths of segments I–IV: 2.64: 2.46: 2.25: 2.59; segment I without black spines. Pronotum broader than long, shorter than head length (1.17: 1.45). Posterior two-thirds of mesonotum strongly swollen, forming a hump. Lengths of mesosternum and metasternum: 1.81 and 1.17. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II) as follows: fore leg: 3.86: 2.91: 0.52: 0.48; middle leg: 6.50: 6.67: 0.41: 0.49; hind leg: 7.25: 8.50: 0.40: 0.48. Fore leg (Fig. 5A): trochanter with one or two long, fine setae; femur slender, length ca.  $11.4 \times$  maximum width (3.86: 0.34), proximal part slightly thicker distal part, flexor side with few long, fine setae about evenly spaced along its length; tibia straight, without short, stout setae on distal third; tarsus covered with dense, short, soft, yellowish setae (denser on ventral surface). Middle and hind femora slender and shorter than body; middle and hind femora with scattered short, stout setae on ventral surface; middle and hind tibiae with very long, stout setae scattered along their lengths. Claws stout, lengths of fore, mid- and hind claws: 0.18: 0.22: 0.21. Abdomen relatively long, total length of abdominal sterna II–VII: 3.06, sterna II–VII weakly depressed medially, not forming distinct groove, depression on sternum VII widened posteriorly. Sternum VII ca.  $0.66 \times$  the length of two preceding sterna combined (0.63: 0.96), posterior margin with shallow median notch (ca.  $0.15 \times$  the length of sternum VII) (Fig. 5B). Genitalia (Figs 4D–F, 5B, E): ventral length of abdominal segment VIII: 0.41. Pygophore with two long, relatively slender posterolateral projections which curve dorsad. Paramere long, with proximal third wider, ca.  $2.0 \times$  as wide as distal part; distal part slender, directed slightly dorsad, apex rounded.



**Figure 3.** *Eotrechus steineri* sp. nov., habitus. **A.** Apterous male; **B.** Apterous female.

Proctiger simple, longer than wide, with broadly rounded apex, posterolaterally slightly produced as broad processes.

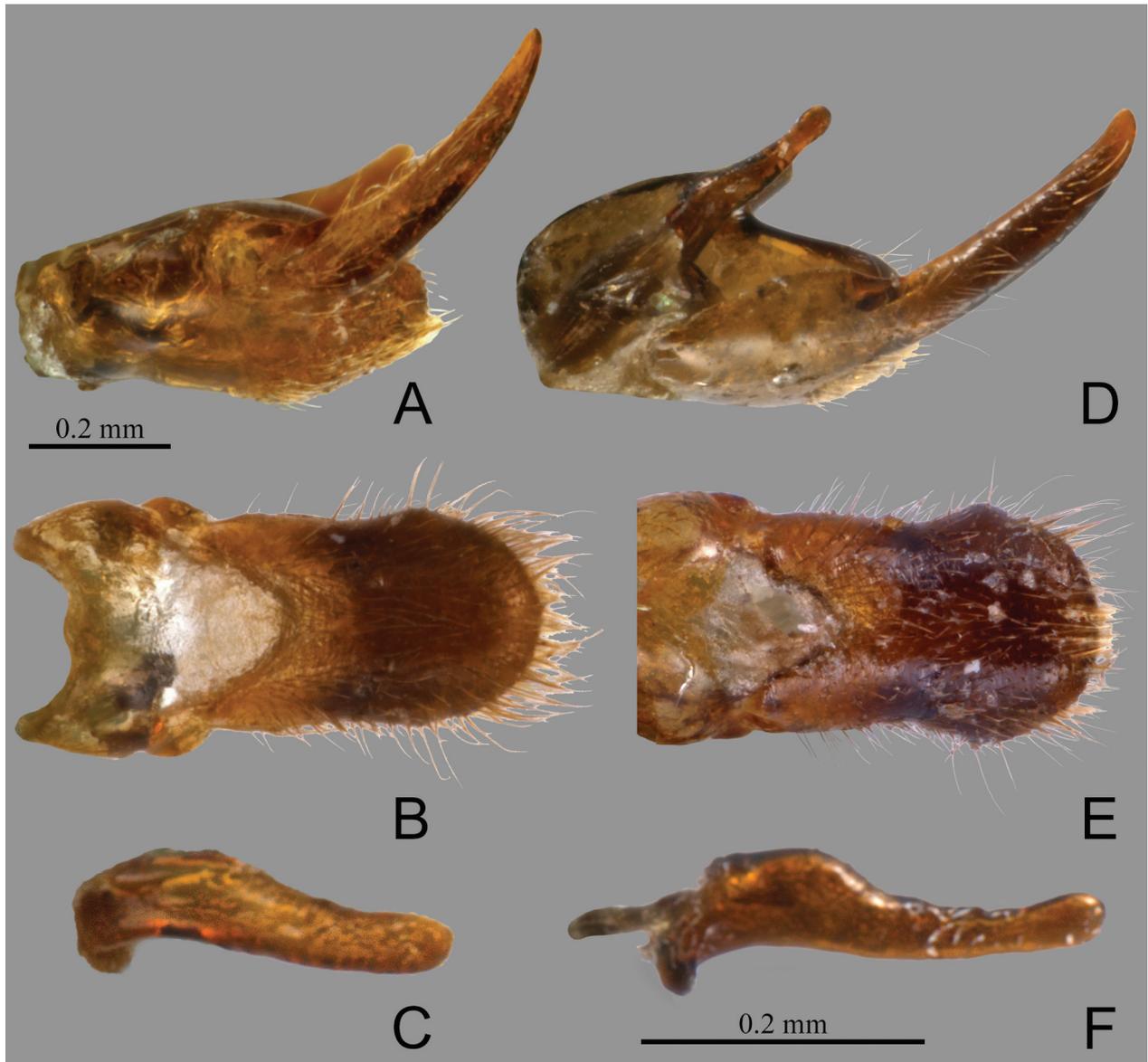
**Apterous female:** Head width across eyes 1.89; interocular width 0.75; eye kidney-shaped in dorsal view, length 0.82. Antennae subequal to body length (10.33: 10.50), lengths of segments I–IV: 2.69: 2.51: 2.36: 2.77; segment I without black spines. Pronotum shorter than head length (1.17: 1.55). Posterior two-thirds of mesonotum strongly swollen, forming a hump. Lengths of mesosternum and metasternum: 1.99 and 1.37. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 3.97: 3.06: 0.65: 0.52; middle leg: 6.83: 6.96: 0.44: 0.53; hind leg: 7.42: 8.83: 0.45: 0.54. Fore trochanter with two or three long, fine setae on ventral side. Fore femur similar to males, length ca.  $11.3\times$  maximum width (3.97: 0.35). Fore tibia similar to males. Middle and hind legs similar to males. Claws stout, lengths of fore, mid- and hind claws: 0.21: 0.22: 0.23. Total length of abdominal sterna II–VII ca.  $0.46\times$  body length (4.82: 10.5). Sternum VII ca.  $0.75\times$  length of two preceding sterna combined (1.17: 1.55), posterior margin straight. Connexival corners of sternum VII broadly rounded. Genitalia almost completely concealed by abdomen in lateral view, only tip of proctiger visible, proctiger broader than long, directed ventrad (Fig. 5C, D).

**Macropterous male:** Similar to apterous male but with following differences: Head ground colour dark-brown to black, with orange markings at middle of posterior margin and at anterodorsal margin of eye extending halfway to base of antenna; pronotum dark-brown to black, with orange longitudinal stripe on midline; propleuron with orange longitudinal stripe posterior to eye; wings chiefly dark-brown with medium-brown patches, reddish-brown veins, and linear series of golden setae. Pronotum length (including pronotal lobe) 3.08, humeral width 1.92. Fore wing length 6.52, wing veins similar to *E. kalidasa* (see Matsuda 1960: fig. 553; Andersen 1982: fig. 8).

**Macropterous female:** Unknown.

**Etymology.** This species is dedicated to the German speleologist Dr Helmut Steiner who discovered it during one of his expeditions to northern Laos.

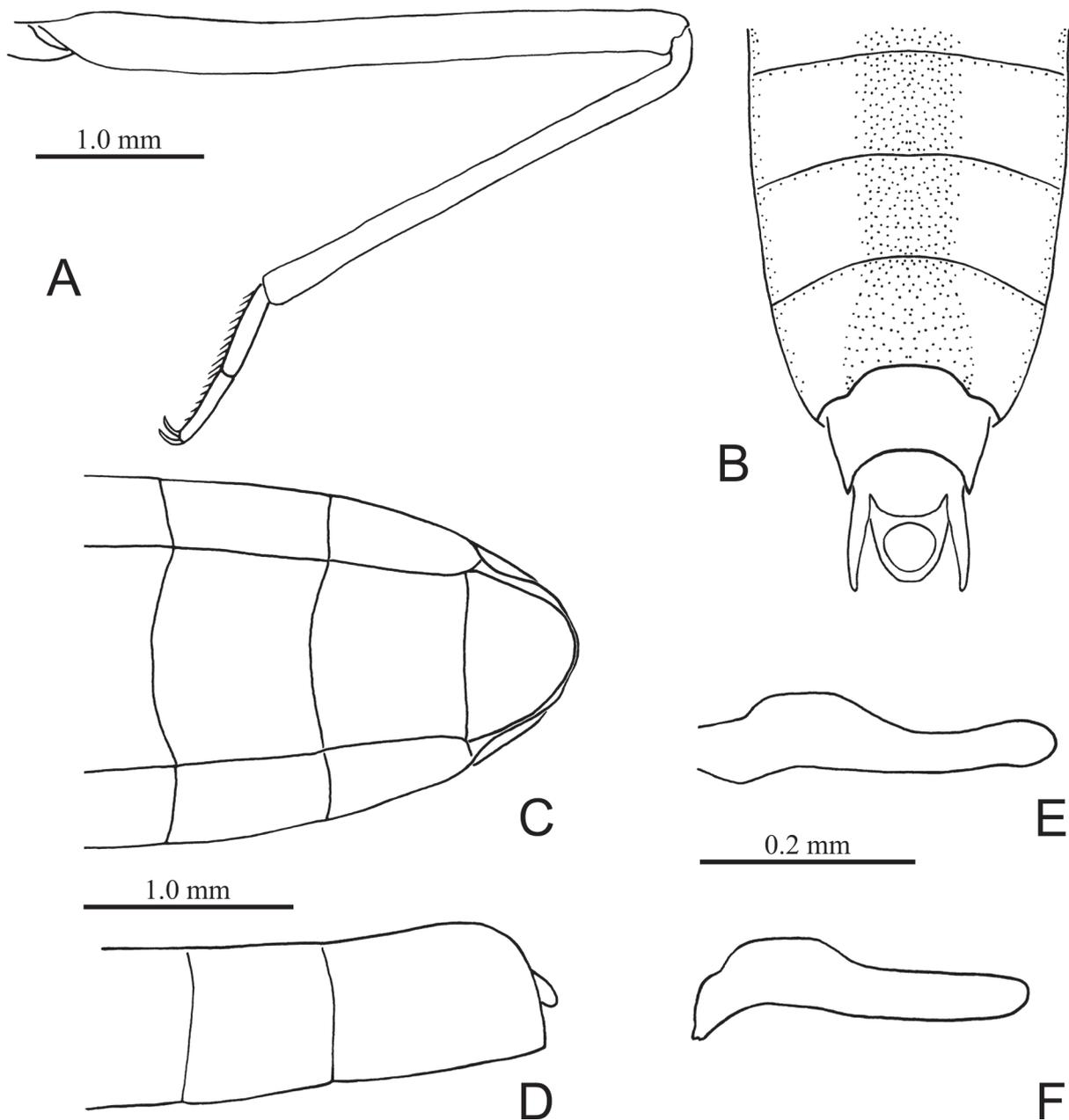
**Remarks.** *Eotrechus steineri* sp. nov. can be separated from *E. kalidasa* and *E. fuscus* by the structure of the paramere, the relative lengths of the antennal segments, and the relative lengths of the fore tarsal segments. This new species can also be recognised by the large hump on the mesonotum. A mesonotal hump is also present in *E. fuscus*, but is much less conspicuous than that of this new species. Detailed differences between the three species are summarised in Table 1.



**Figure 4.** *Eotrechus kalidasa*, specimen from India (A–C) and *E. steineri* sp. nov. (D–F). A, D. Pygophore, lateral view; B, E. Proctiger, dorsal view; C, F. Paramere, lateral view (A, B, D, E. Same scale; C, F. Same scale).

**Table 1.** Comparative morphology of *E. kalidasa*, *E. fuscus*, and *E. steineri* sp. nov.

	<i>E. kalidasa</i>	<i>E. fuscus</i>	<i>E. steineri</i> sp. nov.
Antennal segments	- all segments subequal in length - segments I and IV slightly longer than others - segment III shortest	- segments I and II, each distinctly longer than segments III and IV - segment III shortest, 0.5–0.6× length of segments I, II, and ca. 0.9× length of segment IV	- segments I, II, and IV subequal in length - segment III shortest, only 0.85–0.90× length of each of other segments
Fore tarsal segments	segment I slightly longer than segment II (1.17–1.30: 1.00)	segment I shorter than segment II (ca. 0.7: 1.00)	segment I slightly longer than segment II (1.10–1.25: 1.00)
Mesonotum of apterous form	transversely depressed in the middle	posterior three quarters with a hump	posterior two-thirds with a large hump
Abdominal sterna of males	with narrow median groove from sterna III–VII	with narrow median groove from sterna III–VII	sterna II–VII weakly depressed medially, not forming distinct groove
Paramere	- proximal third only slightly wider than distal part, convex dorsad - distal part slender, straight - apex narrow	- proximal half twice as wide as distal half - distal half stout, slightly twisted - apex rounded	- proximal third twice as wide as distal part - distal two-thirds slender, directed slightly dorsad - apex rounded, slightly broadened
Abdominal apex of females	proctiger completely concealed, not visible	proctiger visible	proctiger almost completely concealed



**Figure 5.** *Eotrechus steineri* sp. nov. (A–E) and *E. kalidasa* (F). A. Fore leg of male; B. Abdomen of male, ventral view; C, D. Posterior part of abdomen of female, dorsal and lateral views; E, F. Paramere, lateral view (B–D. Same scale; E, F. Same scale).

**Distribution.** Laos: Luang Nam Tha, Luang Prabang; Thailand: Loei (the specimen from Thailand reported as *E. kalidasa* by Vitthepradit and Sites (2007) belongs to this new species) (Fig. 25).

#### *Eotrechus petraeus* species group

**Diagnosis.** Male: fore femur incrassate, usually with a large basal tubercle bearing a spot of black, minute setae, or only with a spot of black, minute setae without distinct basal tubercle; posterior margin of sternum VII medially notched, about two-fifths of sternum VII length; pygophore with lateral tubercles with long setae; caudal projection of pygophore subtriangular or elongate with pointed apex; proctiger laterally bearing long setae, posterolaterally with round lobes or pointed processes, apex of proctiger angular. Female:

tergum VIII usually produced posterolaterally; sternum VII about as long as two preceding sterna combined.

**Species included.** *E. petraeus* Andersen, 1982, *E. kerberos* sp. nov., *E. romglaio* Vitthepradit & Sites, 2007, and *E. thai* sp. nov.

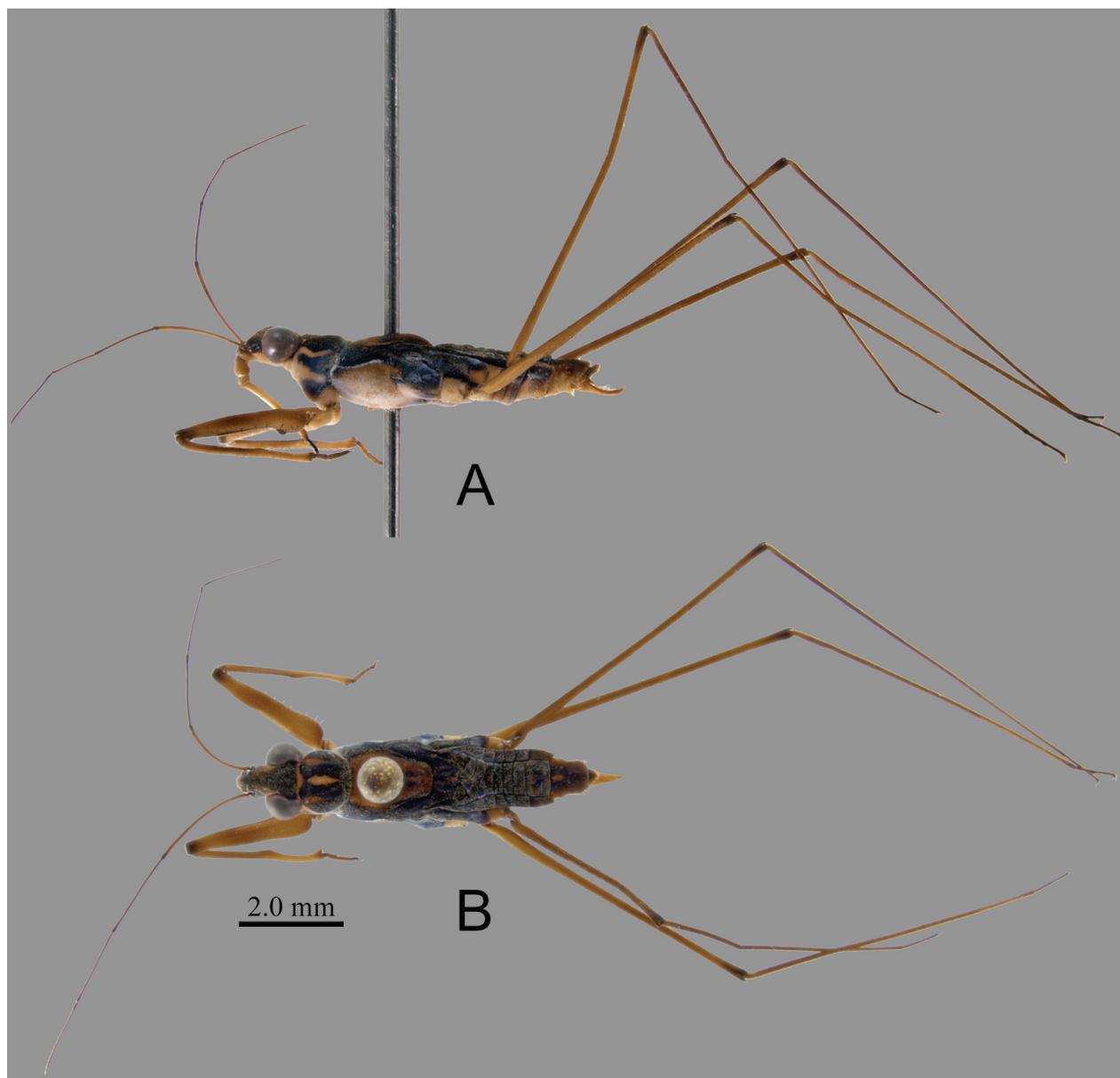
#### *Eotrechus petraeus* Andersen, 1982

Figs 6, 7, 26

*Eotrechus petraeus* Andersen, 1982: 15–16, figs 10, 18, 20, 24 (type locality: Doi Suthep, Chiang Mai, Thailand).

*Eotrechus petraeus*: Andersen (1998: 6) (checklist).

**Material examined.** *Holotype*: THAILAND • ♂ (apterous); Chiang Mai Province, Doi Suthep National Park, Mahidol



**Figure 6.** *Eotrechus petraeus*, habitus of holotype. **A.** Lateral view; **B.** Dorsal view (both of same scale).

waterfall; 1250 m a.s.l.; 27 Sep. 1981; Zool. Museum Copenhagen leg.; ZMUC.

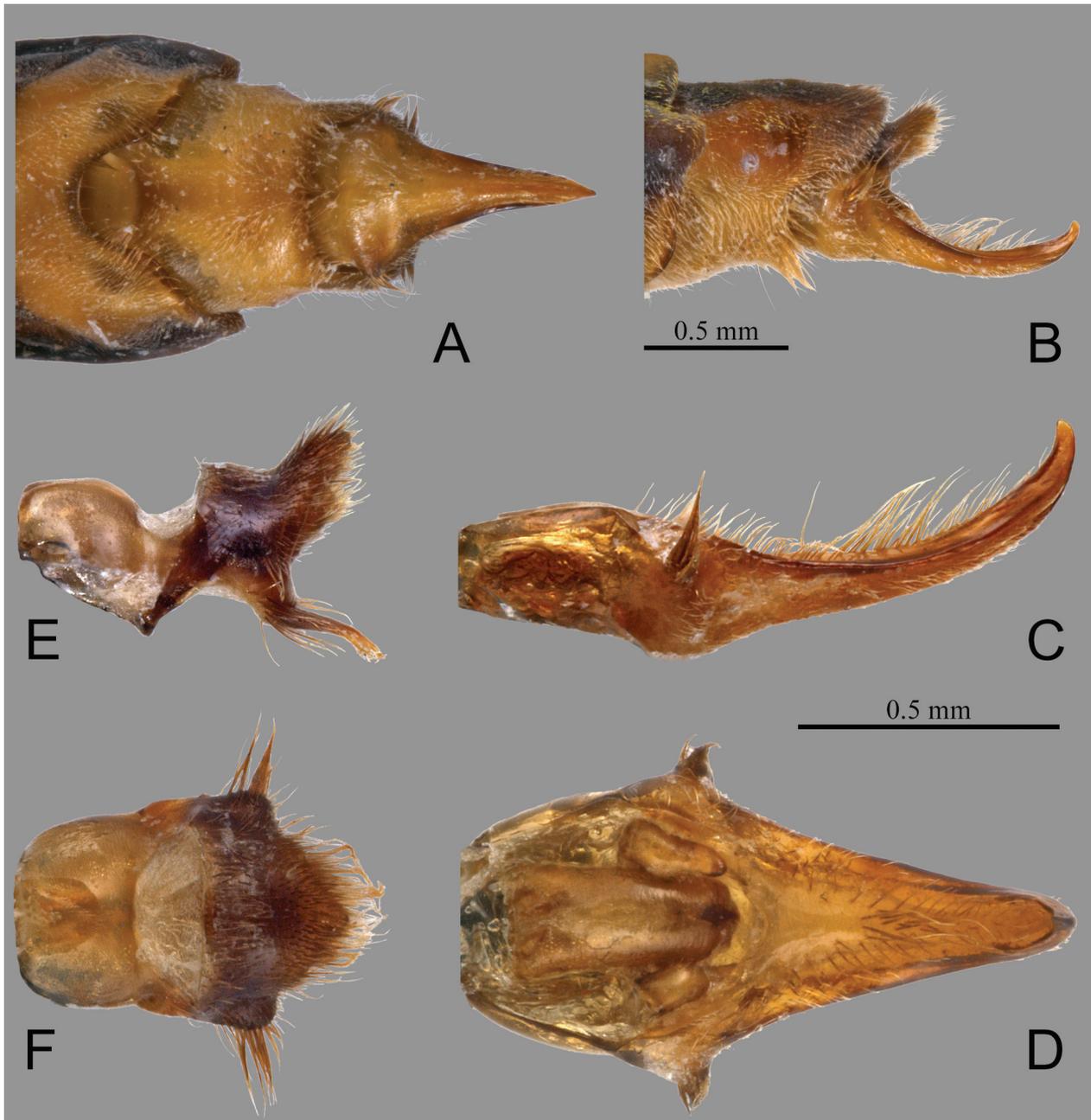
**Diagnosis.** Size: apterous male: length 7.8, width 2.0 (Andersen, 1982). Male: mesosternum ca.  $3.6\times$  length of metasternum; fore femur incrassate, with a large basal tubercle bearing a round spot of black, minute setae, along flexor side of femur with a row of eight long, stiff setae (three on base, five on elongate part); fore tibia distally thicker and curved, flexor side clearly bisinuate, with scattered stiff setae on exterior side (Fig. 6); abdominal sterna II–VI weakly grooved in the middle; sternum VII broadly depressed, slightly shorter than two preceding sterna combined, posterior margin with a large U-shaped median notch about as deep as two-fifths of sternum VII length. Male genitalia: abdominal segment VIII large, ventral side distinctly longer than sternum VII, posterior margin with dense, brownish setae; pygophore with small

lateral tubercles bearing a tuft of yellowish setae, which is directed dorsad, caudal projection of pygophore long, triangular, and with apical part evenly curved dorsad (Fig. 7A–D); paramere elongated, tapering towards apex, length more than twice as width (Fig. 7D); proctiger with lateral processes rectangular, bearing long, brownish setae, ventral surface with a patch of dark, long, brush-like setae (Fig. 7E, F). Female unknown.

**Remarks.** See comparative notes for *E. kerberos* sp. nov.

Some specimens collected at Doi Inthanon (Chiang Mai, Thailand) were recorded as *Eotrechus petraeus* by Vitheepadit and Sites (2007); in fact, they belong to a new species, *E. thai* sp. nov., as described in a later section of the present paper.

**Distribution.** Thailand: Chiang Mai (Andersen 1982) (Fig. 26).



**Figure 7.** *Eotrechus petraeus*, holotype. **A, B.** Genitalia, ventral and lateral views; **C, D.** Pygophore, lateral and dorsal views; **E, F.** Proctiger, lateral and dorsal views. (**A, B.** Same scale; **C–F.** Same scale).

***Eotrechus kerberos* sp. nov.**

<https://zoobank.org/0A6F4B5C-AB18-45F3-A3D5-0AB2AB43B357>  
Figs 8–10, 26

**Material examined. Holotype:** LAOS • ♂ (apterous); Luang Prabang, Tham Seua, Tham Nam Lot, near cave entrance at wall; 19°26.095'N, 102°26.157'E; 4 Feb. 2005; H. Steiner leg.; 109/05; N-Lao-Europ. Cave Project 2005; NHMW.

**Paratypes:** LAOS • 3 ♀♀ (apterous); same locality data as holotype; NHMW.

**Description.** Size: apterous male (holotype), length 7.92, width 2.12; apterous females, length 8.00–8.17, width 2.28–2.38.

Colour (Fig. 8). Dorsum generally dark-brown to black, covered with golden pubescence. Anterolateral sides and posterior margin of head with yellow marks. Pronotum with three longitudinal yellow stripes (one median and two sublateral) all not reaching posterior margin of pronotum. Mesonotum with longitudinal yellow stripe tapering posteriorly but not reaching posterior margin, and two sublateral yellow marks confluent with median stripe on anterior third. Propleuron black, with a longitudinal yellow mark. Meso- and metacetabula black. Proacetabulum, mesopleuron, meso- and metacetabula with patch of reflective silvery pubescence. Antennae brown to dark-brown. All legs chiefly yellowish-brown. Venter of

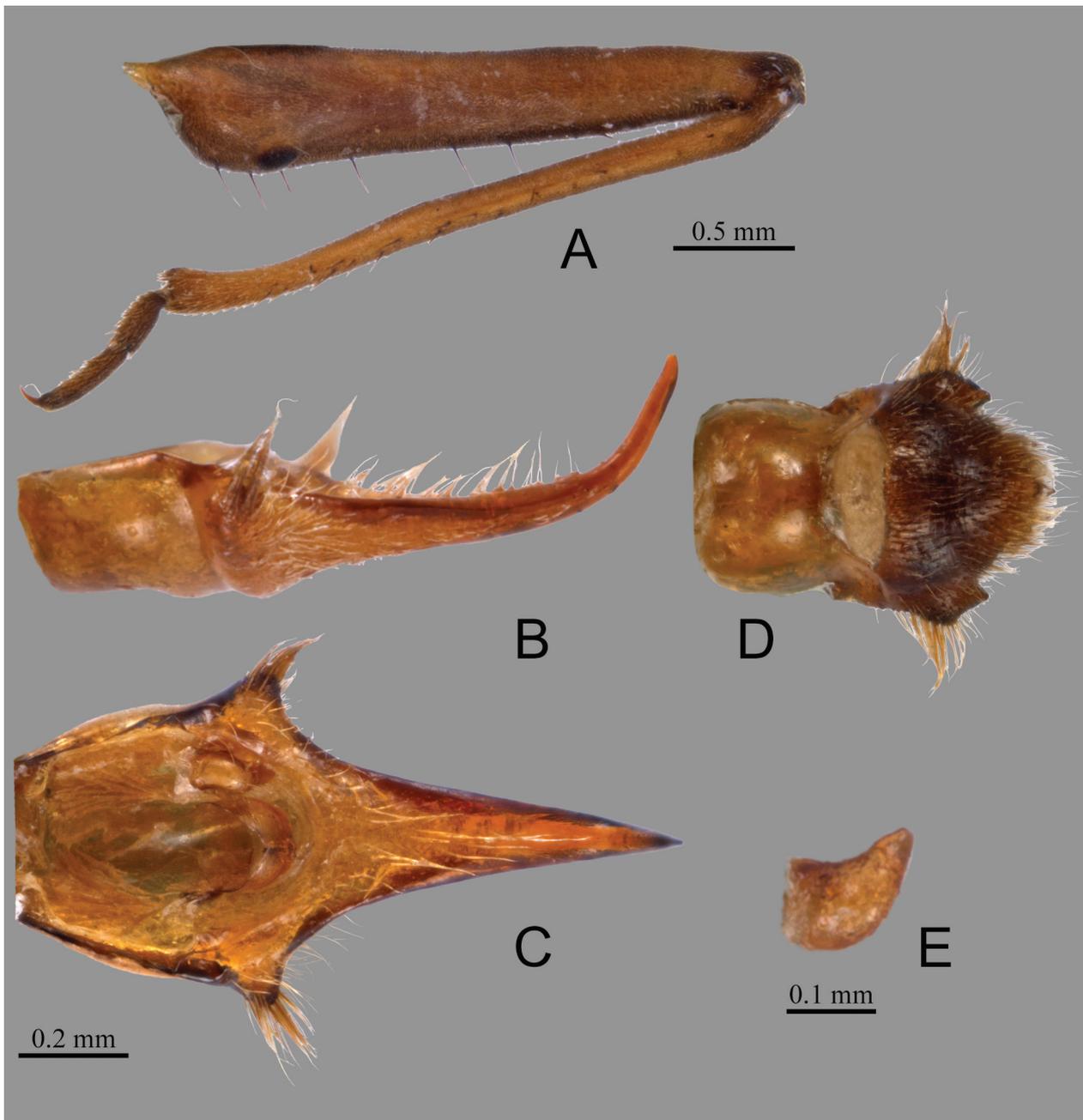


**Figure 8.** *Eotrechus kerberos* sp. nov., habitus. **A.** Male holotype; **B.** Apterous female, paratype.

head mainly pale-yellowish, with a variably distinct brown marking in middle. Prosternum light-coloured. Mesosternum and anterior metasternum chiefly dark-brown to black, posterior metasternum brown. Abdominal venter brown and lateral sides of abdominal dark-brown to black.

Structural characteristics: Apterous male: Head width across eyes 1.58; interocular width 0.57; eye kidney-shaped in dorsal view, length of eye 0.48. Antennae ca. 0.9× body length (7.36: 7.92), lengths of segments I–IV: 2.10: 1.81: 1.58: 1.87; segment I with four black spines in apical part. Pronotum broader than long, shorter than head length (0.98: 1.24). Lengths of mesosternum and metasternum: 2.20 and 0.63. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II)

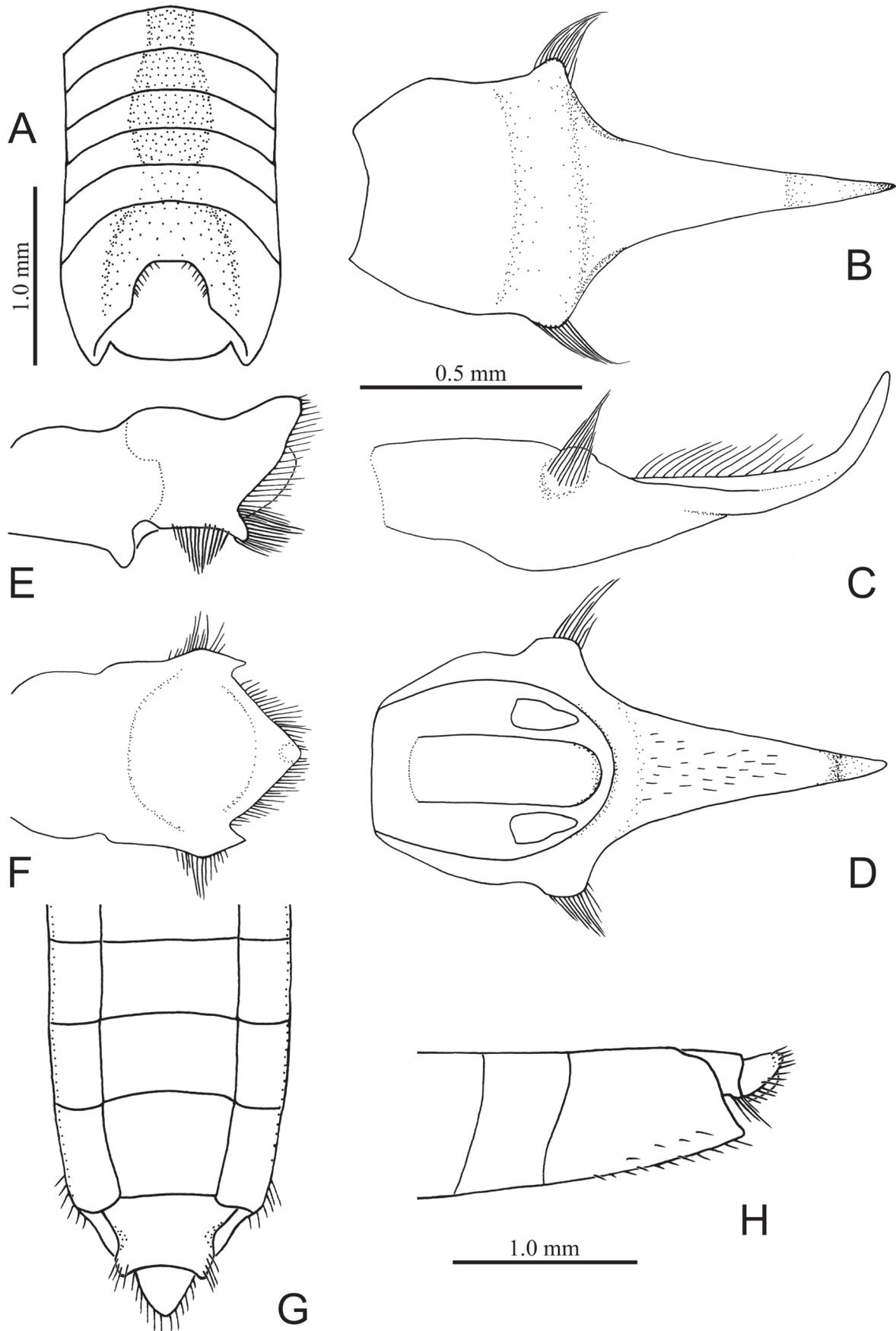
as follows: fore leg: 2.80: 2.75: 0.29: 0.39; middle leg: 7.17: 7.25: 0.42: 0.44; hind leg: 7.50: 8.75: 0.41: 0.45. Fore leg (Fig. 9A): trochanter with two long, fine setae; femur strongly incrassate at basal part, with a large basal tubercle bearing a round spot of black, minute setae, and gradually tapering towards apex, length of femur ca. 5.2× maximum width (2.80: 0.54), flexor side with a row of six long, stout setae; tibia straight at basal part, slightly curved at distal part, with long, brown, stout setae on extensor surface and shorter stout setae on apical margin; tarsus covered with long, soft, yellowish setae (denser on ventral surface). Middle and hind femora slender and slightly shorter than body; middle and hind femora, middle and hind tibiae with scattered short, brown spines. Claws



**Figure 9.** *Eotrechus kerberos* sp. nov., holotype. **A.** Left fore leg, ventral view; **B, C.** Pygophore, lateral and dorsal views; **D.** Proctiger, dorsal view; **E.** Paramere, lateral view (**B–D.** Same scale).

stout, lengths of fore, mid- and hind claws: 0.15: 0.19: 0.18. Abdomen short, total length of abdominal sterna II–VII: 1.76, sterna II–VI medially grooved, the median groove widened in sterna III–V, and indistinct in sternum VI. Sternum VII distinctly longer than the length of two preceding sterna combined (0.67: 0.41), posterior margin with a deep median notch ca. 0.5× the length of sternum VII (Fig. 10A). Genitalia (Figs 9B–E, 10B–F): abdominal segment VIII large; pygophore with lateral tubercles bearing a tuft of long, brownish setae, pygophore with a long, slender caudal projection, with apical third strongly bent dorsad; paramere small and with conical apex; proctiger with pointed posterolateral processes bearing long, brownish setae, ventral surface with short, pale setae.

Apterous female: Head width across eyes 1.61; interocular width 0.57; eye kidney-shaped in dorsal view, length 0.75. Antennae ca. 0.86× of body length (6.89: 8.00), lengths of segments I–IV: 1.94: 1.66: 1.45: 1.84; segment I with five black spines subapically. Pronotum shorter than head length (0.96: 1.24). Lengths of mesosternum and metasternum: 2.15 and 0.73. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 2.69: 2.51: 0.29: 0.41; middle leg: 7.08: 7.21: 0.44: 0.44; hind leg: 7.25: 8.29: 0.42: 0.42. Fore trochanter with 1–3 long, fine setae on ventral side (one specimen with an additional stout seta). Fore femur moderately thickened at basal part and gradually tapering towards apex, length ca. 7.5× maximum width (2.69: 0.36), along flexor side with



**Figure 10.** *Eotrechus kerberos* sp. nov. A–F. Holotype; A. Abdomen of male, ventral view (excluding genitalia); B, C, D. Pygophore, ventral, lateral, and dorsal views; E, F. Proctiger, lateral and dorsal views; G, H. Posterior part of abdomen of female, dorsal and lateral views (B–F. Same scale; G, H. Same scale).

a row of 13–15 long, stout, black setae of irregular length, all shorter than greatest width of fore femur. Fore tibia straight with many long, stout setae on extensor surface and some shorter, stout setae on apical margin. Fore tarsus covered with long, soft, yellowish setae (denser on ventral surface). Middle and hind femur slender and shorter than body length; middle and hind femora, middle and hind tibiae with scattered short, brown spines. Claws stout, lengths of fore, mid- and hind claws: 0.16: 0.19: 0.18. Total length of abdominal sterna II–VII ca.  $0.4 \times$  body length (3.01: 8.00). Sternum VII ca.  $1.3 \times$  length of two preceding sterna combined (1.10: 0.84), posterior margin straight. Connexival apex of sternum VII truncate, slightly curved mesad, and lateral margin with a few long golden setae directed laterad (Fig. 10G, H). Genitalia: not concealed by sternum VII; tergum VIII constricted on posterior part, then produced posterolaterad; proctiger elongate, with pointed apex and directed caudad (Fig. 10G, H).

Macropterous morph: Unknown.

**Remarks.** *Eotrechus kerberos* sp. nov. can be considered as the sister taxon of *E. petraeus* from Thailand because of many similarities, especially a very long caudal projection of the pygophore. However, a set of characteristics of the male distinguishes this new species from *E. petraeus*, as follows. The fore tibia of *E. kerberos* sp. nov. is slender, straight basally and slightly curved distally, whereas that of *E. petraeus* is distally thicker and more curved, with flexor side clearly bisinuate. Detailed structure of genitalia also shows a clear distinction between the two species. In *E. kerberos* sp. nov., the caudal projection of the pygophore is very slender, with the apical part evenly curved dorsad; the setal tufts on the lateral tubercles of the pygophore are pointing more laterally; the lateral processes of the proctiger are acute, pointing posteriorly; the ventral surface of the proctiger has shorter, pale setae; the paramere is short (length ca.  $1.5 \times$  width) and ovoid. In *E. petraeus*, the caudal projection of the pygophore is more triangular, with the apical third strongly bent dorsad; the setal tufts on the lateral tubercles of the pygophore are pointing more dorsad; the lateral processes of the proctiger are rectangular; the ventral surface of the proctiger has very long, dark setae; the paramere is more elongated (length more than  $2.0 \times$  width) and tapers apically.

**Etymology.** The species is named after kerberos, the dog in Greek mythology that guards the gates of the nether world. The name refers to the collector's notes, who observed the specimens sitting at a wall of a cave entrance; it is used as a noun in apposition.

**Distribution.** Laos: Luang Prabang (Fig. 26).

### *Eotrechus romglao* Vitheepreedit & Sites, 2007

Fig. 13A, C–E, 26

*Eotrechus romglao* Vitheepreedit & Sites, 2007: 12–16, figs 2, 9–11 (type locality: Phu Hin Rongkla National Park, Phitsanulok Province, Thailand).

*Eotrechus romglao*: Nakthong et al. (2014: 59–61, figs 38, 44) (diagnosis, notes, key).

**Material examined. Holotype:** THAILAND • ♂ (macropterous); Phitsanulok Province, Phu Hin Rongkla National Park, Namtok Romglao, rock face; 16°59'N, 101°00'E; 1190 m a.s.l.; 6 May 2003; Vitheepreedit, Prommi, Ferro leg.; L-507; UMC.

**Paratypes:** THAILAND • 3 ♂♂, 6 ♀♀ (macropterous); same data as holotype; UMC • 1 ♂, 1 ♀ (macropterous), same data as holotype; ZRC • 1 ♂ (apterous), 4 ♂♂, 1 ♀ (macropterous); same locality as holotype; 11 Mar. 2002; R. Sites, A. Vitheepreedit, K. Kirawanich leg.; L-288; UMC • 10 ♂♂, 7 ♀♀ (macropterous); same locality as holotype; 22 Apr. 2002; CMU team leg.; UMC.

**Diagnosis.** Size (all macropterous): males, length 7.76–8.24, width 2.00–2.08; females, length 7.80–8.40, width 2.16–2.32. Venter of head of both sexes: pale background with a median brown marking and a pair of lateral light-brown, slender stripes. Mesosternum ca.  $2.8 \times$  length of metasternum. Male: fore femur moderately incrassate, broad tubercle on basal part indistinct, but with a spot of dense, minute, black setae, flexor side with a row of approximately six long, stiff setae; fore tibia almost straight, slightly curved subapically, exterior side with scattered long, stiff setae (Fig. 13A); abdominal sterna III–VI medially grooved; sternum VII broadly depressed, length subequal to two preceding sterna combined, posterior margin with a median U-shaped notch as deep as one-third of sternum VII length. Male genitalia (Fig. 13C–E): venter of abdominal segment VIII about as long as sternum VII, posterior margin almost straight with dense, yellowish setae; caudal projection of pygophore triangular (in ventral or dorsal view) and directed dorsad (in lateral view), apex narrowly rounded; lateral tubercle of pygophore well-produced, subtriangular, bearing long setae; paramere ovoid; proctiger with lateral tubercles bearing long setae, apex pointed, ventral surface with a sparse patch of long setae. Female: fore femur relatively slender, with a row of 16 long, stiff setae; extensor side of fore tibia with many long, stiff setae along its length; abdominal sternum VII about as long as two preceding sterna combined, posterior margin almost straight, not concealing genitalia; tergum VIII produced posterolaterally.

**Remarks.** *Eotrechus romglao* is closely related to *E. thai* sp. nov. See Remarks under the latter for further details.

**Distribution.** Thailand: Phitsanulok (Vitheepreedit and Sites 2007) (Fig. 26).

### *Eotrechus thai* sp. nov.

<https://zoobank.org/FBCB9AC9-612D-4992-9576-E7534B28029E>

Figs 11, 12, 13B, F–I, 26

*Eotrechus petraeus* (non Andersen, 1982): Vitheepreedit and Sites (2007: 16–17, fig. 12); Nakthong et al. (2014: 59, figs 37, 43) (key). Misidentifications.

**Material examined. Holotype:** THAILAND • ♂ (apterous); Chiang Mai Province, Doi Inthanon National Park, Huay Sai Luang waterfall, with stream; 18°31'N, 98°27'E;

1060 m a.s.l.; 20 Mar. 2002; Sites, Vitheepradit, Kirawan-ich leg.; L-311; UMC.

**Paratypes:** THAILAND • 8 ♂♂, 1 ♀ (apterous); same locality data as for holotype; UMC • 1 ♂, 1 ♀ (apterous); same locality data as preceding; ZRC • 1 ♀ (apterous); same locality as for holotype; 4 Apr. 2002; UMC & CMU teams leg.; L-322; UMC • 1 ♀ (macropterous); same locality as preceding; 8 May 2002; UMC & CMU teams leg.; L-396; UMC • 1 ♂ (apterous); same locality data as preceding; NHMW • 1 ♀ (apterous); same locality as preceding; 9 Jun. 2002; CMU team leg.; UMC • 1 ♀ (macropterous); same locality as preceding; 11 Aug. 2002; CMU team leg.; UMC • 1 ♂ (apterous); same locality as preceding; 16 Feb. 2003; CMU team leg.; UMC • 1 ♀ (macropterous); same locality as preceding; 7 Dec. 2008; CMU team leg.; UMC • 1 ♀ (apterous); same locality data as preceding; NHMW • 1 ♂ (apterous); Doi Inthanon National Park, Namtok Siriphum; 18°32'N, 98°31'E; 1460 m a.s.l.; 8 Dec. 2002; CMU team leg.; UMC • 1 ♀ (apterous), 1 ♀ (macropterous); Chiang Mai Province, Doi Suthep National Park, Namtok Sai Yoi; 18°48'N, 98°55'E; 1100 m a.s.l.; 11 Jan. 2003; CMU team leg.; UMC • 1 ♂ (macropterous); same locality as preceding; 8 Oct. 2002; CMU team leg.; UMC • 1 ♀ (macropterous); same locality as preceding; 24 Sep. 2002; CMU team leg.; UMC • 1 ♀ (apterous), 1 ♂ (macropterous); Chiang Mai Province, Doi Inthanon National Park, Siriphum waterfalls; 24 Apr. 1995; D. Kovac leg.; ZRC.6.19855; ZRC.

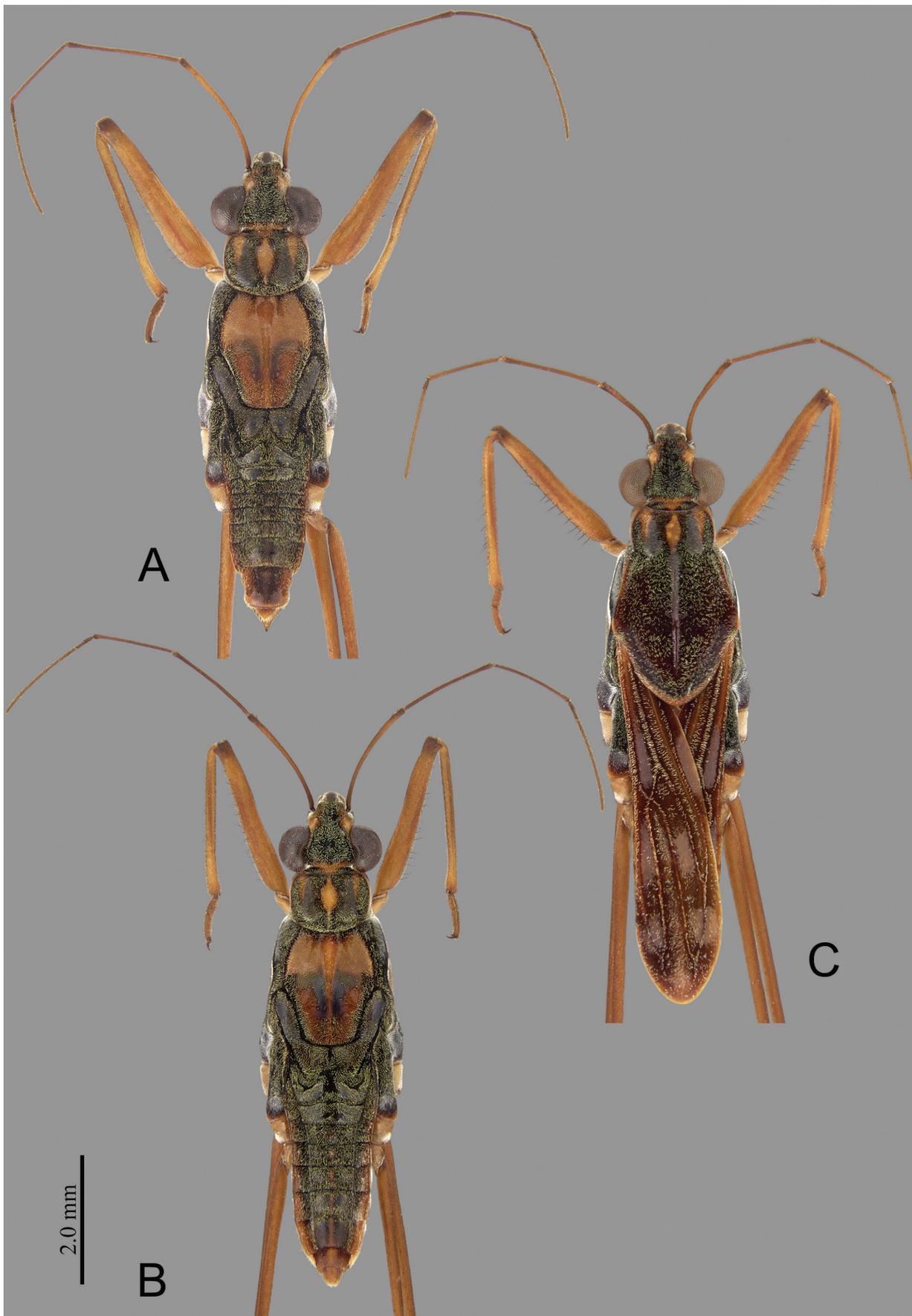
**Description.** Size: apterous males: length 6.48–6.80 (holotype 6.80), width 1.88–2.12 (holotype 1.96); macropterous male: length 8.40, width 2.12; apterous females: length 7.28–7.76, width 2.16–2.28; macropterous females: length 8.40–8.64, width 2.28–2.32.

Colour (Fig. 11): Dorsum generally dark-brown to black, covered with golden pubescence. Anterolateral sides and posterior margin of head with orange marks. Pronotum with three longitudinal orange stripes, one median and two sublateral, all not reaching posterior margin. Mesonotum mostly orange, with darkened transverse band near middle, deflecting posteriorly as paired, longitudinal, darkened stripes close to midline; posterior half with darker-orange suffusion. Propleuron black, with a longitudinal yellowish-orange stripe behind eye and yellowish area dorsad of black proacetabulum. Mesoacetabulum mostly black and metacetabulum black dorsally and orange ventrally. Proacetabulum, mesopleuron, meso- and metacetabula with patch of reflective silvery pubescence. Antennae brown. All legs chiefly yellowish-brown. Venter of head and prosternum mainly yellowish. Mesosternum mostly yellowish with light-brown suffusion and indistinct median and lateral longitudinal stripes; metasternum varying from yellowish-brown to dark reddish-brown. Abdominal sterna orangish-brown, darker brown dorsally just ventrad of terga.

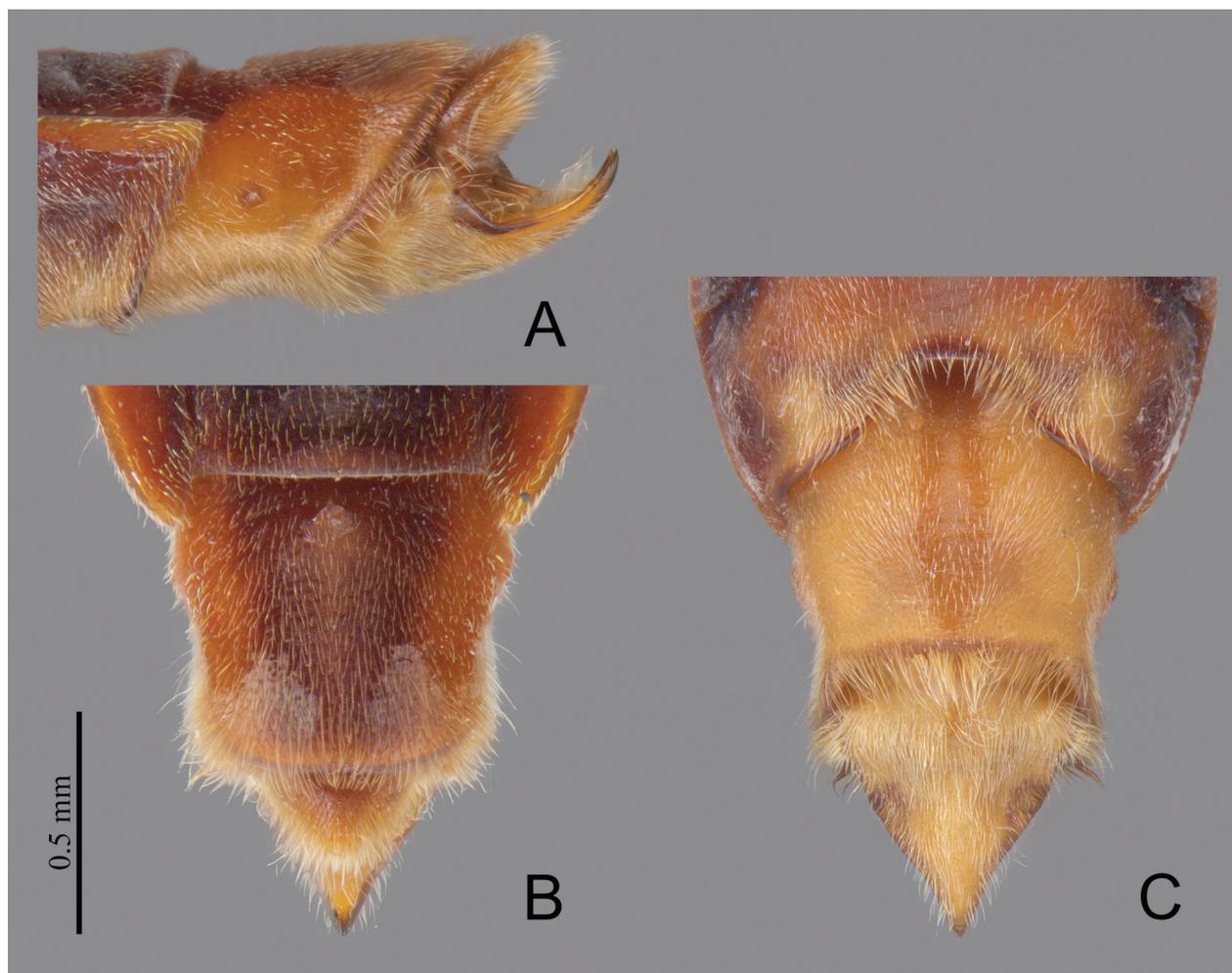
Structural characteristics: Apterous male (holotype): Head width across eyes 1.54; interocular width 0.54; eye kidney-shaped in dorsal view, length of eye 0.73. Antennae 6.56 and subequal to body length, lengths of seg-

ments I–IV: 1.60: 1.80: 1.40: 1.76; segment I with four spines subapically. Pronotum broader than long, shorter than head length (0.90: 1.14). Lengths of mesosternum and metasternum: 1.92 and 0.60. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II) as follows: fore leg: 2.56: 2.56: 0.26: 0.36; middle leg: 6.72: 6.64: 0.40: 0.38; hind leg: 6.88: 7.68: 0.32: 0.44. Fore leg (Fig. 13B): trochanter with two long, fine setae; femur incrassate, length ca. 5.4× maximum width (2.56: 0.47), with a large basal tubercle bearing a round, small, tuberculate spot with black, minute setae, then gradually tapering towards apex, along flexor side of femur with a row of seven long stiff setae; tibia almost straight, slightly narrower at distal part, with scattered, stiff setae on extensor side and some shorter stout setae on apical margin; tarsus covered with long, soft, yellowish setae (denser on ventral surface). Middle and hind femora slender and slightly longer than body; middle and hind femora, middle and hind tibiae with scattered, short, brown spines. Claws stout, lengths of fore, mid- and hind claws: 0.12: 0.10: 0.14. Abdomen short, total length of abdominal sterna II–VII: 1.40, sterna II–VI not medially grooved. Sternum VII slightly longer than length of two preceding sterna combined (0.34: 0.44), broadly depressed, posterior margin with a large median notch about as deep as two-fifths of the length of sternum VII (Fig. 12C). Genitalia (Figs 12, 13G–I): abdominal segment VIII large, ventral side distinctly longer than sternum VII, posterior margin with dense, yellowish setae; pygophore with small lateral tubercles bearing a tuft of yellowish setae, caudal projection triangular, directed dorsad, about as long as main body of pygophore; paramere ovoid; proctiger with lateral tubercle bearing long, brown setae, ventral surface with a patch of brown, brush-like setae.

Apterous female: Head width across eyes 1.58; interocular width 0.60; eye kidney-shaped in dorsal view, length 0.74. Antennae ca. 0.8× of body length (6.08: 7.28), lengths of segments I–IV: 1.68: 1.48: 1.28: 1.64; segment I with 3 dark spines subapically (other shorter spines apically). Pronotum shorter than head length (0.88: 1.24). Lengths of mesosternum and metasternum: 2.04 and 0.68. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 2.56: 2.32: 0.26: 0.36; middle leg: 6.72: 6.64: 0.40: 0.42; hind leg: 7.04: 7.84: 0.42: 0.40. Fore trochanter with one long, fine seta on ventral side (seta length subequal to width of trochanter). Fore femur moderately incrassate, length ca. 7.1× maximum width (2.56: 0.36), without tubercle at basal part, moderately thickened at basal part and gradually tapering towards apex, along flexor side with a row 14–15 long, stiff setae, all shorter than greatest width of fore femur. Fore tibia straight, with many long, stout setae on extensor surface and some shorter, stout setae on apical margin. Fore tarsus covered with long, soft, yellowish setae (denser on ventral surface). Middle and hind femora slender and shorter than body length; middle and hind femora, middle and hind tibiae with scattered short, brown spines. Claws stout, lengths of



**Figure 11.** *Eotrechus thai* sp. nov., habitus. **A.** Apterous male (from Doi Inthanon, Thailand); **B.** Apterous female (from Doi Inthanon); **C.** Macropterous female (from Doi Suthep, Thailand).



**Figure 12.** *Eotrechus thai* sp. nov., male genitalia. **A.** Lateral view; **B.** Dorsal view; **C.** Ventral view.

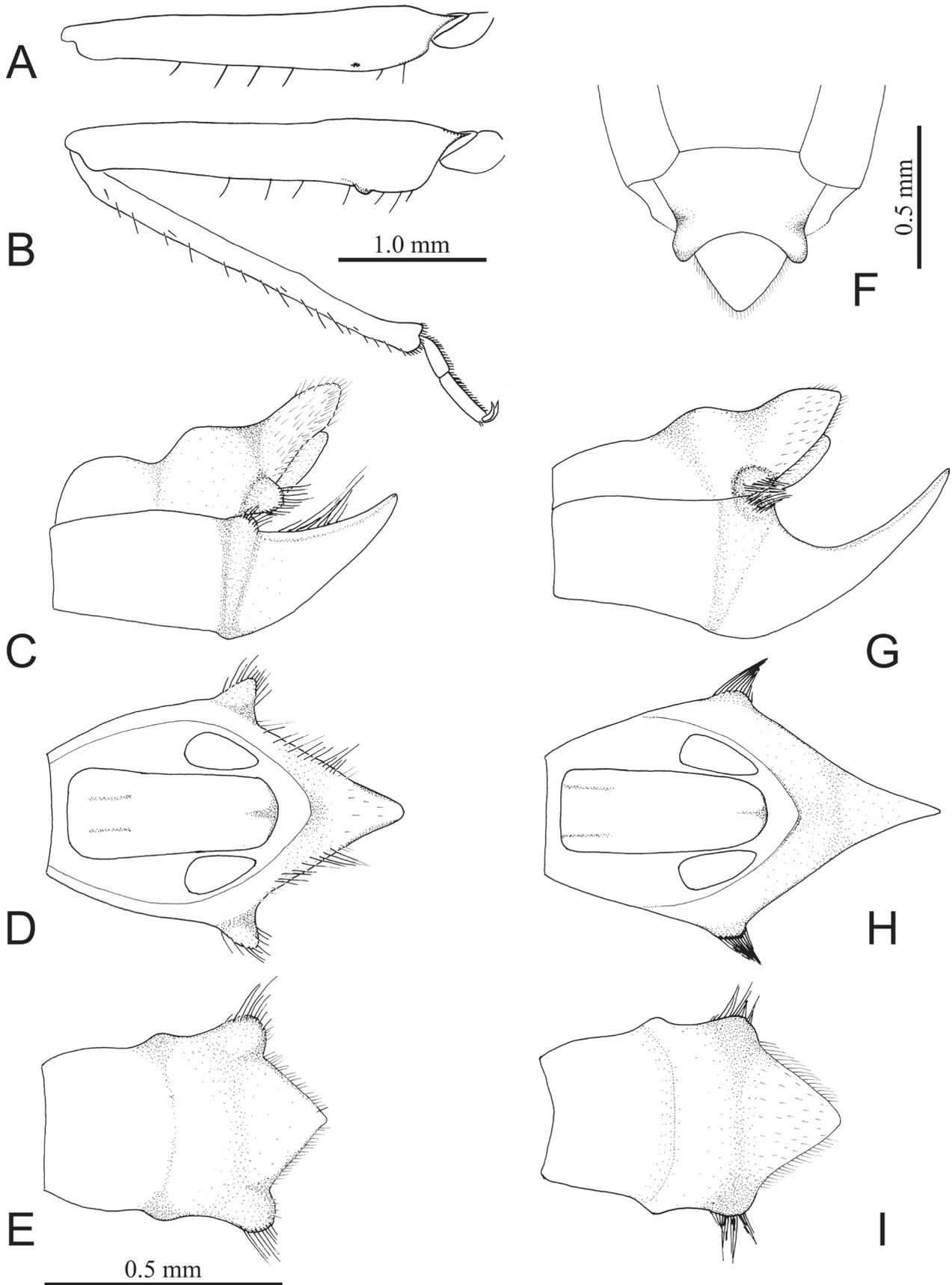
fore, mid- and hind claws: 0.12: 0.16: 0.15. Total length of abdominal sterna II–VII ca.  $0.36 \times$  body length (2.64: 7.28). Sternum VII  $1.2 \times$  length of two preceding sterna combined (0.92: 0.76), posterior margin almost straight. Connexival apex of sternum VII truncate, slightly curved mesad, and lateral and ventral surfaces of sternum VII set with a few long, golden setae interspersed by short, golden setae. Genitalia: not concealed by sternum VII; tergum VIII constricted on posterior part then produced posterolaterally; proctiger elongate, with pointed apex and directed caudad (Fig. 13F).

Macropterous male: Similar to apterous male but with following differences: Pronotum wider, longer, dark reddish-brown, with reddish midline ridge; wings chiefly medium-brown with light-brown patches, reddish-brown veins, four closed cells, and linear series of golden setae, membrane yellowish-brown. Pronotum length (including posterior lobe) 2.88, humeral width 1.80. Fore wing length 5.36.

Macropterous female: Colouration similar to macropterous male. Pronotum length (including posterior lobe) 2.88, humeral width 1.91. Fore wing length 5.28. Other characteristics similar to apterous female.

**Remarks.** Specimens of this new species, collected near the type locality of *E. petraeus*, were previously determined as *E. petraeus* by Vitheepradit and Sites (2007). The pygophore of this species also has a triangular caudal projection, but it is much shorter than that of *E. petraeus*.

This new species is more closely related to *E. romglao* by sharing similarities in the fore femur of the male (with basal spot of black minute setae), the notched posterior margin of male sternum VII, and the male genitalia (pygophore with a triangular caudal projection, similar shape of proctiger). However, males of *E. thai* sp. nov. can be distinguished from those of *E. romglao* by the following: the fore femur has a distinct broad tubercle with a rounded spot of minute, black setae (in *E. romglao*: the basal tubercle is indistinct and the spot of minute, black setae is present, but much smaller); the abdominal sternum is not medially grooved (in *E. romglao*: it is medially grooved from sterna III–VI); abdominal segment VIII, in ventral view, is longer than sternum VII (in *E. romglao*, segment VIII is subequal in length to sternum VII); the lateral tubercles of the pygophore are less developed; the caudal projection of the pygophore is longer and with a pointed apex (in *E. romglao*: the lateral tubercles are much more



**Figure 13.** *Eotrechus romglao* (A, C–E) and *E. thai* sp. nov. (B, F–I). A, B. Right fore leg, ventral view; C, G. Genital capsule (pygophore and proctiger) of male, lateral view; D, H. Pygophore, dorsal view; E, I. Proctiger, dorsal view; F. Abdominal apex of female, dorsal view (A, B. Same scale; C–E, G–I. Same scale).

prominent and subtriangular, and the caudal projection is shorter, with a narrowly rounded apex).

Females of these two species are different only in colouration of the venter of the head: in *E. thai* sp. nov., it is mainly yellow, whereas in *E. romglao*, it has a pale background with dark-brown markings. Otherwise, females are indistinguishable.

**Etymology.** The specific epithet is in reference to the country of Thailand and to the warm, friendly Thai people.

**Distribution.** Thailand: Chiang Mai (Fig. 26).

### *Eotrechus pingae* species group

**Diagnosis.** Male: fore femur with a large basal tubercle, which usually bears a small patch of minute black setae, or produced into a nodule bearing minute black setae, or produced into a pointed tooth-like elevation; posterior margin of sternum VII medially notched, about one-third the length of sternum VII; abdominal segment VIII relatively long; pygophore usually with lateral tubercles bearing long setae; caudal projection of pygophore relatively flat, with broad apical margin; proctiger with angular apex and usually with two posterolateral lobes; lateral or ventral side of proctiger usually bearing long setae. Female: tergum VIII simple; sternum VII about as long as two preceding sterna combined.

**Species included.** *E. pingae* Andersen, 1998, *E. luaae* Tran & Zettel, 2006, *E. elongatus* Vitheepradit & Sites, 2007, *E. fansipan* J. Polhemus, Tran & D. Polhemus, 2009, *E. siamensis* Vitheepradit & Sites, 2007, and *E. konkakin* sp. nov.

### *Eotrechus pingae* Andersen, 1998

Figs 14, 25

*Eotrechus pingae* Andersen, 1998: 2–3, figs 1–5 (type locality: Guangdong, China).

**Material examined. Holotype:** CHINA • ♂ (apterous); “Kwangtung, S. China, Loh Fau Shan, Big Pool, 5 Aug. 1933, Ernest R. Tinkham”; BMNH.

**Diagnosis.** Size: apterous male, length (excluding genitalia) 7.50, width 2.45. Male: mesosternum ca. 3.0× length of metasternum; fore femur incrassate, with a large basal tubercle bearing a patch of black, minute setae (Fig. 14A). Male genitalia (Fig. 14B–D): abdominal segment VIII large, on ventral view, longer than sternum VII, posterior margin broadly rounded; pygophore laterally with rounded tubercle bearing long setae, posteriorly with a broad, subrectangular, plate-like projection; paramere small, ovoid, with soft setae at apex; proctiger trilobed, lateral lobes with long, brownish setae, posteroventral surface without patch of brown, brush-like setae. Female unknown.

**Remarks.** See Remarks for *E. fansipan*.

**Distribution.** China: Guangdong (Andersen 1998) (Fig. 25).

### *Eotrechus luaae* Tran & Zettel, 2006

Fig. 25

*Eotrechus luaae* Tran & Zettel, 2006: 43–46, figs 9–16 (type locality: Hainan Island, China).

**Material examined. Holotype and paratypes:** see Tran and Zettel (2006).

**Diagnosis.** Size: apterous males, length 7.50–8.00 (holotype 8.00), width 2.31–2.51 (holotype 2.51); apterous females, length 8.00–8.70, width 2.48–2.81; macropterous female, length 9.80, width 2.74. Mesosternum 2.9–3.1× length of metasternum. Male: fore femur incrassate, with a large basal tubercle, tubercle with a patch of black, minute setae; abdomen relatively short, slightly depressed from sterna III–VII. Male genitalia: segment VIII large, lateral spiracle situated on minute tubercle; pygophore in ventral view long, slender, and constricted in middle, ventral surface convex, produced into median broad ridge, straight in lateral view, posterior part produced into narrow plate-like structure, tapering towards apex; paramere ovoid, with soft setae at apex; proctiger distinctly trilobed, posteroventral surface with dense patch of long, brush-like setae. Female: fore femur moderately incrassate, base without tubercle; ventral side with row of ca. 12 stiff setae; sternum VII slightly tapering towards apex, length ca. 1.3× length of two preceding sterna combined; genitalia not concealed into abdomen, in lateral view, apex of proctiger acute.

**Remarks.** See Remarks for *E. fansipan*.

**Distribution.** China: Hainan Island (Tran and Zettel 2006) (Fig. 25).

### *Eotrechus elongatus* Vitheepradit & Sites, 2007

Figs 15A–E, 25

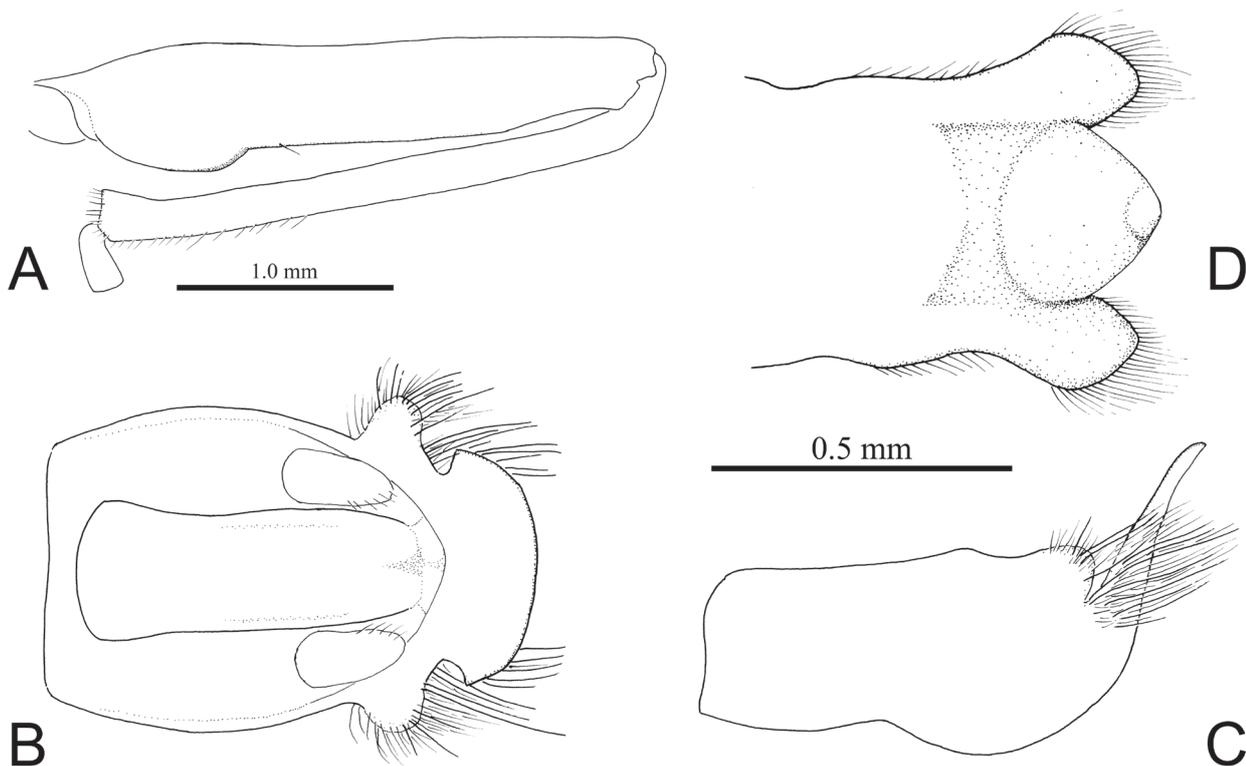
*Eotrechus elongatus* Vitheepradit & Sites, 2007: 8–12, figs 2, 6–8 (type locality: Phu Hin Rongkla National Park, Phitsanulok Province, Thailand).

*Eotrechus elongatus*: Nakthong et al. (2014: 59, figs 36, 40) (key, diagnosis, notes).

**Material examined. Holotype:** THAILAND • ♂ (macropterous); Phitsanulok Province, Phu Hin Rongkla National Park, Nam Tok Romglao, rock face; 16°59'N, 101°00'E; 1190 m a.s.l.; 6 May 2003; Vitheepradit, Prommi, Ferro leg.; L-507; UMC.

**Paratypes:** THAILAND • 10 ♂♂, 7 ♀♀ (macropterous); same locality data as holotype; UMC; • 1 ♂, 1 ♀ (macropterous); same locality data as holotype; ZRC • 1 ♂ (apterous); same locality as preceding; 23 Aug. 2002; CMU team leg.; UMC.

**Other material.** THAILAND • 1 ♂ (apterous), 1 ♂, 1 ♀ (macropterous); Phitsanulok Province, Phu Hin Rongkla National Park, Romglao Waterfall; 16°59'N, 101°00'E; 1190 m a.s.l.; 22 Apr. 2002; CMU Team leg.; UMC.



**Figure 14.** *Eotrechus pingae*, holotype. **A.** Right fore leg; **B, C.** Pygophore, dorsal and lateral views; **D.** Proctiger, dorsal view (**B–D.** same scale).

**Diagnosis.** Size: macropterous males, length 8.56–9.28, width 2.36–2.48; macropterous females, length 9.12–9.52, width 2.64–2.72. Ventral side of head mainly dark-brown (in both sexes). Mesosternum ca. 2.7× (male) and 2.8× (female) length of metasternum. Male: fore femur incrassate, slightly constricted before apex, basal part with broad tubercle bearing patch of minute, dark setae, flexor side of femur with a row of ca. 10 long, stiff setae; fore tibia almost straight, slightly more slender at distal half, long, stiff setae scattered on exterior side and denser at distal part (Fig. 15A, B); abdominal sternum VII broadly depressed, slightly longer than two preceding sterna combined, posterior margin broadly emarginated into a notch about one-third of sternum VII length. Male genitalia (Fig. 15C–E): venter of abdominal segment VIII longer than sternum VII, posterior margin angular medially; pygophore with lateral tubercle indistinct, caudal projection plate-like, narrow, and tapering towards apex, directed dorsad; paramere small, ovoid; proctiger with small lateral lobes not reaching tip of median lobe in dorsal view, posteroventral surface with patch of long, brush-like setae. Female: fore leg more slender than that of male; fore femur without basal tubercle, with 16–18 long stiff setae along flexor side; fore tibia similar to male; abdomen, in lateral view, tapering towards apex; sternum VII about as long as two preceding sterna combined, not enclosing the genitalia.

**Remarks.** In the female, relative lengths of mesosternum to metasternum is 2.76: 1.00, not 1.83: 1.00 as measured by Vitheepradit and Sites (2007). For comparative notes, see Remarks for *E. fansipan*.

**Distribution.** Thailand: Phitsanulok (Vitheepradit and Sites 2007) (Fig. 25).

***Eotrechus fansipan* J. Polhemus, Tran & D. Polhemus, 2009**

Fig. 25

*Eotrechus fansipan* J. Polhemus, Tran & D. Polhemus, 2009: 32–34, figs 1, 4–10, 17 (type locality: Lao Cai, Vietnam).

**Material examined.** VIETNAM • 8 ♂♂, 8 ♀♀ (apterous); Lao Cai Province, Sa Pa, Cat Cat, Ho stream (feeder stream of Muong Hoa stream); 22 Apr. 2011; Dinh N.H. et al. leg.; DNH11.02; ZVNU • 1 ♂, 1 ♀ (apterous); same locality as preceding; 27 Oct. 2020; Tran A.D. leg.; TAD20-23; ZVNU • 3 ♂♂, 1 ♀ (apterous); Lao Cai Province, Sa Pa, Sin Chai, Muong Hoa stream; 22 Apr. 2011; Dinh N.H. et al. leg.; DNH11.03; ZVNU • 1 ♂ (apterous); Lao Cai Province, Sa Pa, waterfall and stream by roadside from Sa Pa town to Nui Xe, ca. 13 km from Sa Pa town; 23 Apr. 2011; Dinh N.H. et al. leg.; DNH11.10; ZVNU • 5 ♂♂ (apterous); same locality as preceding; 30 May 2013; Tran A.D. leg.; TAD1320; ZVNU • 1 ♂ (apterous); same locality as preceding; 25 Oct. 2013; Tran A.D. et al. leg.; TAD1358b; ZVNU • 1 ♂, 4 ♀♀ (apterous); same locality as preceding; 25 Oct. 2020; Tran A.D. & Nguyen V.V. leg.; TAD20-18; ZVNU • 3 ♂♂, 2 ♀♀ (apterous); Lao Cai Province, Sa Pa, waterfall by roadside from Thac Bac waterfall to Nui Xe, ca. 500 m from Thac Bac waterfall; 31 May 2013; Tran A.D. leg. TAD1321; ZVNU

• 1 ♀ (apterous), 1 ♂ (macropterous); Lao Cai Province, Sa Pa, waterfall by roadside from Thac Bac waterfall to Nui Xe, ca. 1 km from Thac Bac waterfall; 31 May 2013; Tran A.D. leg.; TAD1322; ZVNU • 3 ♂♂, 3 ♀♀ (apterous); Lao Cai Province, Sa Pa, Sin Chai, Sin Chai stream, site 1; 27 Oct. 2013; Tran A.D. et al. leg.; TAD1363; ZVNU • 2 ♂♂, 3 ♀♀ (apterous), 1 nymph; Lao Cai Province, Sa Pa, Muong Hoa stream, upstream of Sin Chai; 26 Oct. 2020; Tran A.D. & Nguyen T.A.N. leg.; TAD20-22; ZVNU.

**Diagnosis.** Size: apterous males, length 7.66–8.50 (holotype 8.50), width 2.48–2.74 (holotype 2.74); macropterous male, length 9.80, width 2.56; apterous females, length 8.55–9.50, width 2.77–2.87; macropterous female, length 9.54–9.60. Dorsum mainly brown, venter mainly light-brown. Mesosternum ca. 3.2× (male) and 2.95× (female) length of metasternum. Male: fore femur incrassate, slightly constricted before apex, basal part with broad tubercle bearing patch of minute, dark setae, flexor side of femur with a row of ca. 10 long, stiff setae; fore tibia slightly curved in the middle, long, stiff setae scattered on extensor side and denser at distal part; abdominal sterna III–VI medially depressed, sternum VII broadly depressed, distinctly longer than two preceding sterna combined, posterior margin emarginated into a notch about two-fifths of sternum VII length. Male genitalia: segment VIII longer than sternum VII, posteroventral margin almost straight; pygophore with small lateral tubercle, ventral surface convex in lateral view; caudal projection of pygophore short, plate-like, with dense patch of long, soft setae on ventrolateral sides, apical margin almost straight; paramere small, ovoid; proctiger trilobed, posterolateral lobes small, posteroventral surface with dense patch of long, brush-like setae. Female: fore femur more slender than in male, femur without basal tubercle, with ca. 12 long, stiff setae along flexor side; fore tibia almost straight; abdomen, in lateral view, tapering towards apex; sternum VII ca. 1.1× length of two preceding sterna combined, not enclosing genitalia.

**Remarks.** Four species, *Eotrechus fansipan*, *E. pingae*, *E. luaae*, and *E. elongatus* are closely related to each other, by sharing similarities in the structure of the fore leg

and genitalia of the male. Polhemus et al. (2009) provided a comparison among three species, *Eotrechus fansipan*, *E. pingae*, and *E. luaae*. Herein, we provide further comparison, with the addition of *E. elongatus* (Table 2).

**Distribution.** Vietnam: Lao Cai (Polhemus et al. 2009) (Fig. 25).

### *Eotrechus siamensis* Vitheepradit & Sites, 2007

Figs 15F–I, 25

*Eotrechus siamensis* Vitheepradit & Sites, 2007: 2–8, figs 1, 3–6 (type locality: Doi Inthanon National Park, Chiang Mai Province, Thailand).

*Eotrechus siamensis*: Nakthong et al. (2014: 59, figs 39, 45) (key).

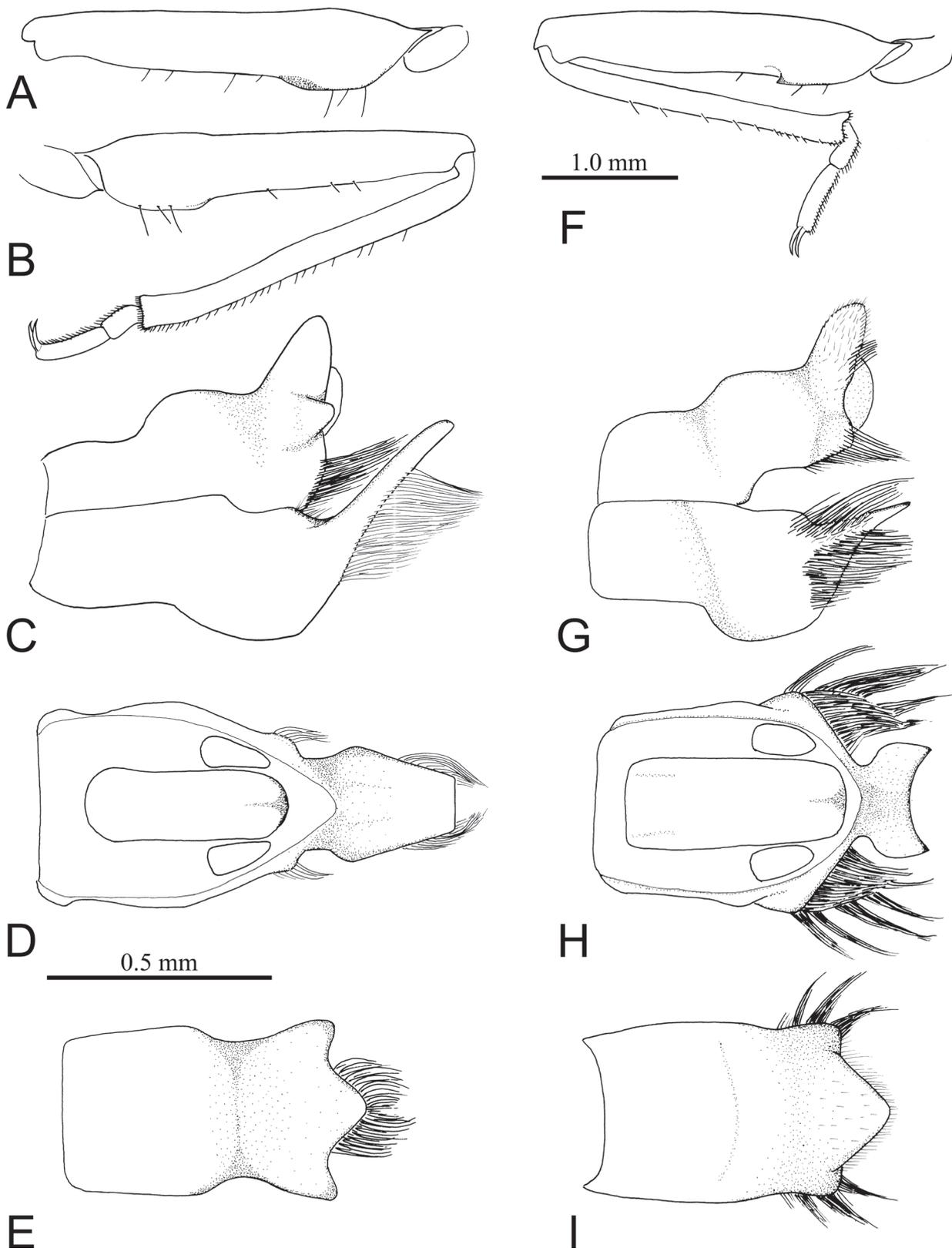
**Material examined. Holotype:** THAILAND • ♂ (apterous); Chiang Mai Province, Doi Inthanon National Park, Pha Dum waterfall, rock face; 18°36'N, 98°31'E; 1379 m a.s.l.; 3 May 2003; UMC and CMU teams leg.; L-499; UMC.

**Paratypes:** THAILAND • 2 ♂♂, 3 ♀♀ (apterous), 5 ♂♂, 4 ♀♀ (macropterous); same locality data as holotype; UMC • 1 ♂, 1 ♀ (macropterous); same locality data as holotype; ZRC • 4 ♀♀ (apterous); Chiang Mai Province, Doi Inthanon National Park, Siriphum Waterfall; 18°32'N, 98°31'E, 1460 m a.s.l.; 2 Apr. 2002; UMC and CMU teams leg.; UMC.

**Other material.** THAILAND • 3 ♂♂, 1 ♀ (apterous), 3 ♂♂, ♀ (macropterous); Chiang Mai Province, Doi Inthanon National Park, Siriphum waterfall; 24 Apr. 1995; D. Kovac leg.; DK#2/47; ZRC.6.19857; ZRC • 3 ♂♂ (macropterous); Chiang Mai Province, Doi Inthanon National Park, Siriphum waterfalls; 28 Apr. 1999; D. Kovac leg.; DK#A221/99; ZRC.6.19858; ZRC • 1 ♀ (apterous), 1 ♀ (macropterous); Chiang Mai Province, Doi Inthanon National Park, Siriphum waterfalls; 28 Apr. 1999; D. Kovac leg.; DK#A223/99; ZRC.6.19859; ZRC • 1 ♀ (apterous), 1 ♀ (macropterous); Chiang Mai Province, Doi Inthanon National Park, Siriphum Waterfall (upper); 18°32'N, 98°31'E; 1380 m a.s.l.; 2 Mar. 2002; Vitheepradit, Kirawanich leg.; UMC.

**Table 2.** Comparative morphology of *E. pingae*, *E. luaae*, *E. elongatus*, and *E. fansipan* (modified from Polhemus et al. 2009).

Male	<i>E. pingae</i>	<i>E. luaae</i>	<i>E. elongatus</i>	<i>E. fansipan</i>
Fore tibia	almost straight	almost straight	almost straight	flexor side curved at middle
Abdominal venter	median groove from sterna II–VII, narrow and deep	median groove from sterna III–VII less conspicuous	median groove not distinct, sternum VII broadly depressed	median groove from sterna III–VI less conspicuous, sternum VII broadly depressed
Posterior margin of segment VIII	without median process	with small acute median process	angular medially	straight, without median process
Proctiger	- posterolateral lobes large - without patch of long setae	- posterolateral lobes large - with patch of long setae on posteroventral surface	- posterolateral lobes small - with patch of long setae on posteroventral surface	- posterolateral lobes small - with patch of long setae on posteroventral surface
Pygophore	- short - lateral tubercles large - posterior plate short and broad - without ventrolateral patches of setae	- long and slender - without lateral tubercles - posterior plate narrow, tapering towards apex - ventrolateral patches of setae less dense	- long and slender - lateral tubercles indistinct - posterior plate relatively narrow, tapering towards apex - ventrolateral dense patches of setae	- medium length - lateral tubercles small - posterior plate short and broad - with ventrolateral dense patches of setae
Pygophore in lateral view	- ventral margin rounded	- ventral margin broad and straight	- ventral margin more angular	- ventral margin rounded



**Figure 15.** *Eotrechus elongatus* (A–E) and *E. siamensis* (F–I), males. A, B, F. Right fore leg (A, F. Ventral view; B. Dorsal view); C, G. Genital capsule, lateral view; D, H. Pygophore, dorsal view; E, I. Proctiger, dorsal view (A, B, F. Same scale; C–E, G–I. Same scale).

**Diagnosis.** Size: apterous males, length 6.80–7.84, width 2.28–2.48; macropterous males, length 8.48–8.96, width 2.48–2.54; apterous females, length 7.60–7.76, width 2.44–2.68; macropterous females, length 8.80–

9.84, width 2.32–2.72 (with additional data from Vith-epradit and Sites 2007). Venter of head with a median brown marking (in both sexes). Mesosternum ca. 2.8× (in female) or 3.2× (in male) length of metasternum.

Male: fore femur incrassate, basal part broadened, with a large tubercle bearing a pointed tooth, distal part slightly constricted (Fig. 15F); fore tibia almost straight with scattered, stiff setae on extensor side; abdominal sterna III–VI medially grooved; sternum VII broadly depressed, slightly longer than two sterna combined, posterior margin with a median notch about as deep as one-third of sternum VII length. Male genitalia (Fig. 15G–I): abdominal segment VIII large, in ventral view, about as long as sternum VII, posterior margin on venter almost straight; pygophore short, posterolaterally with patch of very long, brush-like setae; caudal projection of pygophore plate-like with a concave posterior margin and angular posterolaterally; paramere small, ovoid; proctiger with pointed apex, directed upward, posterolateral lobes with patch of long, brush-like, brown setae, posteroventral surface without long, brush-like setae. Female: fore femur slender, flexor side with a row of ca. 15 long, stiff setae; fore tibia with scattered, long, stiff setae on extensor side along its length; sternum VII about as long as two preceding sterna combined, posterior margin almost straight, not enclosing genitalia; tergum VIII slightly tapering posteriorly; proctiger with acute apex.

**Remarks.** This species can be placed in the *E. pingae* species group because it has a basal tubercle on the fore femur of the male, a median notch on posterior margin of the sternum VII of the male, a plate-like apical projection of the pygophore, and a tri-lobed proctiger. This species possesses some unique characteristics that distinguish it from all other species of *Eotrechus*: the basal tubercle of the fore femur of the male is modified into a pointed tooth and the caudal projection of the pygophore is uniquely crescent-shaped (distinctly concave posteriorly and angular posterolaterally). Colouration of venter of head seems to be a good character to distinguish females of this species from others in the *E. pingae* group. Otherwise, females of species in the *E. pingae* group are very similar to each other.

**Distribution.** Thailand: Chiang Mai (Vitthepradit and Sites 2007) (Fig. 25).

### *Eotrechus konkakin* sp. nov.

<https://zoobank.org/4568AB8C-41D3-4F80-9785-9898FFA9B9A2>

Figs 1B, 16, 17, 25

**Material examined. Holotype:** VIETNAM • ♂ (apterous); Gia Lai Province, Kon Ka Kinh National Park, H'Ngoi, Thác Ba Tầng waterfall and stream; 27 Apr. 2022; Tran A.D. & Phan Q.T. leg.; TAD2224; ZVNU.

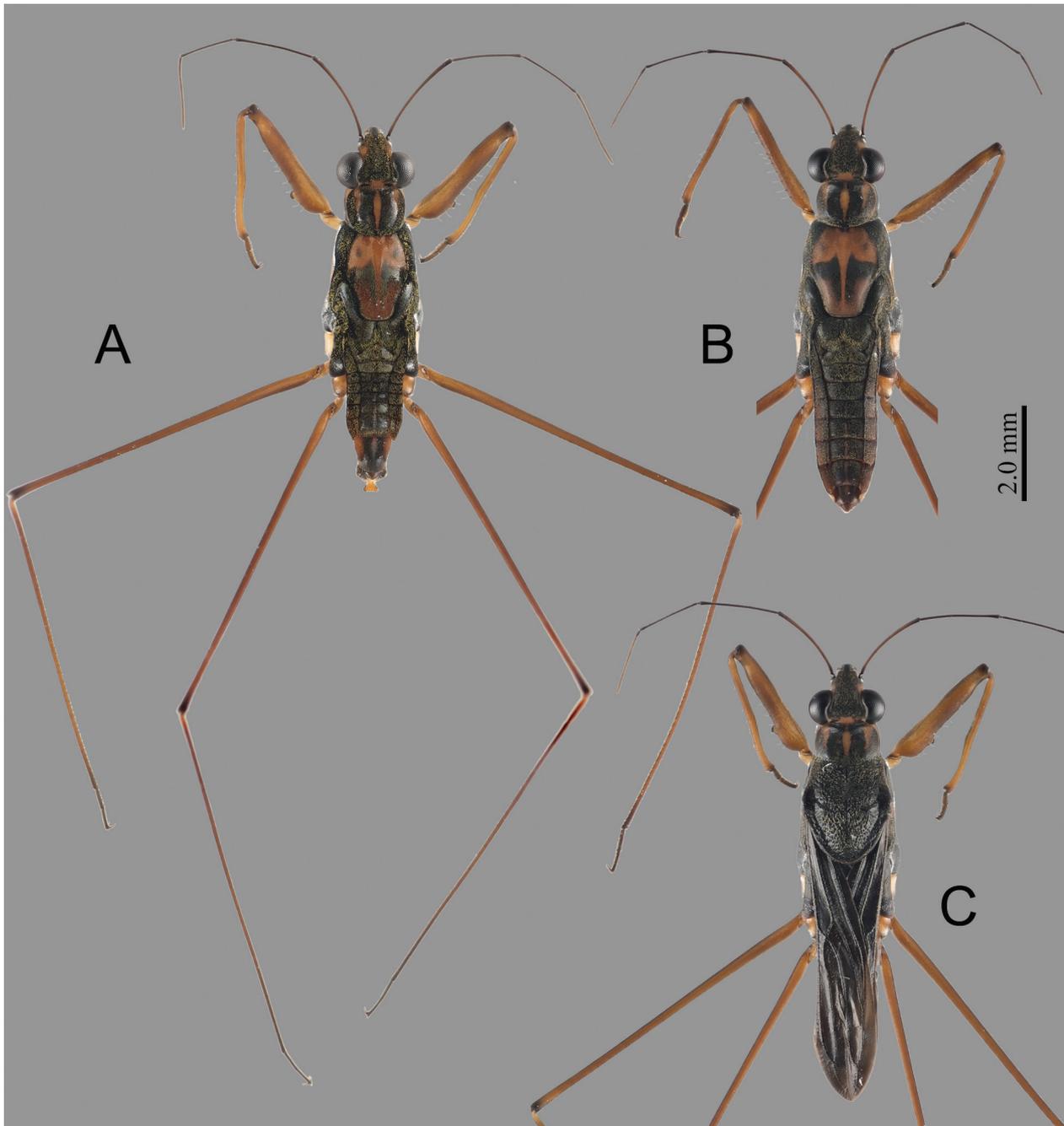
**Paratypes:** VIETNAM • 12 ♂♂, 12 ♀♀ (apterous), 1 ♂, 1 ♀ (macropterous); same locality data as holotype; ZVNU • 3 ♂♂, 3 ♀♀ (apterous); same locality data as holotype; ZRC • 3 ♂♂, 3 ♀♀ (apterous); same locality data as holotype; NHMW.

**Description.** Size: apterous males, length 7.20–7.80 (holotype 7.70), width 2.06–2.25 (holotype 2.18); macropterous male, length 9.10, width 2.16; apterous fe-

males, length 8.00–8.90, width 2.31–2.59; macropterous female, length 9.10, width 2.52.

**Colour** (Figs 1B, 16): Dorsum generally dark-brown to black, covered with golden pubescence. Anterolateral sides and posterior margin of head with orange marks. Pronotum with three longitudinal orange stripes, one median (longer) and two sublateral, all not reaching posterior margin. Mesonotum with anterior half brownish-yellow and posterior half with a pair of dark marks on either side of mid-line, posteriorly suffusion with darker-yellow ground colour. Propleuron black, with a longitudinal brownish-yellow stripe behind eye and yellowish area dorsad of black proacetabulum. Mesoacetabulum mostly black and metacetabulum black dorsally and orange ventrally. Proacetabulum and mesopleuron with thin stripe of reflective silvery pubescence; meso-, metacetabula and sides of abdomen with patch of reflective silvery pubescence. Antennae brown. All legs chiefly brownish-yellowish. Venter of head and prosternum mainly yellowish; in some females, venter of head with median brown mark. Mesosternum and metasternum varying from yellowish to brown, with suffusion of indistinct brown marks. Abdominal sterna varying from yellowish to brown, darker brown dorsally just ventrad of terga.

**Structural characteristics:** Apterous male (holotype): Head width across eyes 1.66; interocular width 0.63; eye kidney-shaped in dorsal view, length of eye 0.84. Antennae: length 6.83 and shorter than body length, lengths of segments I–IV: 1.95: 1.65: 1.35: 1.88; segment I with six spines subapically. Pronotum broader than long, shorter than head length (0.96: 1.38). Lengths of mesosternum and metasternum: 1.90 and 0.73. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II) as follows: fore leg: 2.78: 2.70: 0.30: 0.43; middle leg: 6.95: 6.65: 0.49: 0.47; hind leg: 7.10: 7.75: 0.48: 0.49. Fore leg (Fig. 17A, B): trochanter with three long, fine setae (about as long as width of trochanter, one on ventral, two on dorsal surface); femur moderately incrassate, with a large basal tubercle on flexor side, length of femur ca. 4.8× maximum width at basal tubercle (2.78: 0.58), 5.2× maximum width at basal part, excluding basal tubercle (2.78: 0.53); subbasal tubercle of femur bearing a distinct round nodule covered by black, minute setae; distal part of femur gradually tapering towards apex, along flexor side of femur with a row of eight long, stiff setae; tibia almost straight, slightly thickened near middle of flexor side before narrower distal part, with scattered long, stiff setae on extensor side and some shorter, stout setae on apical part; tarsus covered with long, soft, yellowish setae on ventral surface, and only with short setae on dorsal surface. Middle and hind femora slender and slightly shorter than body length; middle and hind femora, middle and hind tibiae with scattered, short, brown spines (denser on middle femur). Claws stout, lengths of fore, mid- and hind claws: 0.14: 0.18: 0.18. Abdomen short, total length of abdominal sterna II–VII: 1.75, sterna II–V not medially grooved, only sternum VI weakly medially grooved. Sternum VII longer than length of two pre-

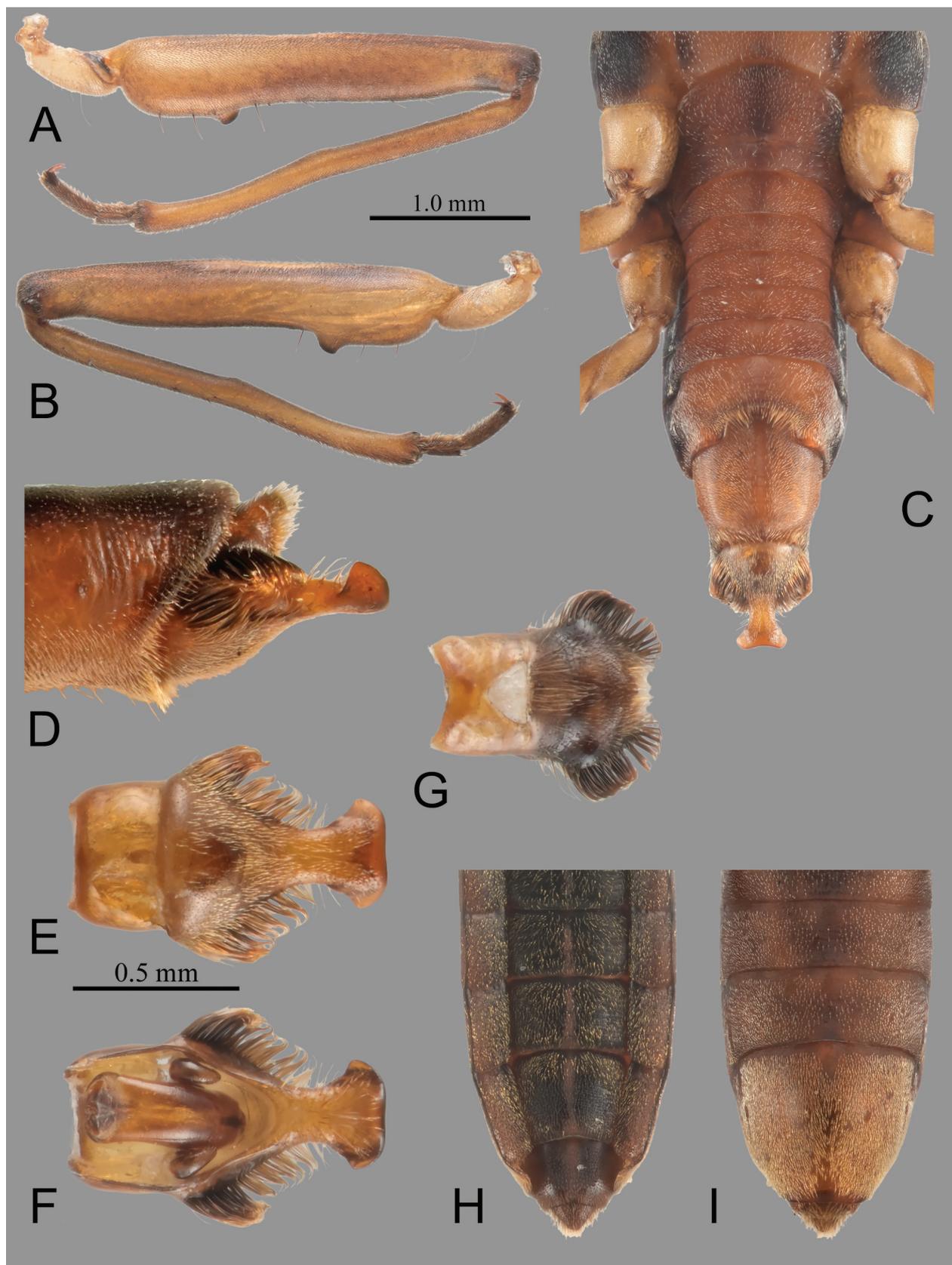


**Figure 16.** *Eotrechus konkakin* sp. nov., habitus. **A.** Apterous male; **B.** Apterous female; **C.** Macropterous male.

ceding sterna combined (0.58: 0.43), broadly depressed, posterior margin with a large median notch about as deep as one-third length of sternum VII (Fig. 17C). Genitalia (Fig. 17C–G): abdominal segment VIII large, ventral side distinctly longer than sternum VII, near posterior margin with dense, yellowish, soft setae; pygophore with a dense posterolateral tuft of long, black, bristle-like setae, caudal projection constricted before laterally-expanded apex, forming two broad, lateral lobes directed dorsad, apical margin of projection almost straight (thus, the shape of pygophore in ventral view appearing somewhat like “a snifter beer glass”, with caudal projection as the base of the glass); paramere subovoid; proctiger with small lateral tubercles situated ventrally, proctiger with a dense

lateral fringe of long, black, bristle-like setae, long brown setae along lateral and posterolateral margins.

Apterous female: Head width across eyes 1.70; interocular width 0.68; eye kidney-shaped in dorsal view, length 0.81. Antennae  $0.8\times$  body length (6.94: 8.40), lengths of segments I–IV: 1.93: 1.60: 1.43: 1.98; segment I with five dark spines subapically. Pronotum shorter than head length (0.98: 1.41). Lengths of mesosternum and metasternum: 2.16 and 0.83. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 2.78: 2.50: 0.32: 0.42; middle leg: 7.15: 6.90: 0.50: 0.48; hind leg: 7.30: 7.95: 0.47: 0.49. Fore trochanter with two long, fine setae on ventral side (seta length subequal to width of trochanter). Fore femur simple, moderately



**Figure 17.** *Eotrechus konkakin* sp. nov. **A, B.** Right fore leg of male, dorsal and ventral views; **C.** Abdomen of male, ventral view; **D.** Genitalia, lateral view; **E, F.** Pygophore, ventral and dorsal views; **G.** Proctiger, dorsal view; **H, I.** Posterior part of abdomen of female, dorsal and ventral views (**A–C, H, I.** Same scale; **D–G.** Same scale).

incrassate, length ca.  $7.1 \times$  maximum width (2.78: 0.39), moderately thickened at basal part and gradually tapering towards apex, along flexor side with a row 10–12 long, stiff setae, all shorter than greatest width of fore femur. Fore tibia straight with many long, stout setae on extensor surface and some shorter, stout setae on apical part. Fore tarsus covered with long, soft, yellowish setae on ventral surface, and only with short setae on dorsal surface. Middle and hind femora slender and shorter than body length; middle and hind femora, middle and hind tibiae with scattered, short, brown spines (denser on middle femur). Claws stout, lengths of fore, mid- and hind claws: 0.15: 0.20: 0.18. Total length of abdominal sterna II–VII ca.  $0.36 \times$  body length (3.06: 8.40). Sternum VII ca.  $1.1 \times$  length of two preceding sterna combined (0.98: 0.88), posterior margin almost straight. Connexival apex of sternum VII truncate, and lateral and ventral surfaces of sternum VII set with a few long, golden setae interspersed by denser, short, golden setae (Fig. 17I). Genitalia: not concealed by sternum VII; tergum VIII simple; proctiger short, with pointed apex and directed caudad (Fig. 17H, I).

Macropterous male (Fig. 16C): Similar to apterous male but with following differences: Pronotal lobe black with scattered, golden setae, irregularly punctured; wings chiefly black with four closed cells and with relatively denser golden setae on wing veins and scattered, golden setae elsewhere, membrane greyish-brown. Pronotum length (including posterior lobe) 2.94, humeral width 1.91. Fore wing length 6.10.

Macropterous female: Colouration similar to macropterous male. Pronotum length (including posterior lobe) 3.00, humeral width 1.97. Fore wing length 6.10. Other characteristics similar to apterous female.

**Remarks.** *Eotrechus konkakin* sp. nov. is placed in the *E. pingae* species group on the basis of having a large basal tubercle on the fore femur of the male and a broad caudal projection of the pygophore. In this species group, *E. konkakin* sp. nov. is most similar to *E. siamensis* in having the caudal projection of the pygophore expanded posterolaterally and dense tufts of long, black, bristle-like setae on both the pygophore and proctiger. *Eotrechus konkakin* sp. nov. can be distinguished from *E. siamensis* by the structure of the basal part of the male fore femur and shape of the caudal projection of the pygophore. In males of *E. konkakin* sp. nov., the fore femur has a distinct sub-basal nodule, which is covered with minute, black setae, whereas in males of *E. siamensis*, a pointed tooth is in the same position. The caudal projection of the pygophore of *E. konkakin* sp. nov. is longer and its lateral lobes are broad and directed dorsad, whereas that of *E. siamensis* is shorter and crescent-shaped (distinctly concave posteriorly and angular posterolaterally).

**Etymology.** The name *konkakin* refers to the type locality, Kon Ka Kinh National Park. It is used as a noun in apposition.

**Distribution.** Vietnam: Gia Lai (Fig. 25).

## *Eotrechus hygropetricus* species group

**Diagnosis.** Male: fore femur simple, tapering towards apex; pygophore not modified posteriorly, but with patches of long, dark, bristle-like setae posterolaterally; proctiger simple, with lateral patches of long, dark, bristle-like setae. Female: genitalia small, but visible in lateral view.

**Species included.** *E. hygropetricus* Andersen, 1982, *E. pilicaudatus* Tran & Zettel, 2006, and *E. boukali* sp. nov.

## *Eotrechus hygropetricus* Andersen, 1982

Figs 19K, 24

*Eotrechus hygropetricus* Andersen, 1982: 16–17, figs 2, 11 (type locality: Chiang Mai, Thailand).

*Eotrechus hygropetricus*: Andersen (1998: 3–4, figs 6–7) (description of male); Vitheepradit and Sites (2007: 18) (additional records Thailand); Nakthong et al. (2014: 59, fig. 41) (key).

**Material examined.** All specimens are macropterous: THAILAND • 1 ♂, 1 ♀; Chiang Mai Province, Doi Sutep National Park, Huai Sa Lad; 24 Mar. 1994; William D. Shepard leg.; NHMW • 5 ♂♂, 3 ♀♀; Chiang Mai Province, Doi Suthep, waterfalls; 10 Apr. 1999; D. Kovac leg.; #A4/99; ZRC.6.19856; ZRC • 5 ♂♂, 2 ♀♀; Chiang Mai Province, Doi Inthanon Nat. Pk., Namtok Huay Sai Luang; 18°31'N, 98°27'E; 1060 m a.s.l.; 20 Mar. 2002; Sites, Vitheepradit, Kirawanich leg.; L-311; UMC • 5 ♂♂, 5 ♀♀; same locality as preceding; 4 Apr. 2002; UMC and CMU teams leg.; L-322; UMC • 1 ♂; same locality as preceding; 6 Jul. 2002; CMU team leg.; UMC • 1 ♀; same locality as preceding; 11 Aug. 2002; CMU team leg.; UMC • 1 ♀; same locality as preceding; 22 Sep. 2002; CMU team leg.; UMC • 1 ♀; same locality as preceding; 6 Oct. 2002; CMU team leg.; UMC • 3 ♀♀; same locality as preceding; 14 Mar. 2003; CMU team leg.; UMC • 1 ♀; Doi Inthanon National Park, Namtok Siriphum; 18°32'N, 98°31'E; 1460 m a.s.l.; 10 Aug. 2002; CMU team leg.; UMC • 1 ♂; same locality as preceding; 8 Dec. 2002; CMU team leg.; UMC • 2 ♂♂; Doi Suthep Nat. Park, Namtok Sai Yoi; 18°48'N, 98°55'E; 1100 m a.s.l.; 14 Feb. 2002; CMU team leg.; UMC • 2 ♂♂, 2 ♀♀; same locality as preceding; 5 Apr. 2002; UMC and CMU teams leg.; L-326; UMC • 1 ♂; same locality as preceding; 5 May 2002; CMU team leg.; L-402; UMC • 14 ♂♂, 12 ♀♀; Doi Suthep National Park, Namtok Monthathan; 18°49'N, 98°55'E; 700 m a.s.l.; 8 Apr. 2002; UMC and CMU teams leg.; L-330; UMC • 22 ♂♂, 13 ♀♀; same locality as preceding; 29 Mar. 2003; Vitheepradit, Thamasenanupap, Ferro leg.; L-489; UMC • 3 ♂♂, 4 ♀♀; Doi Suthep National Park, immediately below Monthathan Falls; 18°49'N, 98°55'E; 690 m a.s.l.; 15 Mar. 2002; Kirawanich & Sites leg.; L-296; UMC • 13 ♂♂, 14 ♀♀; Doi Suthep National Park, Namtok Huay Pa Lad; 18°48'N, 98°54'E; 1250 m a.s.k.; 29 Apr. 2003; Vitheepradit, Thamasenanupap, Ferro leg.;

L-488; UMC • 9 ♂♂, 15 ♀♀; Kanchanaburi Province, Amphur Thong Pha Phum, 6.3 km W of Border Police Station at Ban Padsadoo Klang; 14°32'N, 98°32'E; 568 m a.s.l.; 10 Apr. 2003; UMC and CMU teams leg.; L-463; UMC • 2 ♂♂, 2 ♀♀; Phang Nga Province, E. Lam Pi, Lam Pi waterfall; 26 Nov. 2006; H. Zettel leg.; (36); NHMW.

**Diagnosis.** Size (all macropterous): specimens from Chiang Mai: males, length 7.10–7.60, width 1.80–1.96; females, length 8.10, width 2.25–2.28; specimens from Phang Nga: male, length 6.70, width 1.77; female, length 7.10, width 1.95. Mesosternum 3.0–3.1× length of metasternum. Male: fore femur moderately incrassate, simple, without tubercle at basal part; abdominal sterna III–VI with narrow median groove. Male genitalia simple, pygophore without caudal projection, posterior part only with long setae. Female: fore trochanter, fore femur and fore tibia with rows of long, stiff setae; genitalia small but visible in lateral view (Fig. 19K).

**Remarks.** The sample from Phang Nga (southern Thailand) consists of smaller specimens compared to those from the type locality. However, all other characteristics show that these specimens are conspecific. See Remarks for *E. boukali* sp. nov. below.

**Distribution.** Thailand: Chiang Mai (Andersen 1998), Kanchanaburi, and Phang Nga (new records) (Fig. 24).

#### *Eotrechus boukali* sp. nov.

<https://zoobank.org/F599C0E2-470F-4C0A-AB93-9A7919DCB779>

Figs 18, 19 A–J, 24

**Material examined.** *Holotype*: MYANMAR • ♂ (apterous); Sagaing Division, Alaungdaw Katthapa National Park, Pagoda stream; 22°19.113'N, 94°28.518'E; 350 m a.s.l.; 5 May 2003; Boukal et al. leg.; (105); NHMW.

**Paratypes**: MYANMAR • 1 ♂, 2 ♀♀ (apterous); same locality data as holotype; NHMW • 2 ♂♂, 1 ♀ (apterous); Sagaing Division, Alaungdaw Katthapa National Park, Pagoda stream; 22°19.094'N, 94°28.823'E; 350 m a.s.l.; 6 May 2003; Boukal et al. leg.; (110); NHMW.

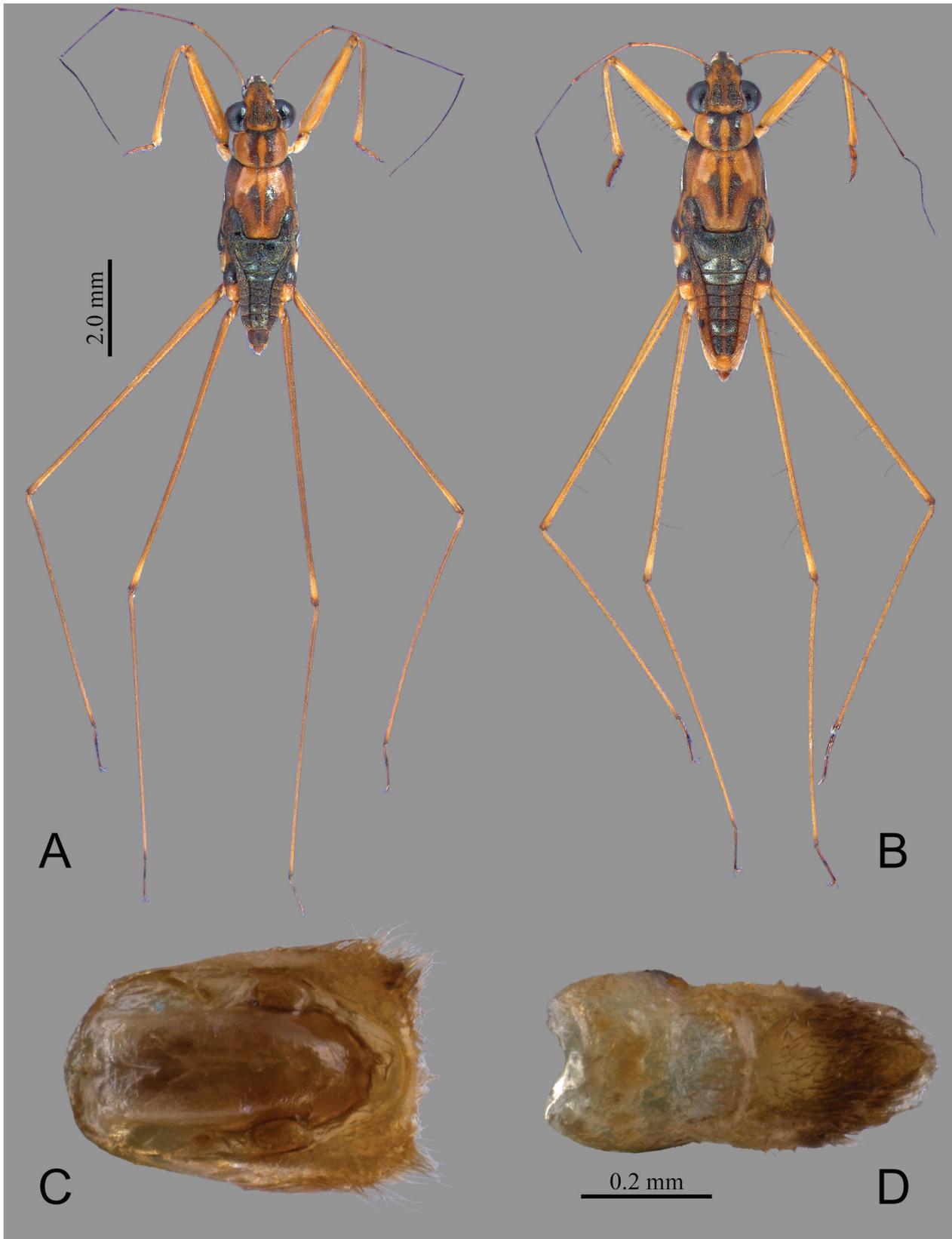
**Description.** Size: apterous males, length 5.70–5.80 (holotype 5.79), width 1.77–1.87 (holotype 1.76); apterous females, length 6.30–6.95, width 2.13–2.25.

Colour (Fig. 18A, B). Apterous form, dorsum of body mainly yellowish-brown to dark-brown with brown markings on thorax, covered with silvery and golden pubescence; venter yellowish. Head with one narrow median longitudinal dark-yellow stripe and two dark-brown marks laterally to the median stripe, anterolateral corners and posterior margin of head yellow. Antennae yellow to brown, segment I yellow, segment II yellow or brown, segments III, IV brown. Pronotum with a median longitudinal yellow stripe and two dark-brown paramedian marks, yellow laterally. Mesonotum mainly yellowish-brown with a median longitudinal yellow stripe and two dark-brown marks laterally to the median stripe, anterosublateral areas with two yellow marks, anterolateral areas dark-brown. Metanotum and abdominal tergum

mainly dark-brown, with narrow median longitudinal dark-yellow stripe on terga III–VII, connexiva brown or yellowish-brown. Pro- and mesopleura yellowish with longitudinal brown stripe; mesopleura with stripe of silvery and reflective pubescence next to and ventrally to brown stripe; apical part of pro-, meso- and metacetabula dark-brown, partially covered with patches of dense silvery and reflective pubescence. Legs with all coxae, trochanters and femora yellow, all tibiae and tarsi yellowish-brown or brown.

**Structural characteristics:** Apterous male (holotype): Head width across eyes 1.49; interocular width 0.57; eye kidney-shaped in dorsal view, length of eye 0.69. Antennae ca. 1.3× body length (7.67: 5.79), lengths of segments I–IV: 1.87: 1.58: 1.58: 2.64; segment I usually with 5–6 black spines in apical part. Pronotum broader than long, shorter than head length (0.75: 1.19). Lengths of mesosternum and metasternum: 1.87 and 0.48; posterior margin of metasternum raised in the middle. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II) as follows: fore leg: 2.46: 2.24: 0.23: 0.39; middle leg: 5.89: 5.17: 0.41: 0.48; hind leg: 6.08: 6.54: 0.32: 0.41. Fore leg (Fig. 19A): trochanter with few long, fine setae; femur moderately thickened at basal part and gradually tapering towards apex, length ca. 6.2× maximum width (2.46: 0.40), flexor side with only one stout seta at basal part and a few fine, long setae; tibia straight, with long, brown stout setae on apical margin; tarsus covered with long, soft, yellowish setae (denser on ventral surface). Middle and hind femora slender and slightly longer than body; middle and hind femora, middle and hind tibiae with scattered, short, brown, stout setae. Claws stout, lengths of fore, mid- and hind claws: 0.18: 0.19: 0.17. Abdomen short, total length of abdominal sterna II–VII: 1.23, sternum II distinctly raised in the middle, sterna III–V medially grooved. Sternum VII slightly longer than length of two preceding sterna combined (0.39: 0.35), posterior margin with a median notch (ca. 0.25× the length of sternum VII) (Fig. 19B). Genitalia (Figs 18C, D, 19D–H): small, pygophore in ventral view truncate posteriorly, with posterolateral corners produced into small lobes (or rounded in sample from location 22°19.094'N, 94°28.823'E) bearing long, yellowish setae; paramere small and blunt; proctiger simple, elongate, with apex acute and bearing long, yellowish setae.

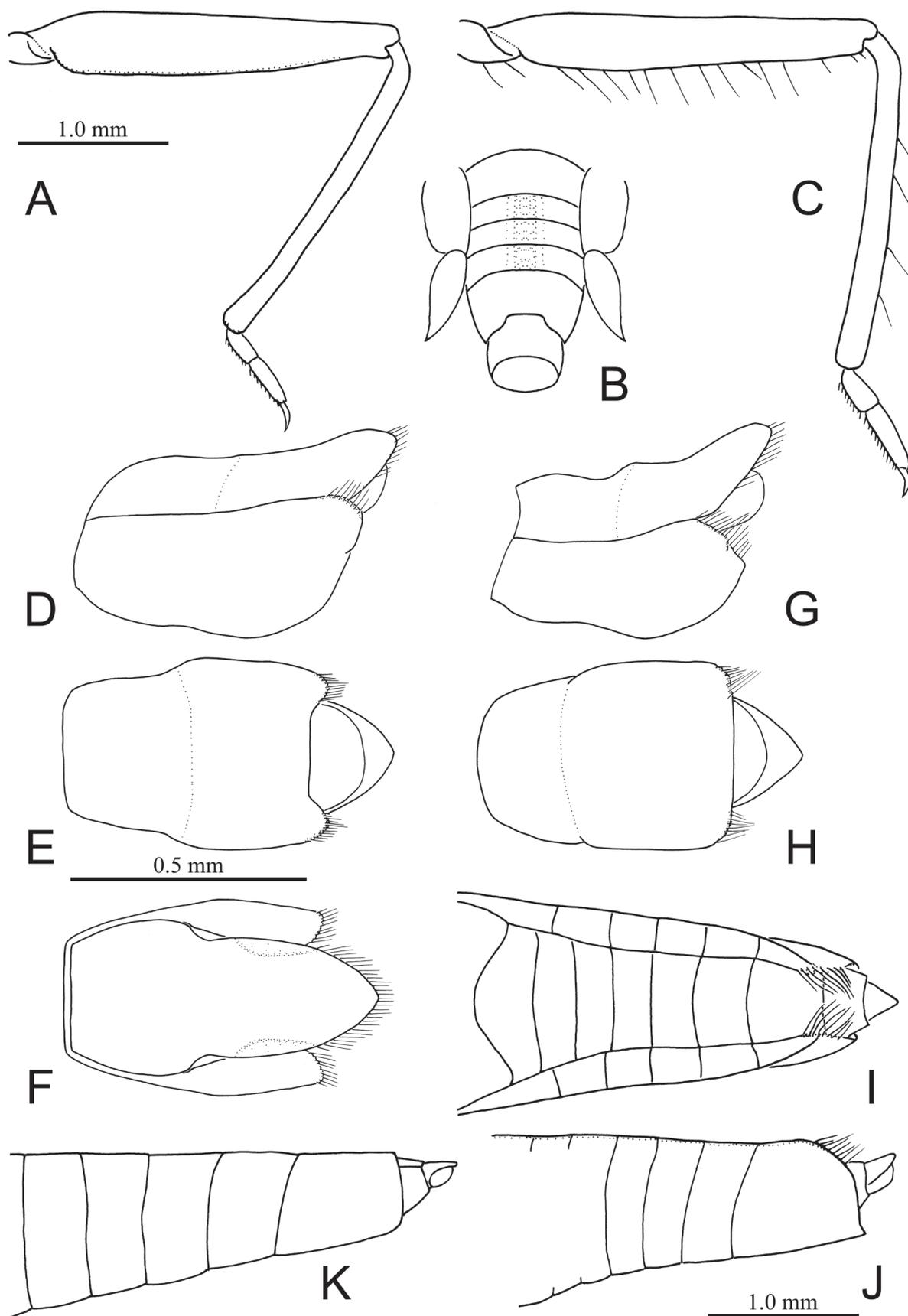
Apterous female: Head width across eyes 1.50; interocular width 0.61; eye kidney-shaped in dorsal view, length 0.68. Antennae ca. 1.1× of body length (7.12: 6.30), lengths of segments I–IV: 1.75: 1.47: 1.38: 2.52; segment I with 4–5 black spines subapically. Pronotum slightly shorter than head length (0.72: 1.08). Lengths of mesosternum and metasternum: 1.87 and 0.58. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 2.22: 2.00: 0.26: 0.40; middle leg: 5.69: 4.85: 0.50: 0.47; hind leg: 5.95: 5.31: 0.41: 0.43. Fore leg (Fig. 19C): trochanter with two or three long, stout setae on ventral side; femur moderately thickened at basal part and gradually tapering towards apex, length ca. 6.3×



**Figure 18.** *Eotrechus boukali* sp. nov. **A, B.** Habitus; **A.** Apterous male; **B.** Apterous female; **C.** Pygophore, dorsal view; **D.** Proctiger, dorsal view (**A, B.** Same scale; **C, D.** Same scale).

maximum width (2.22: 0.35), along flexor side with a row of 12–15 stout, black setae of irregular length, some as long as greatest width of fore femur; tibia straight with

10–14 scattered, long, stout setae on extensor surface and long, black spines on apical margin; tarsus covered with long, soft, yellowish setae (denser on ventral sur-



**Figure 19.** *Eotrechus boukali* sp. nov. (A–J) and *E. hygropetricus* (K). A. Right fore leg of male; B. Abdomen of male, ventral view (excluding genital capsule); C. Right fore leg of female; D, G. Genital capsule, lateral view; E, H. Genital capsule ventral view; F. Genital capsule, dorsal view (D–F. Paratype from location 22°19.113'N, 94°28.518'E; G, H. Paratype from location 22°19.094'N, 94°28.823'E); I, K. Abdomen of female, lateral view; J. Abdomen of female, lateral view (A, B, I–K. Same scale; D–H. Same scale).

face). Middle and hind femur slender and subequal to body length; middle and hind femora, middle and hind tibiae with scattered, short, brown spines. Claws stout, lengths of fore, mid- and hind claws: 0.18: 0.21: 0.21. Total length of abdominal sterna II–VII ca.  $0.3 \times$  body length (2.04: 6.30). Sternum VII ca.  $1.6 \times$  length of two preceding sterna combined (0.85: 0.54), posterior margin straight. Connexival corners of sternum VII curved mesad and with tuft of long, golden setae directed mesad. Genitalia not totally concealed by sternum VII, part of gonocoxae and proctiger still visible in lateral and ventral views; proctiger elongate, with cone-shaped apex and directed posterodorsad (Fig. 19I, J).

Macropterous morph: unknown.

**Remarks.** *Eotrechus boukali* sp. nov. is most similar to *E. hygroptericus* in the following characteristics: the fore femur of both sexes is widest at the basal part and gradually tapering towards the apex; the fore femur of the female has a row of long, stout setae on the flexor side; the proctiger of the female is elongate and with a cone-shaped apex; the genitalia of the female is not totally concealed in lateral view of the abdomen; however, this new species can be easily distinguished from the latter by the following: In *E. boukali* sp. nov., the fore femur of the male has no long, stout setae on the flexor side; abdominal sterna III–V of the male have a distinct median, longitudinal groove; the pygophore is truncate in ventral view, with posterolateral corners rounded or produced in to small lobes; sternum VII of the female is distinctly longer than the two preceding sterna combined; the proctiger of the female is directed posterodorsad. In *E. hygroptericus*, the fore femur of both sexes has long, stout setae on the flexor side; the male pregenital abdomen is only slightly impressed in the middle; the pygophore is simple, with a rounded posterior margin in ventral view; sternum VII of the female is subequal in length to the two preceding sterna combined; the proctiger of the female is directed almost straight caudad (Andersen 1982). Note that the apterous morph of *E. hygroptericus* is still unknown; thus, it is not possible to determine whether the apterous female of this species has the tuft of long, golden setae on the connexival corners of sternum VII. If not, this structure might be unique for *E. boukali* sp. nov., in comparison with its congeners.

Body size and general dorsal colour pattern of *E. boukali* sp. nov. resemble that of *E. vietnamensis* Tran & Yang, 2006 and *E. pumat* J. Polhemus, Tran & D. Polhemus, 2009. However, this new species is clearly different from these species in the following characteristics: the pronotum and mesonotum lack sublateral, brown marks; the fore femur (both sexes) gradually tapers towards the apex (whereas in *E. vietnamensis* and *E. pumat*, it is clearly constricted at the apical part); the fore femur of the female has a row of ca. 12 long, stiff setae along the flexor side and the fore femur of the male lacks stiff setae (Fig. 19A, C) (whereas in both sexes of *E. vietnamensis* and *E. pumat*, the flexor side of the fore femur has only

2–5 stiff setae at basal part); the posterior margin of sternum VII of the male has a wide and shallow median notch (whereas in *E. vietnamensis* and *E. pumat*, the median notch on sternum VII is narrower and deeper); the pygophore is simple, less modified, without prominent posterolateral processes (Figs 18C, D, 19D–F); the connexival corner of sternum VII of the female has a tuft of long, golden setae (Fig. 19I, J).

**Etymology.** This species is dedicated to Czech scientist Dr David Boukal from the University of South Bohemia who collected the type series.

**Distribution.** Myanmar: Sagaing Region (Fig. 24).

### *Eotrechus pilicaudatus* Tran & Zettel, 2006

Fig. 24

*Eotrechus pilicaudatus* Tran & Zettel, 2006: 40–43, figs 1–8 (type locality: Meghalaya, NE India).

**Material examined. Holotype:** INDIA • ♂ (apterous); Meghalaya, 3 km E Tura; 25°30'N, 94°14'E; 1150 m a.s.l.; 18 Apr. 1999; L. Dembický & P. Pacholátko leg.; NHMW.

**Diagnosis.** Size: apterous male: length (excluding genitalia) 6.50; width 2.40. Mesosternum ca.  $4.0 \times$  length of metasternum. Male: fore femur incrassate at basal part and tapering towards apex; middle and hind trochanters and basal part of middle and hind femur with many small spines; sternum VII about twice as long as two preceding sterna combined, posterior margin slightly emarginated. Male genitalia: abdominal segment VIII large; pygophore suboval, without lateral projections but with large tufts of long, black posterolateral setae, posterior margin with paired, small, pointed, black processes consisting of tightly packed, thick setae; proctiger with paired long, bristle-like, black setal tufts distolaterally. Female unknown.

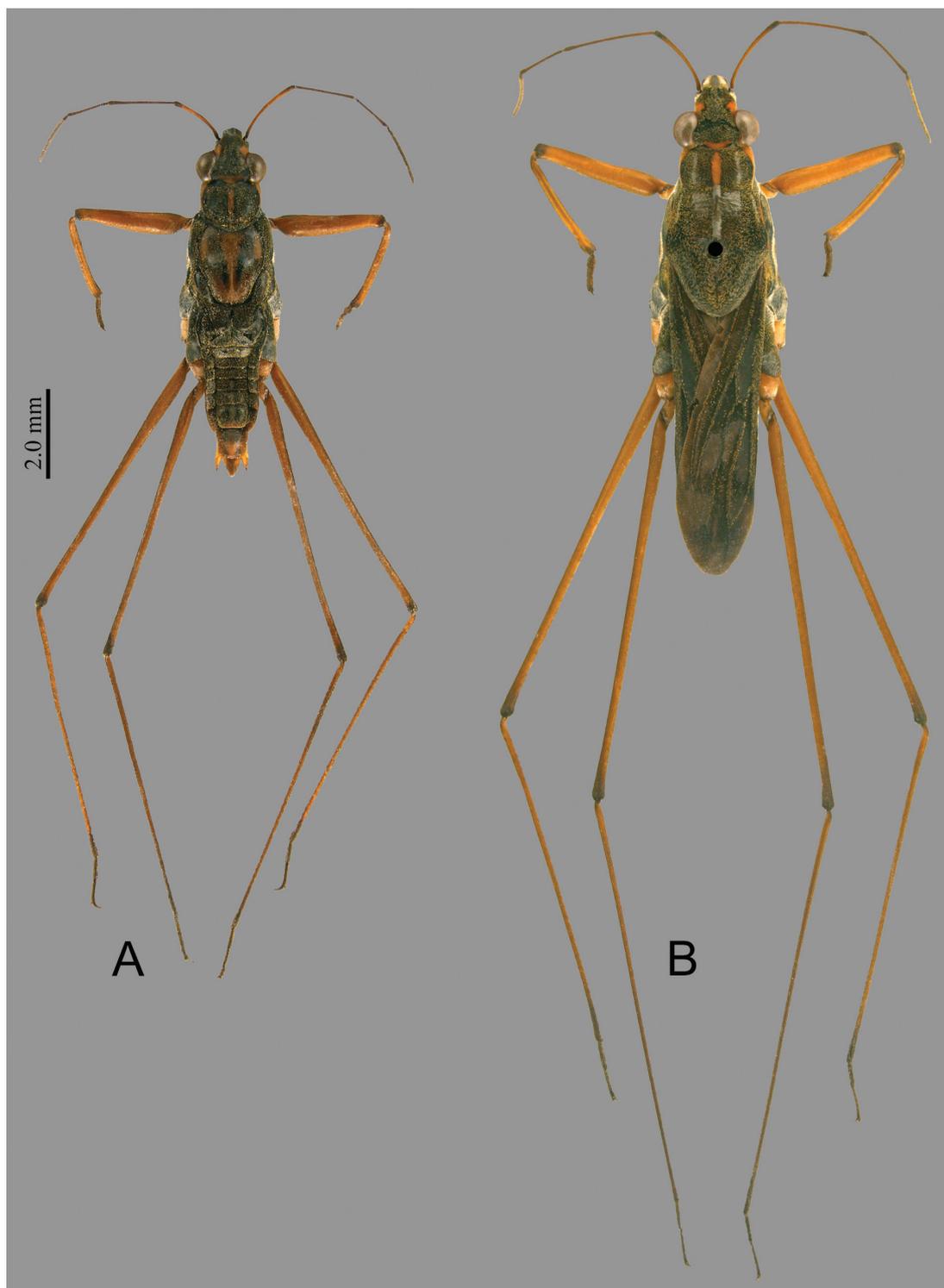
**Remarks.** This species is unique in having thick pilosity on the genitalia. Based on the absence of a caudal projection on the pygophore, this species can be placed in the *E. hygroptericus* species group. A comparison between *E. pilicaudatus* and *E. hygroptericus* was discussed in detail by Tran and Zettel (2006: 41, 43).

**Distribution.** India: Meghalaya (Tran and Zettel 2006) (Fig. 24).

### *Eotrechus longipes* species group

**Diagnosis.** Male: fore femur moderately incrassate, tapering towards apex; posterior margin of sternum VII emarginated medially; genitalia large: pygophore with a pair of posterolateral projections; proctiger slender, with subtriangular apex. Female: sternum VII  $1.1–1.5 \times$  length of two preceding sterna combined, posterior margin medially produced (except in *E. anderseni* sp. nov.); genitalia visible in lateral view (only partly visible in *E. anderseni* sp. nov.).

**Species included.** *E. longipes* Andersen, 1982, *E. terrestris* Andersen, 1982, and *E. anderseni* sp. nov.



**Figure 20.** Habitus of *Eotrechus* species. **A.** *E. longipes*, apterous male from Nepal; **B.** *E. anderseni* sp. nov., macropterous female.

***Eotrechus longipes* Andersen, 1982**

Figs 20A, 21, 26

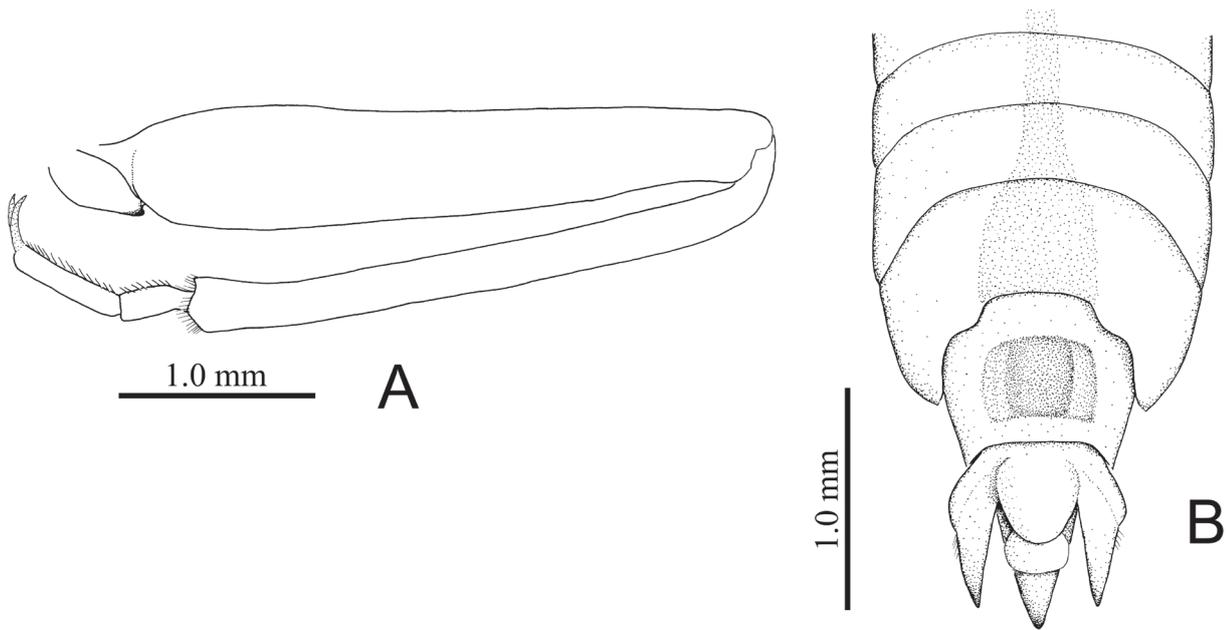
*Eotrechus longipes* Andersen, 1982: 11–13, figs 3, 6, 9, 14, 16, 22, 29, 30 (type locality: Jukdah-Ghoom, India).

*Eotrechus longipes*: Andersen (1998: 5) (checklist); Thirumalai (2002: 59) (distribution); Basu et al. (2017: 397) (record Sikkim, India).

**Material examined. Holotype:** INDIA • ♂ (macropterous); “Jundah-Ghoom, 14-VI-19”; BMNH.

**Other material.** NEPAL • 1 ♂ (apterous); Seti D: Bajhang #21, way Ghatganga Khola SW Shima (29°43'16"N, 81°20'44"E) to NE Shima (29°44'51"N, 81°23'04"E); 2000–2300 m a.s.l.; 19 Jun. 2009; J. Kűßner leg.; NME.

**Diagnosis.** Size: apterous males, length 7.6–8.2, width 2.4–2.6; macropterous males, length 8.9–10.0 (holotype 10.0), width 2.30–2.71 (holotype 2.71); apterous female, length 8.3, width 2.6; macropterous females, length 8.9–10.2, width 2.6–2.9 (from Andersen 1982). Mesosternum ca. 3.0× length of metasternum. Male: fore femur mod-



**Figure 21.** *Eotrechus longipes*, holotype. **A.** Right fore leg; **B.** Abdominal apex, ventral view.

erately incrassate, fore trochanter with small tubercle bearing black, minute setae (Fig. 21A); abdominal sterna V–VII medially grooved, more widened on sternum VII; length of sternum VII subequal to two preceding sterna combined, posterior margin slightly emarginated. Male genitalia: venter of segment VIII broadly, medially depressed; pygophore with two broad posterolateral projections, lower margin of projection with a notch (in lateral view); proctiger slender, with pointed apex (Fig. 21B). Female: abdomen about a half of body length; sternum VII ca.  $1.5\times$  length of two preceding sterna combined; genitalia visible in lateral view.

**Remarks.** See Remarks under *E. anderseni* sp. nov. for comparative notes on three species of the *E. longipes* group.

**Distribution.** India: W. Bengal, Uttar Pradesh, Arunachal Pradesh, Sikkim; Nepal (Andersen 1982; Thirumalai 2002; Basu et al. 2017) (Fig. 26).

### *Eotrechus terrestris* Andersen, 1982

Fig. 26

*Eotrechus terrestris* Andersen, 1982: 15, figs 17, 23 (type locality: Sikkim, India).

*Eotrechus terrestris*: Andersen (1998: 6) (checklist); Tran and Zettel (2006: 49–50, figs 21–24) (record Nepal, descriptive notes).

**Material examined. Paratypes:** INDIA (?) • 1 ♂, 1 ♀ (apterous); “Taken from wet path in copula, 4600ft., 9.VII.18 / H. Stevens. Brit. Mus. 1922-307”; BMNH.

**Other material.** NEPAL • 2 ♂♂ (apterous); Lanqtanq National Park, Lanqtanq valley, Rimche env.; 13 Oct. 2002; P. Šrámek leg.; NHMW.

**Diagnosis.** Size: apterous males, length 7.30–7.60, width 2.30–2.34; apterous female, length 8.20, width 2.70. Mesosternum ca.  $2.8\times$  length of metasternum.

Male: fore femur moderately incrassate, length about  $5.1\times$  width, simple, flexor side without stiff setae; abdomen moderately long, sterna VI and VII medially grooved (more broadly grooved in sternum VII). Male genitalia: segment VIII relatively large; pygophore with two long, slender posterolateral projections, apices of projections pointed; proctiger with narrowly rounded apex; proctiger and projections of pygophore slanting dorsad. Female: similar to *E. longipes*.

**Remarks.** See Remarks under *E. anderseni* sp. nov.

**Distribution.** India: West Bengal, Sikkim (Andersen 1982); Nepal (Tran and Zettel 2006) (Fig. 26).

### *Eotrechus anderseni* sp. nov.

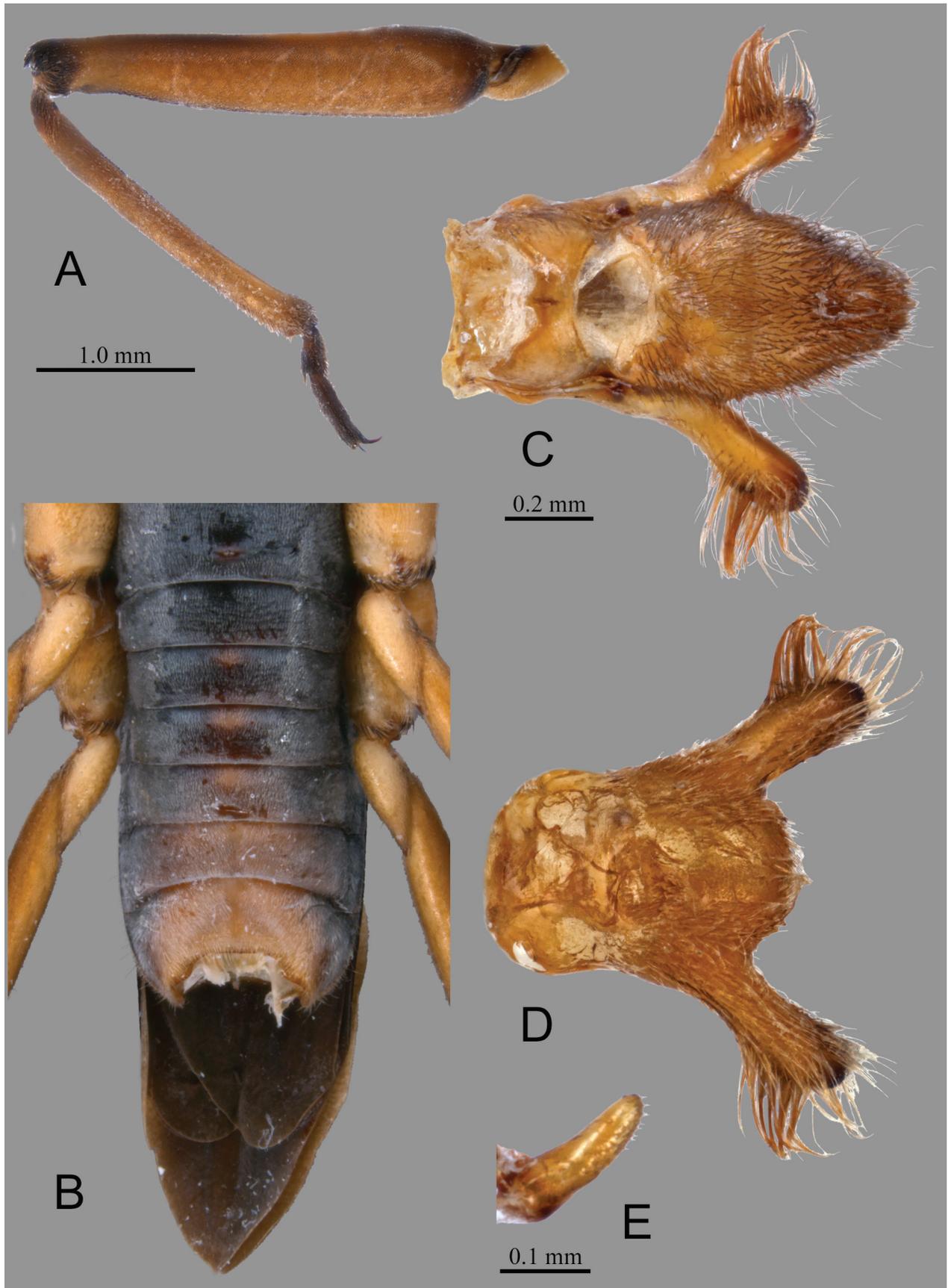
<https://zoobank.org/E3518FB6-D2CD-4E83-A1D1-D2FBD247912A>  
Figs 20B, 22, 26

**Material examined. Holotype:** INDIA • ♂ (macropterous); Meghalaya State (10), E Khasi Hills, 11 km SW Cherrapunjee, Laitkynsew, seepage, wet rocks with algae/blue algae/moss, exposed, ca. 1.5–2 km via road from “Cherapunjee Holiday Resort” in direction Cherapunjee;  $25^{\circ}13'N$ ,  $91^{\circ}39'E$ ; 810 m a.s.l.; 21–24 Apr. 2008; Fikáček, Podskalská & Šípek leg.; ZSM.

**Paratypes:** INDIA • 1 ♀ (macropterous); same locality data as holotype; ZSM • 1 ♀ (macropterous); same locality data as holotype; NHMW • 1 ♀ (macropterous); same locality data as holotype; NMPC.

**Description.** Size: macropterous male (holotype), length 10.45, width 2.81; macropterous females, length 10.70–11.25, width 3.01–3.15.

Colour (Fig. 20B): Dorsal side of head largely black, ventral side with broad median black stripe. Dorsal side of pronotum only with yellow midline and sides, without yellow sublateral stripes, but with a pair of shiny stripes



**Figure 22.** *Eotrechus anderseni* sp. nov., holotype. **A.** Left fore leg; **B.** Abdomen, ventral view; **C.** Genital capsule, dorsal view; **D.** Pygophore, ventral view; **E.** Paramere (**A, B.** Same scale; **C, D.** Same scale).

at this position. Wings mostly black with dark-brown patches, membrane dark-greyish. Venter of thorax and abdomen chiefly black, sterna V–VII medially yellow.

Structural characteristics: Macropterous male (holotype): Head width across eyes 1.76; interocular width 0.76; eye kidney-shaped in dorsal view, length of eye 0.83. Antennae: length 8.94, and shorter than body length, lengths of segments I–IV: 2.65: 2.61: 1.60: 2.08; segment I with one short spine subapically. Pronotum length 3.52, humeral width 2.03; pronotal lobe with median carina in anterior half. Fore wing length 6.36. Lengths of mesosternum and metasternum: 2.65 and 0.95. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II) as follows: fore leg: 3.23: 2.86: 0.36: 0.57; middle leg: 8.50: 7.65: 0.61: 0.78; hind leg: 8.90: 9.29: 0.67: 0.82. Fore leg (Fig. 22A): trochanter without long, fine setae; femur moderately incrassate, length ca.  $5.5\times$  maximum width at basal part (3.23: 0.59), distal part gradually tapering towards apex, without long, stiff setae along flexor side of femur; tibia almost straight, simple, with short, stout setae on apical third of extensor side; tarsus covered with long, brown setae on ventral surface, and only with short setae on dorsal surface. Middle and hind femora slender and shorter than body length; middle and hind tibiae with scattered, short, brown spines in distal parts. Claws moderately stout, lengths of fore, mid- and hind claws: 0.22: 0.30: 0.28. Abdomen short, total length of abdominal sterna II–VII: 3.51, sterna II–V medially not grooved. Sternum VI with narrow median impression. Sternum VII shorter than length of two preceding sterna combined (0.50: 0.82), triangularly depressed, posterior margin broadly and deeply emarginated, and with fringe of setae (Fig. 22B). Genitalia (Fig. 22C–E): abdominal segment VIII large, ventral side distinctly longer than sternum VII (0.73: 0.50), posterolaterally with dense, yellowish, soft setae; pygophore with thick posterolateral projections, apex of projection rounded, and distal part of projection swollen, covered with dense, long, bristle-like setae directed laterad; paramere simple, length about three times as width; proctiger simple, longer than wide, with narrowly rounded apex.

Macropterous female: Head width across eyes 1.97; interocular width 0.81; eye kidney-shaped in dorsal view, length 0.86. Antennae  $0.64\times$  body length (7.16: 11.25), lengths of segments I–IV: 2.10: 2.08: 1.25: 1.73; segment I with one short, dark, subapical spine. Pronotum length 3.73, humeral width 2.37. Fore wing length 7.30. Lengths of mesosternum and metasternum: 2.75 and 1.02. Lengths of leg segments (femur: tibia: tarsal segment I: tarsal segment II): fore leg: 3.08: 2.61: 0.31: 0.56; middle leg: 8.47: 7.60: 0.58: 0.80; hind leg: 8.85: 9.18: 0.65: 0.81. Fore trochanter without long setae on ventral side. Fore femur simple, moderately incrassate, length ca.  $5.9\times$  maximum width (3.08: 0.52), moderately thickened at basal part and gradually tapering towards apex, flexor side without long, stiff setae. Fore tibia straight, with long, stout setae

at apical third of extensor side. Fore tarsus covered with brown setae. Middle and hind femora slender and shorter than body length; middle and hind femora (in distal parts), middle and hind tibiae with scattered, short, brown spines. Claws stout, lengths of fore, mid- and hind claws: 0.18: 0.28: 0.27. Total length of abdominal sterna II–VII ca.  $0.36\times$  body length (4.08: 11.25). Sternum VII  $1.1\times$  length of two preceding sterna combined (1.34: 1.22), posteriorly narrowed, posterior margin straight. Connexival apex of sternum VII obtuse. Genitalia: not totally concealed by sternum VII; tergum VIII simple; gonocoxae concealed by sternum VII; proctiger acuminate, protruded, directed caudad.

Apterous morph: Unknown.

**Remarks.** In the *E. longipes* species group, *E. anderseni* sp. nov. can be easily distinguished from *E. longipes* and *E. terrestris* based on the unique structure of the pygophore. In *E. longipes* and *E. terrestris*, posterolateral projections of the pygophore taper towards the pointed or narrow apex. In *E. anderseni* sp. nov., posterolateral projections are thickened at the distal part and bear dense, long, bristle-like setae. The female of the new species differs from *E. longipes* and *E. terrestris* by the shorter sternum VII (ca.  $1.1\times$  the length of two preceding sterna combined), whereas sternum VII of the latter two species is ca.  $1.5\times$  the length of two preceding sterna combined).

*Eotrechus longipes* can be distinguished from *E. terrestris* by the characteristics of fore trochanter, abdominal venter, and the posterolateral projections of the male pygophore. In *E. longipes*, the fore trochanter has a small tubercle bearing black, minute setae; the abdominal venter has a median groove from sterna V–VII; and the posterolateral projections of the pygophore are broad at the basal part and taper apically. In *E. terrestris*, the fore trochanter is without such a tubercle; the median groove is present only on sterna VI and VII; and the posterolateral projections of the pygophore are long and more slender.

**Etymology.** This species is dedicated to the late Prof. Nils Møller Andersen (University of Copenhagen) for his influential contributions to the systematics and evolution of semi-aquatic bugs, including the genus *Eotrechus*.

**Distribution.** India: Meghalaya (Fig. 26).

#### *Eotrechus brevipes* species group

**Diagnosis.** Both sexes: fore femur short and stout, strongly incrassate basally, gradually tapering towards apex, and without stiff setae on flexor side; fore tibia distinctly curved. – Male: posterior margin of metasternum simple, without a fringe of short, black setae; abdominal venter without median patch of long, soft setae; posterior margin of sternum VII only slightly emarginated; pygophore with a pair of posterolateral projections. Female: mediotergite VIII flap-like, posterolaterally with grooves; genitalia enclosed by sternum VII and mediotergite VIII.

**Species included.** *E. brevipes* Andersen, 1982.

***Eotrechus brevipes* Andersen, 1982**

Fig. 24

*Eotrechus brevipes* Andersen, 1982: 17–19, figs 13, 19, 25–27, 32–33 (type locality: Goom, Darjeeling, India).

*Eotrechus brevipes*: Andersen (1998: 4–5) (descriptive notes); Chen and Andersen (1993: 70) (checklist China); Thirumalai (2002: 59) (checklist India); Polhemus et al. (2009: 30–32, figs 1–3) (diagnosis, record Vietnam).

**Material examined. Paratypes:** INDIA • 1 ♀ (apterous); “N. India: Darjeeling, 7000ft., 11–20.iii.1924, Maj. R.W.G. Hingston / Everest Exp. Brit. Mus. 1924–386”; BMNH • 1 ♀ (macropterous); “Gopaldhara, Darjeeling, 4720 [not 4729 as in Andersen, 1982]–6100 ft., on wet ground, 24-7-17, H. Stevens, Brit. Mus. 1922–307”; BMNH.

**Other material.** INDIA • 1 ♀ (apterous); NW Bengal, Rimbik-Srikhola; 2650 m a.s.l.; 15–27 May 2006; E. Kučera leg.; NHMW.

NEPAL • 1 ♀ (apterous); Seti/D: Bajhang #34, 24 km NE Chainpur, vic. Dhalum; 29°42.083'N, 81°22.067'E; 2400–2600 m a.s.l.; 26 Jun. 2009; J. Küßner leg.; NME.

**Diagnosis.** Size: apterous males, length 7.2–7.8, width 2.2–2.6; macropterous males, length 8.7–8.9, width 2.3; apterous females, length 6.8–7.8, width 2.5–2.6; macropterous females, length 8.9, width 2.6 (with additional data from Andersen, 1982, 1998). Dorsum mainly brown, covered with green, reflective pubescence. Mesosternum 3.2–3.5× length of metasternum. Male: fore femur incrassate at basal part, gradually tapering towards apex, without stiff setae on flexor side; sternum VII distinctly longer than two preceding sterna combined, posterior margin slightly emarginated. Male genitalia: pygophore with two broad and flattened posterolateral projections, each projection with a small, finger-like process at apex; proctiger simple, with narrow apex. Female: fore femur more slender than in male; abdomen about half of body length; sternum VII large, ca. 1.3× length of two preceding sterna combined; genitalia concealed in abdomen by sternum VII and tergum VIII.

**Remarks.** *Eotrechus brevipes* appears to be related to the *E. vietnamensis* species group in having broad posterolateral projections of the male pygophore. However, the set of characteristics, as in the diagnosis above, distinguishes it from the *E. vietnamensis* species group, which thus supports it in a species group of its own. In addition, the finger-like process on posterolateral projections of the male pygophore in *E. brevipes* is unique within *Eotrechus*.

**Distribution.** India: Arunachal Pradesh, Sikkim, and West Bengal; Nepal (new record); China: Fujian (Andersen 1982; Chen and Andersen 1993; Thirumalai 2002); Vietnam: Lao Cai (Polhemus et al. 2009) (Fig. 24).

***Eotrechus vietnamensis* species group**

**Diagnosis.** Dorsum brown with extensive yellowish markings. Male: fore femur moderately incrassate

and constricted before apex; posterior margin of metasternum with a median fringe of short, black setae; abdominal venter with a median patch of long, yellow setae on sterna II–VI; posterior margin of sternum VII deeply notched, about half the length of sternum VII length; pygophore with a pair of broad, posterolateral projections, each directed obliquely dorsad; proctiger simple, with round apex. Female: sternum VII distinctly longer than two preceding sterna combined; genitalia visible in lateral view.

**Species included.** *E. vietnamensis* Tran & Yang, 2006 and *E. pumat* J. Polhemus, Tran & D. Polhemus, 2009.

***Eotrechus vietnamensis* Tran & Yang, 2006**

Figs 1A, 26

*Eotrechus vietnamensis* Tran & Yang, 2006: 12–14, figs 1–6, 26 (type locality: Tam Dao, Vinh Phuc, Vietnam).

*Eotrechus vietnamensis*: Polhemus et al. (2009: 37) (key, diagnosis); Tran et al. 2014: 26 (record Phu Tho, Vietnam).

**Material examined.** VIETNAM • 1 ♂ (apterous); Lao Cai Province, Sa Pa, Sin Chai, Sin Chai stream, site 1; 27 Oct. 2013; Tran A.D. et al. leg.; TAD1363; ZVNU • 1 ♀ (apterous); Lao Cai Province, Sa Pa, Sin Chai, Muong Hoa stream; 22 Apr. 2011; Dinh N.H. et al. leg.; DNH11.03; ZVNU • 11 ♂♂, 11 ♀♀ (apterous), 1 ♂ (macropterous); Ha Giang Province, Vi Xuyen, Xin Chai commune, Da stream by the road from Thanh Thuy to Lao Chai; 09 May 2014; Tran A.D. et al. leg.; TAD1405; ZVNU • 3 ♂♂, 3 ♀♀ (apterous); Ha Giang Province, Hoang Su Phi, Nam Ty commune, bridge at km 34 road 177, waterfall & stream, ca. 65km to Coc Pai; 10 May 2014; Tran A.D. et al. leg.; TAD1411; ZVNU • 2 ♂♂, 1 ♀ (apterous), 1 nymph; Ha Giang Province, Xin Man, Nam Dan commune, Thac Tien – Deo Gio, waterfall & stream; 11 May 2014; Tran A.D. et al. leg.; TAD1414; ZVNU • 2 ♂♂ (apterous); Cao Bang Province, Phia Oac – Phia Den National Park, connecting road from Road #212 to Road #34, upstream of fish farm; 28 Oct. 2020; Tran A.D. leg.; TAD20-27; ZVNU • 6 ♂♂, 9 ♀♀ (apterous), 3 nymphs; Cao Bang Province, Phia Oac – Phia Den National Park, km 3 Road #212, 25 km to Na Ban; 30 Oct. 2020; Tran A.D. leg.; TAD20-30; ZVNU • 2 ♂♂ (apterous), 2 nymphs; Cao Bang Province, Phia Oac – Phia Den National Park, km 6 Road #212, 22 km to Na Ban; 30 Oct. 2020; Tran A.D. et al. leg.; TAD20-32; ZVNU • 2 ♂♂, 2 ♀♀ (apterous), 4 nymphs; Phu Tho Province, Xuan Son National Park, Kim Thuong, Tan Ong stream, site 1, at Chin Tang waterfall; 6 Jun. 2013; Tran A.D. et al. leg.; TAD1334; ZVNU • 3 ♂♂, 2 ♀♀ (apterous); Hanoi, Ba Vi National Park, small creek by main road to summit, ca. 9.5km from park head quarter; ca. 600 m asl.; 11 Jun. 2010; Tran A.D. leg.; TAD1014; ZVNU.

**Diagnosis.** Size: apterous males, length 5.50–5.90 (holotype 5.90), width 1.85–2.07 (holotype

1.97); apterous females, length 6.30–7.00, width 2.22–2.39; macropterous females, length 7.20–7.80, width 2.20–2.44. Dorsum covered with silvery or greenish pubescence, background colour brown with yellowish markings. Mesosternum 4.4–5.3× length of metasternum, posterior margin of metasternum with a median fringe of closely-set, black setae. Male: fore femur simple, distal part slightly constricted; abdominal venter with patch of long, yellow, soft setae on mediosternites II–VI; sternum VII more than twice as long as two preceding sterna combined; posterior margin of sternum VII with a deep, rectangular notch. Male genitalia: pygophore broadly suboval, with a pair of flat, posterolateral projections, projection with slightly triangular apex pointing laterad. Female: flexor side of fore femur with 4–5 stiff setae at basal part; sternum VII ca. 1.2× length of two preceding sterna combined; genitalia visible in lateral view.

**Distribution.** Vietnam (northern provinces): Vinh Phuc, Lai Chau, Dien Bien, Lao Cai, Phu Tho, Hanoi (Ba Vi) (Tran and Yang 2006; Polhemus et al. 2009; Tran et al. 2014); Ha Giang, Cao Bang (new records) (Fig. 26).

#### *Eotrechus pumat* J. Polhemus, Tran & D. Polhemus, 2009

Fig. 26

*Eotrechus pumat* J. Polhemus, Tran & D. Polhemus, 2009: 34–37, figs 11–17 (type locality: Pu Mat, Nghe An).

**Material examined.** VIETNAM • 9 ♂♂, 7 ♀♀ (apterous), 5 nymphs; Nghe An Province, Pu Mat National Park, Khe Kem waterfall & stream, site #1; 18 Apr. 2013; Tran A.D. et al. leg.; TAD1310; ZVNU • 4 ♂♂, 4 ♀♀ (apterous), 3 nymphs; same locality as preceding; 30 Aug. 2020; Tran A.D., Le P.L., Nguyen T.C. leg.; TAD20-06; ZVNU.

**Diagnosis.** Size: apterous males, length 5.70–6.10 (holotype 5.90), width 1.99–2.19 (holotype 2.13); apterous females, length 6.49–8.44, width 2.33–2.55. Dorsum covered with silvery or greenish pubescence, background colour brown with yellowish markings. Mesosternum ca. 4.5× (male) and 4.0× (female) length of metasternum, posterior margin of metasternum with a median fringe of closely-set, black setae. Male: fore femur simple, distal part slightly constricted; abdominal venter with patch of long, yellow, soft setae on mediosternites II–VI; sternum VII ca. 2.1× length of two preceding sterna combined; posterior margin of sternum VII with a deep, rectangular notch. Male genitalia: pygophore with a pair of broad, thick, posterolateral projections, each bearing prominent tubercles on both sides. Female: flexor side of fore femur with four stiff setae at basal part; sternum VII ca. 1.6× length of two preceding sterna combined; genitalia visible in lateral view.

**Remarks.** *Eotrechus pumat* and *E. vietnamensis* are sister species, as they share many characteristics.

They can be distinguished by using the revised key above. Males can be readily separated based on the structure of the posterolateral projections of the pygophore. Females are almost indistinguishable. The only difference between females of these two species is that sternum VII of *E. pumat* is longer, ca. 1.6× the length of the two preceding sterna combined, whereas that of *E. vietnamensis* is ca. 1.2× the length of the two preceding sterna combined.

**Distribution.** Vietnam: Nghe An (Polhemus et al. 2009) (Fig. 26).

#### Species unassigned to a group

##### *Eotrechus sinensis* Andersen, 1982

Fig. 25

*Eotrechus sinensis* Andersen, 1982: 17–19, figs 12, 31 (type locality: Fukien, China).

*Eotrechus sinensis*: Andersen (1998: 6) (checklist).

**Material examined.** Material not available for examination.

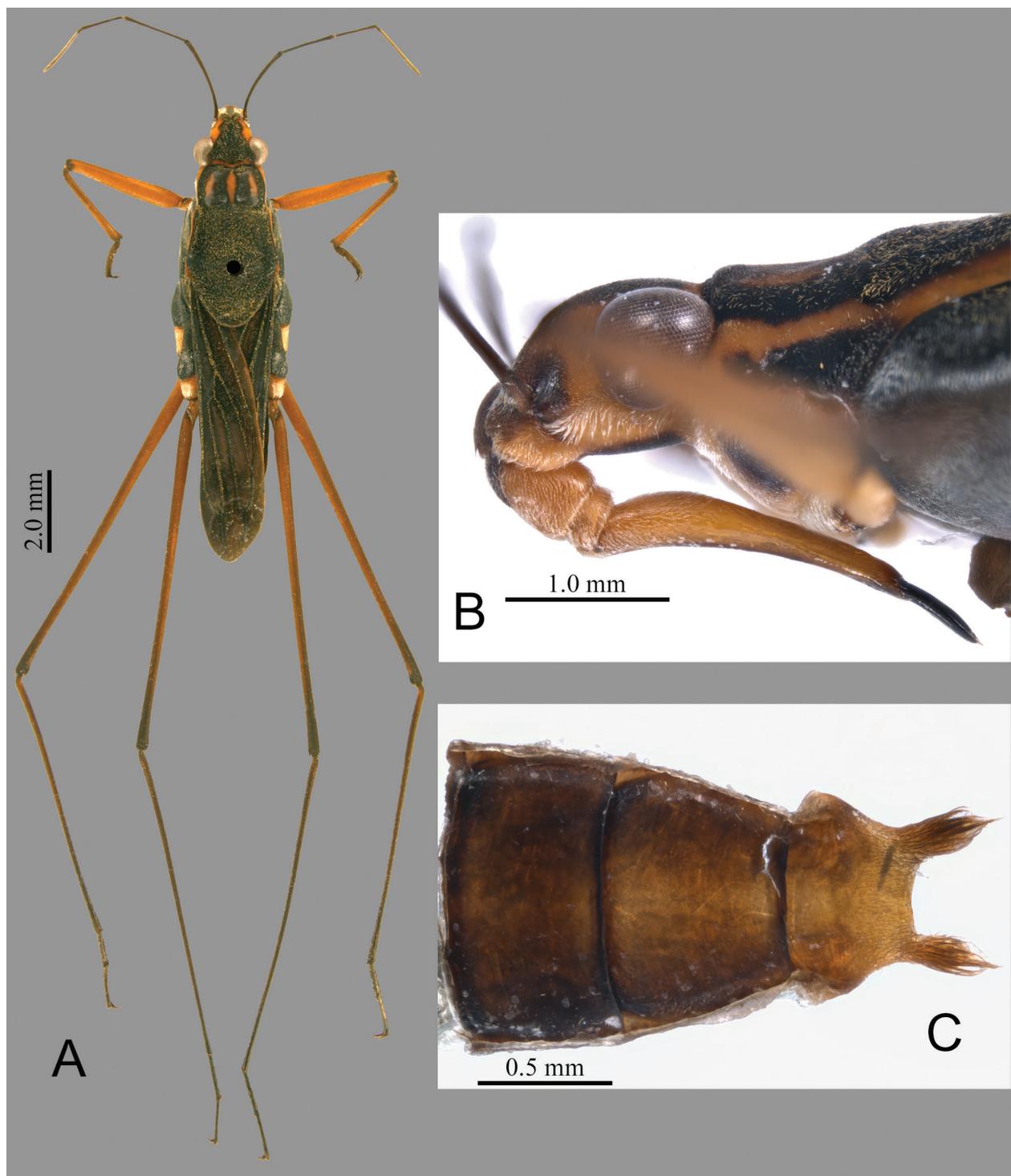
**Diagnosis** (after Andersen 1982). Size: apterous female: length 8.2, width 2.8. Male unknown. Female: Mesosternum ca. 2.9× length of metasternum. Fore femur moderately incrassate, flexor side with a row of ca. 13 dark, stiff setae, which are shorter than maximum width of femur; fore trochanter without such setae. Venter of pregenital abdomen ca. 0.4× body length; sternum VII ca. 1.4× length of two preceding sterna combined; posterior margin of sternum VII produced medially. Female genitalia small, but visible in lateral view.

**Remarks.** *Eotrechus sinensis* is known from only the female holotype. The holotype was supposedly deposited at the U.S. National Museum of Natural History (Washington, D.C.), but we could not access this specimen for the present study. Andersen (1982: 19) suggested that this species was related to *E. hygropetricus* by a row of dark, stiff setae on the flexor side of the fore femur. However, this character state is also present in females of the *E. pingae* and *E. petraeus* species groups.

The type locality data of *E. sinensis* is exactly the same as that of one paratype of *E. brevipes*: “Fukien, East Gate, Kwangtseh Hsien” (see Andersen 1982: 17, 19). However, the female of *E. brevipes* can be easily distinguished from that of *E. sinensis* by the shape of the abdomen (in lateral view) and the fully concealed genitalia (Andersen 1982). *Eotrechus pingae* is known from Guangdong, China and is nearest to the type locality of *E. sinensis*. Unfortunately, *E. pingae* is known only from a single male. Until males of *E. sinensis* are collected from its type locality, it is not possible to determine the relationship of this species to its congeners. Due to this uncertainty, this species is currently not assigned to any species group.

This species marks the easternmost limit of the known distribution of the genus *Eotrechus*.

**Distribution.** China: Fujian (Andersen 1982) (Fig. 25).



**Figure 23.** *Eotrechus* sp. A, macropterous female. **A.** Habitus; **B.** Head in lateral view showing rostrum; **C.** Terga VI–VIII, dorsal view.

#### Undetermined species

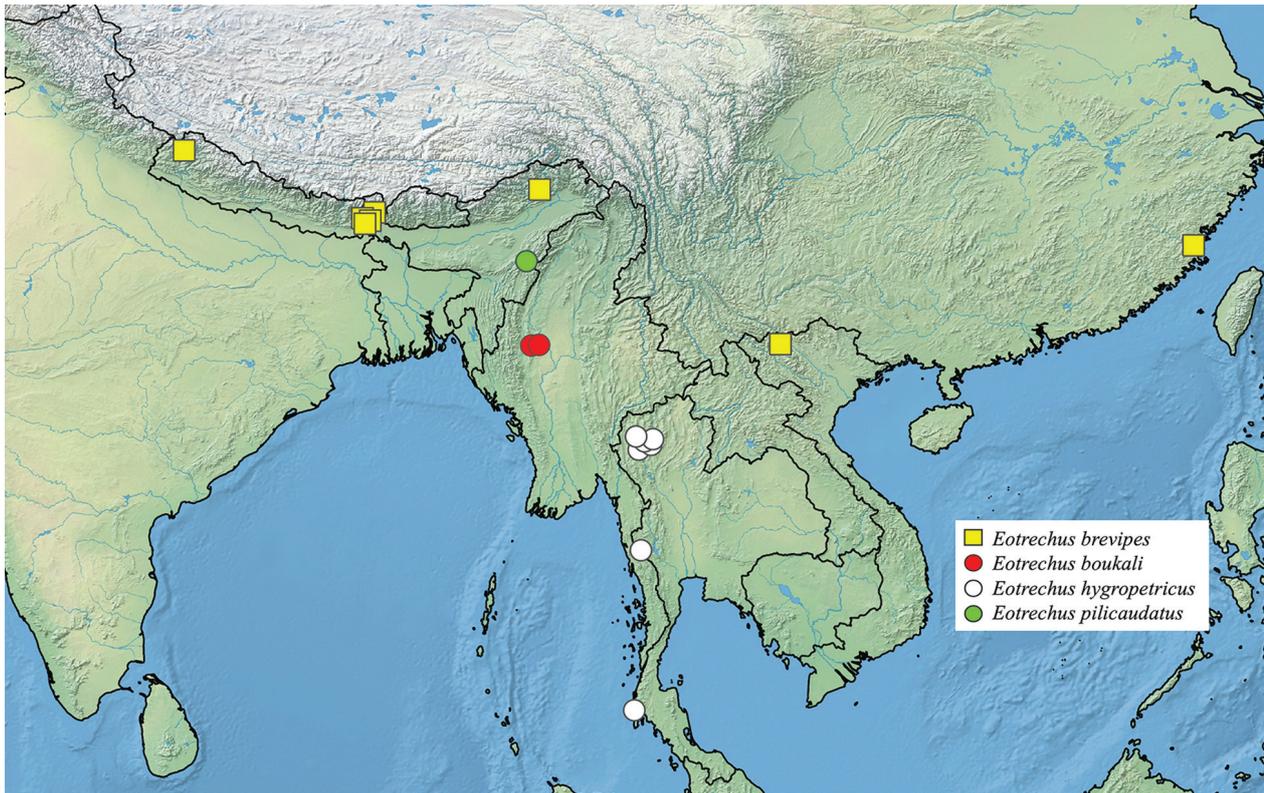
##### *Eotrechus* sp. A

Figs 23, 25

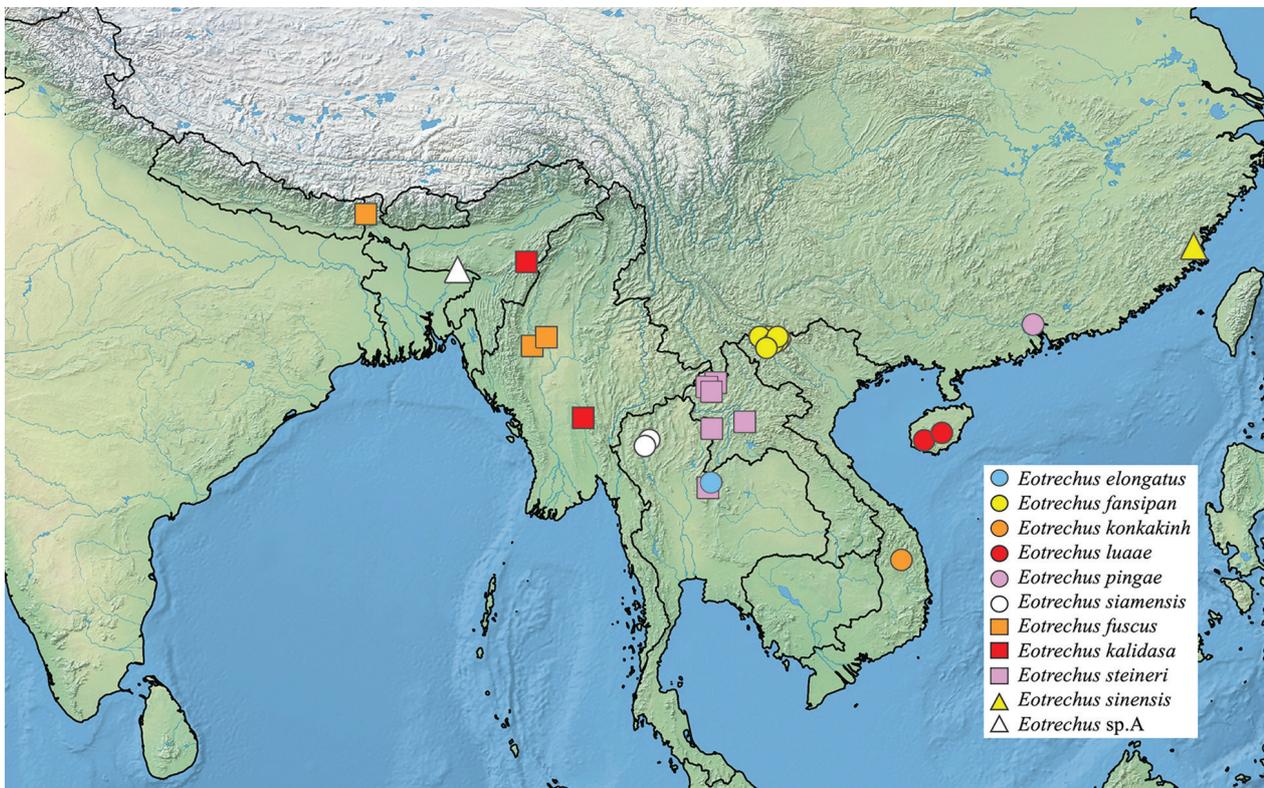
**Material examined.** INDIA • 1 ♀ (macropterous); Meghalaya State (10), E Khasi Hills, 11 km SW Cherrapunjee, Laitkynsew, seepage, wet rocks with

algae/blue algae/moss, ca. 1.5–2 km via road from “Cherapunjee Holiday Resort” in direction Cherapunjee, exposed; 25°13'N, 91°39'E; 810 m a.s.l.; 21–24 Apr. 2008; Fikáček, Podskalská & Šípek leg.; NMPC.

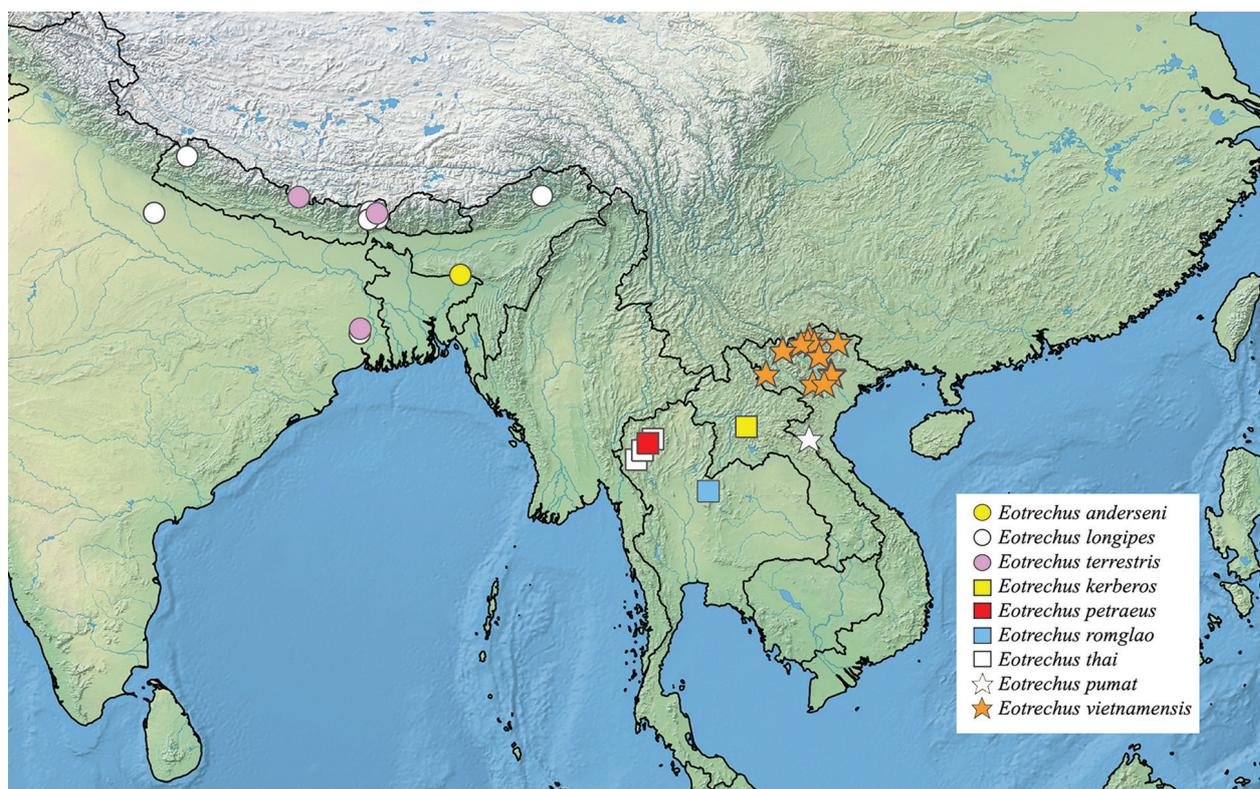
**Diagnosis.** Size: macropterous female: length 10.70, width 2.90. Male unknown. Female: Dorsal side of head largely black, ventral side with median black stripe. Dorsal side of pronotum with three yellow stripes (Fig. 23A).



**Figure 24.** Distribution records of species of *Eotrechus*. Squares represent *E. brevipes* species group; circles represent *E. hygropetricus* species group.



**Figure 25.** Distribution records of species of *Eotrechus*. Squares represent *E. kalidasa* species group; circles represent *E. pingae* species group; triangles represent species unassigned to a group.



**Figure 26.** Distribution records of species of *Eotrechus*. Circles represent *E. longipes* species group; squares represent *E. petraeus* species group; stars represent *E. vietnamensis* species group.

Venter of thorax and abdomen chiefly black. Penultimate segment of rostrum (Fig. 23B) distinctly curved and basally swollen. Pronotum in posterior half on each side of midline with large, shiny area; pronotal lobe without median carina. Fore femur slender, length ca.  $6.6\times$  width at base, without row of setae on flexor side. Claws long. Mesosternum ca.  $3.5\times$  length of metasternum, posterior margin of metasternum without fringe of black setae. Hind femur slightly shorter than middle femur. Sternum VII medially as long as sterna V and VI combined; hind margin straight; connexival corner with small, acute tip. Tergum VIII with distinct pair of processes bearing tufts of long, bristle-like setae on posterolateral corners (Fig. 23C). Gonocoxae and proctiger slightly protruded, pointing caudad.

**Remarks.** The female specimen at hand has two peculiar characteristics, the swollen and curved third rostral segment and the very peculiar paired processes with long, bristle-like setae on tergum VII, which have not been described for any other species of *Eotrechus*. It also has very prominent claws. However, we refrain from formally describing it as new based on a single female, without an associated male specimen.

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