Notes on *Eotrechus* Kirkaldy, 1902 (Heteroptera: Gerridae), with descriptions of two new species

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Abstract

Two new species of *Eotrechus* are described: *Eotrechus pilicaudatus* **sp.n.** from northeastern India and *Eotrechus luaae* **sp.n.** from China (Hainan Island); both are closely related to *Eotrechus pingae* Andersen, 1998 from China (Guangdong). The occurence of *Eotrechus kalidasa* Kirkaldy, 1902 in northeastern India is confirmed. *Eotrechus terrestris* Andersen, 1982 is recorded from Nepal for the first time.

Key words: Gerridae, Eotrechus, new species, new record, descriptive notes, China, India, Nepal

Introduction

The genus *Eotrechus* Kirkaldy, 1902 consists of nine described species, which are distributed from northern India and Nepal to northern Thailand, southern China (Andersen 1982, 1998), and Vietnam (Tran & Yang 2006). With the two new species described in this study, one from northeastern India and one from Hainan Island (China), the total number of described *Eotrechus* species is raised to eleven.

These interesting insects are rarely collected and were thought to be scarce because of their special habitats and behaviours (Andersen 1998). Most described species are known only from their type localities. They are hygropetric and inhabit rocks or soil kept wet by waterfalls, streams, or even seepage (Andersen 1982, 1998). However, from A.D. Tran's personal observations, we know that at least some species are not rare in number of individuals, if closer attention is paid to their cryptic habitats.

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Material and methods

Material studied consists of dry-mounted and alcohol-preserved specimens deposited in the following collections:

BMNH The Natural History Museum, London, England CPS Coll. Petr Šrámek, Jilemnice, Czech Republic NHMW Natural History Museum Vienna, Austria

ZRC Zoological Reference Collections, Raffles Museum of Biodiversity Research, Singapore

Material has been studied with Leica Wild M10 binocular microscopes. Illustrations have been prepared with the help of a camera lucida fixed to these microscopes. All measurements are given in millimetres. Length of the body is measured in the apterous form from the apex of the head to the tip of the proctiger (unless otherwise specified, e.g., *E. pilicaudatus*), in the macropterous form from the apex of the head to the tip of the wings. Eye size refers to the length of the eye in dorsal aspect. The length of sternum 7 was measured medially, and is thus reduced by the postermedial notch. Terminology follows that of Andersen (1982, 1998).

Taxonomy

Eotrechus pilicaudatus sp.n. (Figs. 1–8)

Material examined. Holotype (apterous ♂): INDIA (NE), Meghalaya, 3 km E Tura, 1150 m, 25°30'N 94°14'E, leg. L. Dembicky & P. Pacholatko, 18 Apr. 1999 (NHMW).

Description of apterous male. Size: length 6.50 (from head to hind margin of 8th tergite), width 2.40.

Colour. Body mainly brown dorsally and pale yellowish ventrally; dorsum with scattered silvery or golden pubescence; venter also with silvery scattered pubescence. Head with median yellowish stripe, anterolateral areas and hind margin yellowish; antennae dark brown; pronotum with median longitudinal yellow stripe and two U-shaped yellow markings (sub-)laterally; yellowish markings on mesonotum almost as wide as brown markings; metanotum and abdominal terga mostly dark brown; pro-, meso-, metasternopleura dark brown, with dense silvery and reflective pubescence; legs: fore and mid coxae and trochanters yellowish; hind coxa and trochanter more yellow than brown; fore femur and tibia yellow, mid and hind femora and tibiae brownish, all tarsi and claws brown.

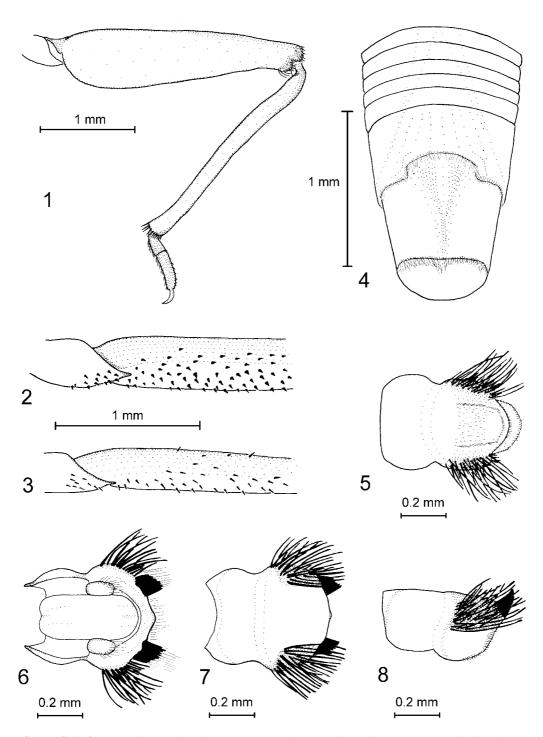
Structural characteristics: Head width across eyes 1.53; interocular width 0.70; eye

kidney-shaped on dorsal view, eye size 0.69. Antennae about 1.07x of body length (6.95: 6.50), lengths of segments 1-4: 2.33: 1.70: 1.04: 1.88; first segment with two black spinelike hairs apically. Pronotum broader than long, shorter than median head length (1.00: 1.50). Lengths of mesosternum and metasternum: 2.20 and 0.55. Lengths of leg segments (femur: tibia: tarsal segment 1: tarsal segment 2) as follows, fore leg: 2.73: 2.40: 0.24: 0.43; mid leg: 8.10: 7.10: 0.60: 0.74; hind leg: 8.20: 7.50: 0.63: 0.79. Fore femur (Fig. 1) incrassate at base and tapering toward apex, length about 4.27x maximum width (2.73: 0.64), ventral surface without spinelike hairs; fore tibia slightly S-curved, with some long black spinelike hairs apically. Mid and hind femora slender and longer than body. Mid and hind trochanters with some black spines, mid and hind femora with numerous black spines; those spines shorter and stouter on mid trochanter and ventral surface of mid femur (Figs. 2-3). Claws stout, lengths of fore, mid, hind claws 0.20: 0.26: 0.26. Abdomen relatively short, venter slightly depressed from segment 3-7, length of abdominal venter from sternum 2 to sternum 7: 1.09; sternum 7 about 2.08x length of two preceding sterna combined (0.50: 0.24), posterior margin moderately emarginated: width of median notch equal to length of sternum 7 (0.50), depth less than one-third length of sternum 7 (0.16: 0.50), margin with long, soft, brown hairs (Fig. 4). Segment 8 relatively wide, with almost straight posteroventral margin (Fig. 4). Genital segments relatively large: proctiger slightly smaller than pygophore, with paired long, bristlelike, black hair tufts on slightly produced distolateral margins (Fig. 5); pygophore broad, sub-oval, with paired long, bristle-like, black hair tufts lateroventrally, hind margin with paired, small, pointed, black processes consisting of tightly packed thick setae (Figs. 6–8);. Paramere very short, blunt, with some long soft hairs on apex.

Apterous female, macropterous female, and macropterous male: unknown.

Etymology. The species epithet is an adjective derived from the Latin *pilus* (= hair) and *cauda* (= tail or genitalia) and refers to the dense, long hair-tufts on the genitalia of the male.

Remarks. This new species resembles *Eotrechus pingae* Andersen, 1998 and *Eotrechus hygropetricus* Andersen, 1982 in having patches of long hairs laterally on the pygophore and the proctiger. However, it differs from *E. pingae* by the simple shape of the proctiger (in *E. pingae*, this is produced laterally), and from *E. pingae* and *E. hygropetricus* by the simple fore femur, without basal tubercle and without stout hairs. *Eotrechus pilicaudatus* is distinguished from other described species of *Eotrechus* by the following combination of characters: broad yellow markings on head, pro- and mesonotum; relative length of mesosternum, about 4.0x metasternum (greater than the maximum ratio 3.6x provided by Andersen (1982) in his generic description); fore femur incrassate at base and tapering toward apex, without spinelike hairs; sternum 7 of male much longer than preceding two sterna combined (in generic description by Andersen (1982), sternum 7 only subequal to or shorter than sterna 5 and 6 combined); pygophore and proctiger with dense bundles of bristlelike hairs; posterolateral processes of pygophore very short. See also remarks for *E. luaae* sp.n.



FIGURES 1–8. *Eotrechus pilicaudatus* **sp.n.** (male): (1) right fore leg; (2) abdominal venter (genitalia excluded); (3) mid trochanter and part of femur; (4) hind trochanter and part of femur; (5) proctiger (dorsal); (6) pygophore, dorsal view; (7) same, ventral view; (8) same, lateral view.

So far, this is the fifth *Eotrechus* species recorded from India (previous records are *E. brevipes* Andersen, 1982 from West Bengal and Sikkim, *E. longipes* Andersen, 1982 from Uttar Pradesh and West Bengal, *E. terrestris* from Sikkim, and *E. kalidasa* from Meghalaya).

Eotrechus luaae sp.n.

(Figs. 9-16)

Material examined. Holotype (apterous ⋄) and allotype (apterous ⋄), CHINA, Hainan Prov., Ledong, Jianfenglin forest reserve, cascade along road, leg. I-S. Chen et al., 13 Sep. 2005, THH05-87 (ZRC).

Paratypes: CHINA, **Hainan Prov.:** $10 \, \text{dot} \, 59 \, \text{g}$ (apterous), $1 \, \text{g}$ (macropterous), same label data as holotype (BMNH, ZRC); $7 \, \text{dot} \, 49 \, \text{g}$ (apterous), Qiongzhong, Baihua waterfall, near Qiongzhong town, leg. I-S. Chen et al., 11 Sep. 2005, THH05-73 (NHMW, ZRC); $9 \, \text{dot} \, 19$ (apterous), Qiongzhong, Linmushan forest park, ca. 15 km into track from road, leg. I-S. Chen et al., 11 Sep. 2005, THH05-77 (ZRC).

Description of apterous form. 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 (allotype 8.40), width 2.48–2.81 (allotype 2.57).

Colour: Dorsal body mainly brown, covered with golden pubescence, with yellow markings on head, pronotum, mesonotum, as follows: head with yellow markings on anterolateral corners, next to inner margin of eyes, and a yellow marking on posterior margin; pronotum with yellow median longitudinal stripe, in lateral view with two yellow markings, one longer in upper part and one shorter on lower part; mesonotum mainly dark brown, with yellow median stripe running from anterior to posterior margin, lateroposterior margin light brown (sometimes expanded). Pro-, meso-, metasternopleura, meso- and meta-acetabula with dense reflective silvery pubescence. Metanotum, abdominal tergites mainly dark brown, tergites 5–7 usually with narrow yellowish-brown median stripe. All leg segments (including coxae) yellowish, except tarsi dark brown. Ventral body: prosternopleuron yellow; meso- and metasternopleura usually dark brown or light brown; abdominal venter mainly light brown, sometimes darker.

Structural characteristics: Apterous male (holotype): Head width across eyes 1.72; interocular width 0.98; eye kidney-shaped on dorsal view, eye size 0.80. Antennae about 0.97x of body length (7.72: 8.00), lengths of segments 1–4: 2.21: 1.98: 1.45: 2.08; first segment with 4–5 black spines on apical part. Pronotum, broader than long, shorter than head length (1.09: 1.37); mesonotum length 1.80. Lengths of mesosternum and metasternum: 2.16 and 0.70. Lengths of leg segments (femur: tibia: tarsal segment 1: tarsal segment 2) as follows, fore leg: 2.87: 2.67: 0.29: 0.44; mid leg: 7.60: 6.60: 0.56: 0.59; hind leg: 7.90: 7.70: 0.54: 0.57. Fore femur (Fig. 9) incrassate, length about 4.63x maximum width (2.87: 0.62), slightly constricted before apex, basal part with broad tubercle bearing

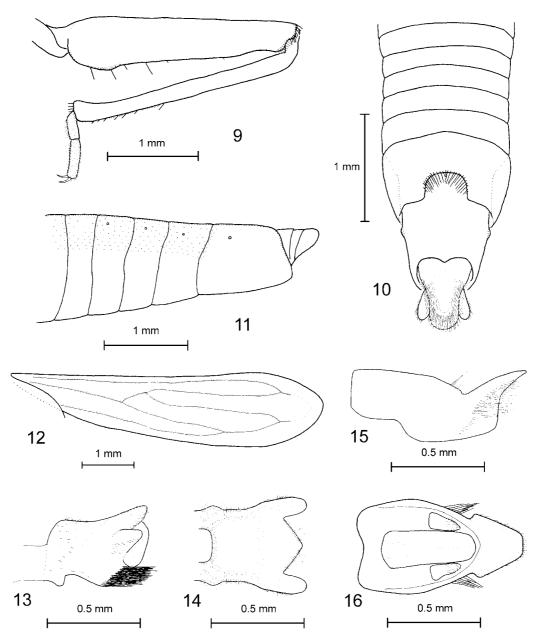
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patch of minute dark hairs; ventral surface of femur with 3-4 spinelike hairs (male paratypes: 0-4 hairs, or broken off); fore tibia slightly curved in apical part, with scattered long black spinelike hairs on external side of distal part and apex. Mid and hind femora slender and slightly shorter than body. Mid and hind trochanters without spines, mid and hind femora with black spines scattered on distal. Claws stout (fore claw very stout), lengths of fore, mid, hind claws 0.19: 0.21: 0.21. Abdomen relatively short, venter slightly depressed from segment 3-7, length of abdominal venter from sternum 2 to sternum 7: 1.82; sternum 7 about 1.48x length of two preceding sterna together (0.65: 0.44), posterior margin deeply emarginate, depth around 2/5 of sternum 7 length, margin with long, soft, brown hairs (Fig. 10). Abdominal segment 8 long (dorsal length 0.81, ventral length 1.02), with medially produced posteroventral margin; abdominal spiracle of segment 8 produced into minute tubercle, near anterior margin (Fig. 10). Genital segments relatively large, modified as follow: Proctiger (Figs. 13-14): distinctly trilobed, posterolateral lobes covered with yellowish hairs, ventrocaudal surface of proctiger with dense patch of long, brushlike hairs (in "in situ" position not visible). Pygophore: on ventral view, long and slender and constricted on mid part, ventral surface convex, produced into median broad ridge, straight in lateral view, posterior part produced into narrow platelike structure, tapering towards apex (Figs. 15-16). Paramere very short, blunt, with some soft hairs on apex.

Apterous female (allotype): Head width across eyes 1.76; interocular width 0.98; eye kidney-shaped on dorsal view, eye size 0.83. Antennae about 0.84x of body length (7.03: 8.40), lengths of segments 1-4: 1.96: 1.74: 1.32: 2.01; first segment with about 5-6 black spines on apical part. Pronotum broader than long, shorter than median head length (1.00: 1.37), mesonotum length 1.88. Lengths of mesosternum and metasternum: 2.12 and 0.76. Lengths of leg segments (femur: tibia: tarsal segment 1: tarsal segment 2) as follows, fore leg: 2.64: 2.28: 0.29: 0.44; mid leg: 6.80: 5.80: 0.57: 0.60; hind leg: 7.00: 6.65: 0.59: 0.59. Fore femur incrassate, length about 6.44x maximum width (2.64: 0.41), slightly tapering towards apex, base without tubercle; ventral with about 12 spinelike hairs in a row; fore tibia slightly curved apically, with many long black spinelike hairs along external side and on apex. Mid and hind femora slender and slightly shorter than body. Mid and hind trochanters without spines, mid and hind femora with black spines scattered distally. Claws stout, lengths of fore, mid, hind claws 0.18: 0.22: 0.22. Abdomen (Fig. 11) moderate in length, length of abdominal venter from sternum 2 to sternum 7: 2.97; sternum 7 large, slightly tapering towards apex, length about 1.28x length of two preceding sterna combined (1.08: 0.84), posterior margin smooth. Genital segments not concealed by sternum 7, proctiger acute.

Description of macropterous female. Size: length 9.80, width 2.74, slightly larger than apterous form.

Colour: pronotum: a yellow median mark on anterior part, pronotal lobe totally dark brown or black, margin slightly less dark; wings dark brown or black, with golden pubescence denser on wing veins and anterior margin; colouration of head and other parts similar to that of apterous form.



FIGURES 9–16. *Eotrechus luaae* **sp.n.** (9–10, 13–16: male; 11–12: female): (9) right fore leg; (10) abdominal venter; (11) abdomen, lateral view; (12) right fore wing; (13) proctiger, lateral view; (14) same, dorsal view; (15) pygophore, lateral view; (16) same, dorsal view.

Structural characteristics: Pronotum length (including pronotal lobe): 3.23. Fore wing length (from humeri to tip of wing): 6.20, wing veins as shown in Fig. 12. Other characteristics similar to apterous form.

1353

Macropterous male: unknown.

Etymology. This species is named in honour of Ms. Lua Hui Kheng, curator of the Raffles Museum of Biodiversity Research (Singapore), for her kind support of the authors' work on Southeast Asian aquatic bugs.

Remarks. This new species is very closely related to *E. pingae* Andersen (from Guangdong Province, China) by the identical shape of male fore femur and the similar structures of abdomen and genital segments (median groove of ventral abdomen, emarginated posterior margin of sternum 7, plate-like structure on posterior part of pygophore, and trilobed proctiger). However, further details of the abdomen and the genital segments clearly prove that *E. luaae* is a separate species from *E. pingae*:

- (1) Pregenital abdomen. In *E. luaae*, the median, longitudinal groove only from sterna 3–7, less conspicuous and broader than in *E. pingae* (there the groove running from sterna 2–7, narrow and deep); emargination of sternum 7's posterior margin deeper in *E. luaae* than in *E. pingae*.
- (2) Abdominal segment 8. Posterior margin produced into a small median and acute process (in *E. pingae*, only slightly produced).
- (3) Pygophore. In *E. luaae*, ventral surface convex, produced into a median, broad ridge, straight in lateral view (in *E. pingae*, pygophore with a simple, flat ventral surface and round in lateral view); posterior plate narrower, slightly tapering towards apex (in *E. pingae*, broader than long and subrectangular); pygophore laterally without tubercle (in *E. pingae*, with a round tubercle on each side).
- (4) Proctiger. In *E. luaae* posterolateral lobes more produced and with relatively short hairs (in *E. pingae*, posterolateral lobes not surpassing median lobe and with dense, relatively long, dark brushlike hairs); ventrocaudal surface of proctiger with dense patch of long, brushlike hairs (in *E. pingae*, patch not present, only some short and soft, yellowish hairs).

Eotrechus pingae is only known from a single male specimen, thus it is not possible to compare the females of these two species. The characteristics mentioned above also make *E. luaae* distinctly separable from other species of *Eotrechus*. This is the first time that the genus *Eotrechus* has been recorded from Hainan Island.

Eotrechus kalidasa Kirkaldy, **1902** (Figs. 17–20)

Eotrechus kalidasa Kirkdaldy, 1902: 137 (type-locality: Carin Cheba, Burma). —Distant, 1904: 182 (description), fig. 130. —Paiva, 1919: 364 (records Assam [locality today in Meghalaya]). —Andersen, 1982: 8–11 (descriptive notes), fig. 8, 15, 28.

Material examined. Paratype: 1º (macropterous), MYANMAR, Carin Cheba, 900-1100 m, leg. L. Fea, 1889, Distant Collection 1911-383 (BMNH).

Other: INDIA (NE): 1 of (macropterous), Meghalaya, 3 km E Tura, 1150 m, 25°30′N 94°14′E, leg. L. Dembicky & P. Pacholatko, 18 Apr. 1999 (NHMW).

Descriptive notes on macropterous male. Size: length 9.50, width 2.06.

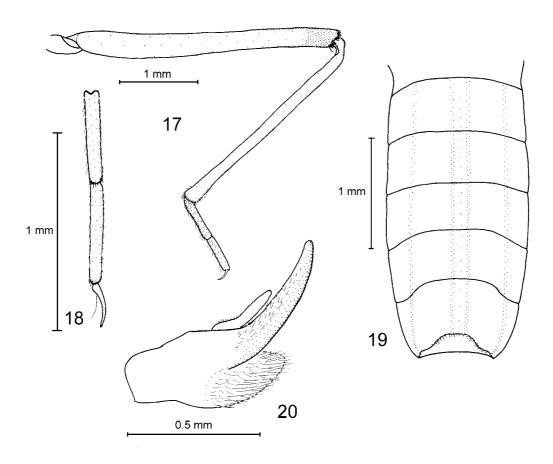
Colour. Dorsal side mainly brownish and black with silvery or golden pubescence. Head with two yellow spots laterally on anterior margin of eyes and yellow spot on posterior margin of head; pronotum with median yellow stripe and two lateral stripes on anterior part, pronotal lobe yellowish brown; legs and wings like in females described by Andersen (1982). Venter with silvery pubescence. Venter of head dark brown; prosternum yellow; mesosternum brownish yellow medially and dark brown laterally; metasternum and abdominal venter brownish yellow.

Structural characteristics: Head width across eyes 1.72, head length 1.50; interocular width 0.64; eye kidney-shaped on dorsal view, eye size 0.76. Lengths of antennal segments 1–2: 2.70: 2.43 (3–4 missing). Pronotum length 2.84. Wing venation as illustrated in Andersen (1982). Lengths of mesosternum and metasternum: 1.72 and 1.13. Lengths of leg segments (femur: tibia: tarsal segment 1: tarsal segment 2) as follows, fore leg: 3.60: 2.85: 0.56: 0.48; mid leg: 6.50: 6.95: 0.45: 0.53; hind leg: 6.90: 8.75 (hind tarsus missing); Fore femur (Fig. 17) simple and very slender, length about 13.84x maximum width (3.60: 0.26), ventral surface without spinelike hairs; fore tibia straight and simple, with row of long spinelike hairs on apical margin. Mid and hind femur slender and shorter than the body, with very few small black spines. Mid tarsi (Fig. 18) without ventral row of spines. Claws stout, lengths of fore, mid claws 0.19: 0.21. Abdomen relatively long, length of abdominal venter from sternum 2 to sternum 7: 3.00, with narrow median groove from sterna 3–7; sternum 7 about 0.75x length of two preceding sterna combined (0.68: 0.91), posterior margin slightly emarginated (Fig. 19). Genital segments and parameres (Fig. 20) matching illustrations by Matsuda (1960: figs. 552, 557).

Remarks. Eotrechus kalidasa is the type species of the genus and was described by Kirkaldy (1902) from "Carin Cheba, Burma," which is located in the mountains east of Toungoo in Kayin State, Myanmar. Kirkaldy wrote that the type material was to be deposited in the Museo Civico di Storia Naturale di Genova, Italy (Kirkaldy 1902), but it apparently never was returned there by Kirkaldy (Andersen 1982). Matsuda (1960), reviewing the Gerridae of the world, provided a more detailed description and good illustrations based on one male from the G.W. Kirkaldy Collection at the University of Kansas, USA, which originated from the type locality and which is probably a syntype. Later, this specimen was designated the lectotype by Andersen (1982) without examination, but based on the "identity confirmed by P.D. Ashlock, in litt." (for more details, see Andersen 1982, p. 7–10). When revising the genus Eotrechus, Andersen (1982) examined only two females, one from the type locality (deposited in BMNH, London) and the other one from "Assam, Garo Hills above Tura." Already, much earlier, Paiva (1919) had recorded E. kalidasa from Assam (India) based on the same female, which is now in the collections of the Zoological Survey of India. Although E. kalidasa

can be distinguished by the slender fore femur, the record of *E. kalidasa* from the Garo Hills remains still uncertain, as females of *Eotrechus* species are normally difficult to separate.

There was the possibility that the population from the Garo Hills belongs to another species closely related to *E. kalidasa*. Thanks to Dr. L. Dembicky & Dr. P. Pacholatko (Brno, Czech Republic), the authors were able to examine a male from the same area and confirm the occurrence of *E. kalidasa* in India. Some descriptive notes on that specimen are provided above. Unfortunately, the authors could not borrow the lectotype, but as the Meghalaya specimen matches the description and illustrations by Matsuda (1960), especially in the structures of the genitalia, we determine the Maghalaya specimen as *Eotrechus kalidasa*.



FIGURES 17–20. *Eotrechus kalidasa* (male): (17) right fore leg; (18) mid tarsi; (19) abdominal venter (genitalia excluded); (20) pygophore, lateral view.

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

Material examined. Paratypes: 1 σ 1 φ (apterous), INDIA?, taken from wet path in copula, 4600 ft., leg. H. Stevens., 9 Jul. 1918, Brit. Mus. 1922-307 (BMNH).

Others: NEPAL: 25°5' (apterous), Centr., Lanqtanq NP, Lanqtanq valley, Rimche env., leg. P. Šrámek, 13 Oct. 2002 (CPS, NHMW).

Descriptive notes. Size. Apterous males, length 7.60 (incl. genitalia)/ 7.25 (from head to hind margin of 8th tergite), width 2.34.

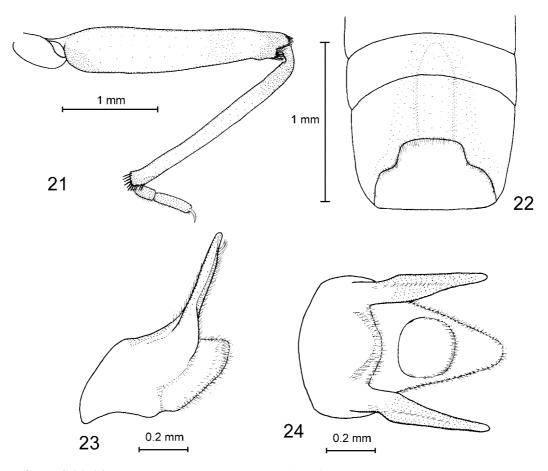
Colour. Body mainly black dorsally with golden or metallic green pubescence. Head with triangular yellow markings posteriorly. Antennal segments: first, second, third segments mainly yellow, with brown apices; fourth segment brown. Pronotum with three longitudinal slender yellow stripes, running from anterior to posterior margins: one median and two lateral. Mesonotum with slender yellow stripe medially, length of stripe about one-half mesonotal length. Venter, except prosternum light yellowish, mainly black or dark brown, covered with a golden pubescence. All coxae, trochanters, femora, and tibiae yellow or slightly brown. All tarsi dark brown.

Structural characteristics: Head width across eyes 1.64; interocular width 0.64; eye kidney-shaped on dorsal view, eye size 0.75. Antennae about 0.79x of body length (6.00: 7.60), lengths of segments 1-4: 1.70: 1.52: 1.34: 1.44; first segment with 7-8 black spinelike hairs in apical part. Pronotum broader than long, shorter than head length (0.98: 1.32). Lengths of mesosternum and metasternum: 2.00 and 0.71. Lengths of leg segments (femur: tibia: tarsal segment 1: tarsal segment 2) as follows, fore leg: 2.65: 2.29: 0.28: 0.40; mid leg: 5.85: 5.90: 0.40: 0.48; hind leg: 5.80: 6.60: 0.41: 0.50. Fore trochanter apically with small black tubercle. Fore femur (Fig. 21) moderate, length about 5.10x maximum width (2.65: 0.52), ventral surface without spinelike hairs; fore tibia almost straight, with scattered black spinelike hairs along external side, with row of long spines on apical margin, inner process at apex not produced. Mid and hind femora slender and shorter than body, with scattered small black spines. Claws stout, lengths of fore, mid, hind claws 0.15: 0.20: 0.18. Abdomen moderate, length of abdominal venter from sternum 2 to sternum 7: 1.90; sterna 6-7 with median groove, this wide on sternum 7; sternum 7 about 1.18x length of two preceding sterna combined (0.60: 0.51), posterior margin slightly emarginated (Fig. 22). Genital segments relatively long: proctiger with hind margin triangularly produced (Fig. 24); pygophore broad, 2 long projections with pointed apex (Figs. 23–24), proctiger and pygophore projections slanting dorsad. Paramere small, length about 2 times width, tip round, with some long soft hairs.

Remarks. Eotrechus terrestris was described by Andersen (1982) very briefly, based on four specimens from India. Andersen noted that this species is very similar to Eotrechus longipes and can be separated by the structure of the male genitalia. Thanks to

(1353)

the collecting efforts of Petr Šrámek, two males of *E. terrestris* from Nepal are available to the authors for examination. These specimens agree with the male paratype of *Eotrechus terrestris* deposited in BMNH, although a few structural differences were observed. This is the first record of *E. terrestris* from Nepal. Thus, in this study, we provide some descriptive notes on the specimens from Nepal (see above).



FIGURES 21–24. *Eotrechus terrestris* (male): (21) right fore leg; (22) abdominal venter, posterior part, genitalia excluded; (23) pygophore, lateral view; (24) pygophore & proctiger, ventral view.

Acknowledgments

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