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Article

Revision of the *Aenictus minutulus* species group (Hymenoptera: Formicidae: Aenictinae) from Southeast Asia

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Abstract

The genus *Aenictus* is a diverse group of army ants in the Old World tropics and subtropics. The worker-based *Aenictus piercei* species group of Jaitrong and Yamane (2011) is redefined and renamed here as the *Aenictus minutulus* group. *Aenictus piercei* Wheeler et Chapman, 1930 and *A. lifuiae* Terayama, 1984 are removed from this group; the former is moved to the *A. javanus* group and the latter to the *A. ceylonicus* group. The Southeast Asian species of the group are revised to include six species: *Aenictus changmaianus* Terayama et Kubota, 1993, *Aenictus* sp.56 of WJT, *A. minimus* **sp. nov.**, *A. minutulus* Terayama et Yamane, 1989, *A. peguensis* Emery, 1895 and *A. subterraneus* **sp. nov.** *Aenictus changmaianus*, *A. minimus* and *A. peguensis* are probably restricted to the seasonal forest located northward from the Isthmus of Kra, while *A. minutulus*, *A. subterraneus* and *Aenictus* sp.56 of WJT are obviously Sundaland species inhabiting the perhumid evergreen rainforest.

Key words: *Aenictus minutulus* species group, army ants, taxonomy, distribution, Southeast Asia

Introduction

The genus *Aenictus* Shuckard, 1840 (subfamily Aenictinae) is one of the larger ant genera of the world with 182 valid species and subspecies, and is distributed in the Old World tropics and subtropics (Wilson 1964; Bolton 1994; Gotwald 1995; Shattuck 2008; Jaitrong & Yamane 2011; Jaitrong *et al.* 2012). Jaitrong and Yamane (2011) established 12 species groups in the genus from the eastern part of the Oriental region, and the Indo-Australian and Australasian regions, with these groups being well defined on the basis of worker morphology.

In this report we redefine and rename the *A. piercei* group as the *A. minutulus* group, and we provide a revision of the Southeast Asia members of the group. Morphological and bionomic information is presented for each species. We omit the male-based names from the species treatment in this paper, following Wilson (1964). We anticipate that male-based names will eventually be matched with worker-based names using DNA information, but until then it is important to develop a sound worker-based taxonomy. Where our new worker-based species co-occur with potentially matching named males, we use temporary morphospecies codes to refer to the workers.

Materials and methods

This study is mainly based on the materials deposited in the SKY Collection at Kagoshima University (Japan) and The Natural History Museum of the National Science Museum (Thailand). Syntypes or paratypes were examined for the three named species of the *Aenictus minutulus* group. The holotype and eight paratypes of *A. lifuiae* and syntypes of *A. piercei* were also examined.

Most morphological observations were made with a Nikon SMZ1000 stereoscope. Multi-focused montage

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images were produced using Helicon Focus 4.75 Pro from a series of source images taken by a Nikon EOS Kiss×4 digital camera attached to a Nikon ECLIPSE E600 microscope. Workers of each species were measured for the following parts using a micrometer, representing to the second decimal place.

The abbreviations used for the measurements and indices are as follows:

TL	Total length, roughly measured from the anterior margin of head to the tip of gaster in stretched specimens.
HL	Maximum head length in full-face view, measured from the anterior clypeal margin to the midpoint of a line drawn across the posterior margin of head.
HW	Maximum head width in full-face view.
SL	Scape length excluding the basal of constriction and condylar bulb.
ML	Mesosomal length measured from the point at which the pronotum meets the cervical shield to the posterior margin of metapleuron in profile.
PL	Petiole length measured from the anterior margin of the peduncle to the posteriormost point of tergite.
SI	Scape index, SL/HW × 100.
CI	Cephalic index, HW/HL × 100.

Abbreviations of the type depositories and others are as follows:

AMK	Ant Museum, Faculty of Forestry, Kasetsart University.
BMNH	The Natural History Museum, London, U.K.
MCSN	Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italy.
MCZC	Museum of Comparative Zoology, Cambridge, MA, U.S.A.
MHNG	Museum d’ Histoire Naturelle, Geneva, Switzerland.
MNHA	Museum of Nature and Human Activities, Hyogo, Japan
MZB	Museum Zoologicum Bogoriense, Cibinong, Indonesia.
NIAST	The National Institute of Agro-Environmental Sciences, Tsukuba, Japan.
NSMT	The National Science Museum, Tsukuba, Japan.
SKYC	SKY Collection at Kagoshima University, Japan.
THNHM	Natural History Museum of the National Science Museum, Thailand.
UMS	‘BORNEENSIS’, Universiti Malaysia Sabah, Sabah, Malaysia.
VNMN	Vietnam National Museum of Nature.
WJT	Weeyawat Jaitrong

The general terminology for the worker morphology follows Hölldobler and Wilson (1990), and Bolton (1994). For the important characters in the genus *Aenictus* used in this paper see Jaitrong and Yamane (2011).

Systematics

Aenictus minutulus species group

Aenictus piercei group in Jaitrong et Yamane, 2011: 9.

Diagnosis. In an earlier paper (Jaitrong & Yamane 2011) this species group was defined as follows: head in full-face view with occipital corner convex, and posterior margin almost straight to shallowly and broadly concave; occipital margin lacking collar; antenna 10-segmented; antennal scape short reaching only midlength of head; anterior clypeal margin roundly convex, lacking denticles; mandible subtriangular; its masticatory margin with a large apical tooth, medium-sized subapical and basal teeth, and 2-6 denticles between them; basal margin of mandible with conspicuous denticles; frontal carina short; parafrontal ridge absent; with mesosoma in profile promesonotum

convex dorsally and sloping gradually to propodeum; metapleural groove present or absent (mesonotum and propodeum fused); propodeal junction angulated; subpetiolar process well developed, triangular or subrectangular. Head and first gastral segment entirely smooth and shiny. Body yellowish brown to reddish brown; typhlatta spot absent.

Size variation occurs among individuals from single colonies.

Remarks. This is a group of rather small species, measuring 1.80-3.20 mm in total body length. It is most similar to the *A. javanus* group in terms of body size and coloration, but in the former the anterior clypeal margin lacks denticles, while it has several denticles in the latter.

The *Aenictus piercei* group was established by Jaitrong and Yamane (2011) to include five named species occurring in Southeast Asia: *Aenictus changmaianus* Terayama et Kubota, 1993; *A. lifuiae* Terayama, 1984; *A. minutulus* Terayama et Yamane, 1989; *A. peguensis* Emery, 1894; and *A. piercei* Wheeler et Chapman, 1930. However, after carefully examining the type material and an associated specimen of *A. piercei* we concluded that this species should be removed from this group and that it is a member of the *A. javanus* group (*A. piercei* has denticles on the anterior margin of clypeus). The *A. piercei* group is renamed here as the *A. minutulus* group.

After a careful examination of the smaller specimens of *A. lifuiae* collected from Iriomote-jima and Okinawa-jima, southern Japan, we found that the mandible is almost linear, the anterior clypeal margin is straight or weakly concave, and that a gap occurs between the mandibles and anterior clypeal margin. These characteristics are used to separate the *A. ceylonicus* group from the other groups of the genus *Aenictus*, and also these specimens possess other conditions shared with the *A. ceylonicus* group. We transfer *A. lifuiae* to the *A. ceylonicus* group.

Checklist of species

Aenictus changmaianus Terayama et Kubota, 1993
Aenictus minimus **sp. nov.**
Aenictus minutulus Terayama et Yamane, 1989
Aenictus peguensis Emery, 1895
Aenictus subterraneus **sp. nov.**
Aenictus sp.56 of WJT

Key to species based on the worker caste

1.	Promesonotum in profile with clearly convex dorsal outline; propodeum dorsally extremely lower than promesonotum (Figs 2C, 5C, 6C) 2
-	Mesosoma dorsally almost flat or feebly convex (Figs 1C, 3C, 4C) 4
2	Declivity of propodeum shallowly concave, encircled with a distinct rim (Fig. 2C–E) (Borneo and Java). . . *A.* sp. 56 of WJT
-	Declivity of propodeum with lateral carinae, but not demarcated basally by a transverse carina (Figs 5D–E, 6B–D). 3
3	In full-face view posterior margin of head convex (Fig. 5A); propodeal junction angulated, right-angled (Fig. 5E); larger species (TL 2.95–3.15 mm; HW 0.52–0.58 mm) (Vietnam and Myanmar) . . . . . *A. peguensis*
-	In full-face view posterior margin of head almost straight or feebly concave (Fig. 6A); propodeal junction roundly angulated (Fig. 6C); smaller species (TL 2.10–2.15 mm; HW 0.48–0.50 mm) (Borneo). . . . . *A. subterraneus* **sp. nov.**
4	Basal margin of mandible with 1–2 small denticles next to large basal tooth and followed by a larger denticle (Fig. 3E); antennal scape relatively short (SI 63–64) (N. Vietnam). . . . . *A. minimus* **sp. nov.**
-	Basal margin of mandible with 3–5 denticles that gradually reduce in size toward base of mandible (Figs 1E, 4E); antennal scape relatively long (SI 67–72) 5
5	Metapleural gland bulla relatively large; distance between propodeal spiracle and metapleural gland bulla shorter than or almost as long as spiracular diameter (Fig. 1D) (Vietnam and Thailand). . . . . *A. changmaianus*
-	Metapleural gland bulla relatively small; distance between propodeal spiracle and metapleural gland bulla clearly longer than spiracular diameter (Fig. 4D) (Sumatra and Java) . . . . . *A. minutulus*

Aenictus changmaianus Terayama et Kubota, 1993

(Figs 1A–E, 7)

Aenictus changmaianus Terayama et Kubota, 1993: 68, figs 2–4.

Types. Holotype and three paratype workers from Thailand, Chang Mai Prov. [Chiang Mai Prov.], Doi Step [Doi Suthep N.P.], 1500 m, 18.VIII.1992, M. Terayama and S. Kubota leg. (NIAST and NSMT; two paratypes examined).

Measurements. Paratypes (n = 2): TL 2.00–2.05 mm; HL 0.48–0.50 mm; HW 0.39–0.40 mm; SL 0.28 mm; ML 0.63 mm; PL 0.14 mm; CI 78–84; SI 69–71.

Non-type workers (n = 6): TL 1.95–2.60 mm; HL 0.50–0.58 mm; HW 0.38–0.50 mm; SL 0.26–0.35 mm; ML 0.58–0.80 mm; PL 0.13–0.19 mm; CI 75–89; SI 68–72.

Description of worker (paratypes and non-types). Head in full-face view rectangular, clearly longer than broad, with almost parallel sides and shallowly concaved posterior margin. Antennal scape reaching midlength of head; antennal segment II longer than broad; III–IX each broader than long; terminal segment (X) distinctly longer than broad and 2.1 times as long as broad. Frontal carina very short, not extending beyond the level of posterior margin of torulus. Masticatory margin of mandible with a large apical tooth followed by a medium-sized subapical tooth, 1–4 denticles and a medium-sized basal tooth; basal margin with 2–3 small denticles. Mesosoma seen in profile almost flat or weakly convex dorsally; suture between mesopleuron and metapleuron present; metanotal groove indistinct; metapleural gland bulla large and transparent; distance between propodeal spiracle and metapleural gland bulla shorter than or almost as long as spiracular diameter (Fig. 1D). Propodeal junction obtusely angulated; declivity of propodeum with lateral carinae, but not demarcated basally by a transverse carina. Petiole excluding subpetiolar process almost as long as high, with its dorsal outline convex; subpetiolar process large, rectangular; anterior corner and posterior corner each acutely angulate. Postpetiole higher than long, slightly smaller than petiole and its dorsal outline convex. Femora and tibiae incrassate and widened.

Head including mandible and antennal scape smooth and shiny; promesonotum, dorsa of petiole and postpetiole smooth and shiny; mesopleuron densely reticulate, but shiny; metapleural gland bulla almost smooth and shiny; lateral faces of propodeum, petiole, and postpetiole weakly microreticulate. Legs entirely smooth and shiny.

Head and mesosoma dorsally with relatively dense standing hairs mixed with sparse short hairs over the surface; longest pronotal hair 0.05 mm long. Ground color yellow.

Non-type material examined. **VIETNAM:** Nghe An, Tuong Duong Dist., Sang Le Forest, 3.IV.2006, K. Eguchi leg., Eg06-VN-08 (SKYC); same loc., 2.IV.2006, K. Eguchi leg., Eg06-VN-05 (SKYC); S. Vietnam, Dong Nai, S. Cat Tien N.P., behind the Head Quarter, 21.X.2004, K. Eguchi leg., Eg04-VN-758 (SKYC); same loc., 14.X.2004, K. Eguchi leg., Eg04-VN-630 (SKYC). **THAILAND:** N. Thailand, Chiang Mai Prov., Campus of Chiang Mai University, 10.VI.2001, K. Eguchi leg., Eg01-TH-161 (AMK, SKYC, THNHM,); N. Thailand, Chiang Mai Prov., Mae Tang Dist., Mae Hair Tai, 1.IX.2000, W. Jaitrong leg., WJT00-MHT02 (AMK, SKYC, THNHM); N. Thailand, Chiang Mai Prov., Mae Tang Dist., Wad Pha Deang, 8.IX.2000, W. Jaitrong leg., WJT00-WPD01 (SKYC, THNHM); same loc., 9.IX.2000, W. Jaitrong leg., WJT00-WPD02 (SKYC, THNHM); NE. Thailand, Loei Prov., Phu Luang W.S. (ca. 700 m alt.), 10.IV.2008, Sk. Yamane leg., TH08-SKY-66 (SKYC, THNHM); NE. Thailand, Nakhon Ratchasima Prov., Sakaerat ERS., 14.XII.2010, S. Hasin leg., TH10-SH-01 (SKYC, THNHM); same loc., 10.VII.1999, Sk. Yamane leg., TH99-SKY-23 (SKYC, THNHM); same loc., 4.III.2005, S. Hasin leg., WJT05-NE50 (SKYC, THNHM); same loc., 18.X.2002, W. Jaitrong leg., WJT02-1 (SKYC, THNHM). **CAMBODIA:** Kampong Cham Prov., Rubber plantation, 30.IV.2010, S. Hosoishi leg., Winkler extraction #1 (THNHM).

Distribution. Vietnam (new record), Thailand and Cambodia (new record) (Fig. 7).

Bionomics. No biological information is available for *A. changmaianus*. However, we found this species in highland seasonal forests (hill evergreen forest) and disturbed areas in northern Thailand (900–1500 m). In eastern Thailand and southern Vietnam it was collected from lowland seasonal forests (dry evergreen forest), secondary forests, and plantations (160–700 m), thus this species probably ranges from lowland to highland and inhabits both primary and disturbed forests.

Remarks. *Aenictus changmaianus* is very similar in general appearance to *A. minutulus*, and *A. minimus*. However, *A. changmaianus* is separated from *A. minimus* by the dentition on the basal margin of the mandible (see couplets 5 and 6 in the key) and antennal scape being relatively longer than in the latter (SI 67–72 in *A. changmaianus*; SI 63–64 in *A. minimus*). It is distinguished from *A. minutulus* by the large metapleural gland bulla (relatively small in *A. minutulus*).

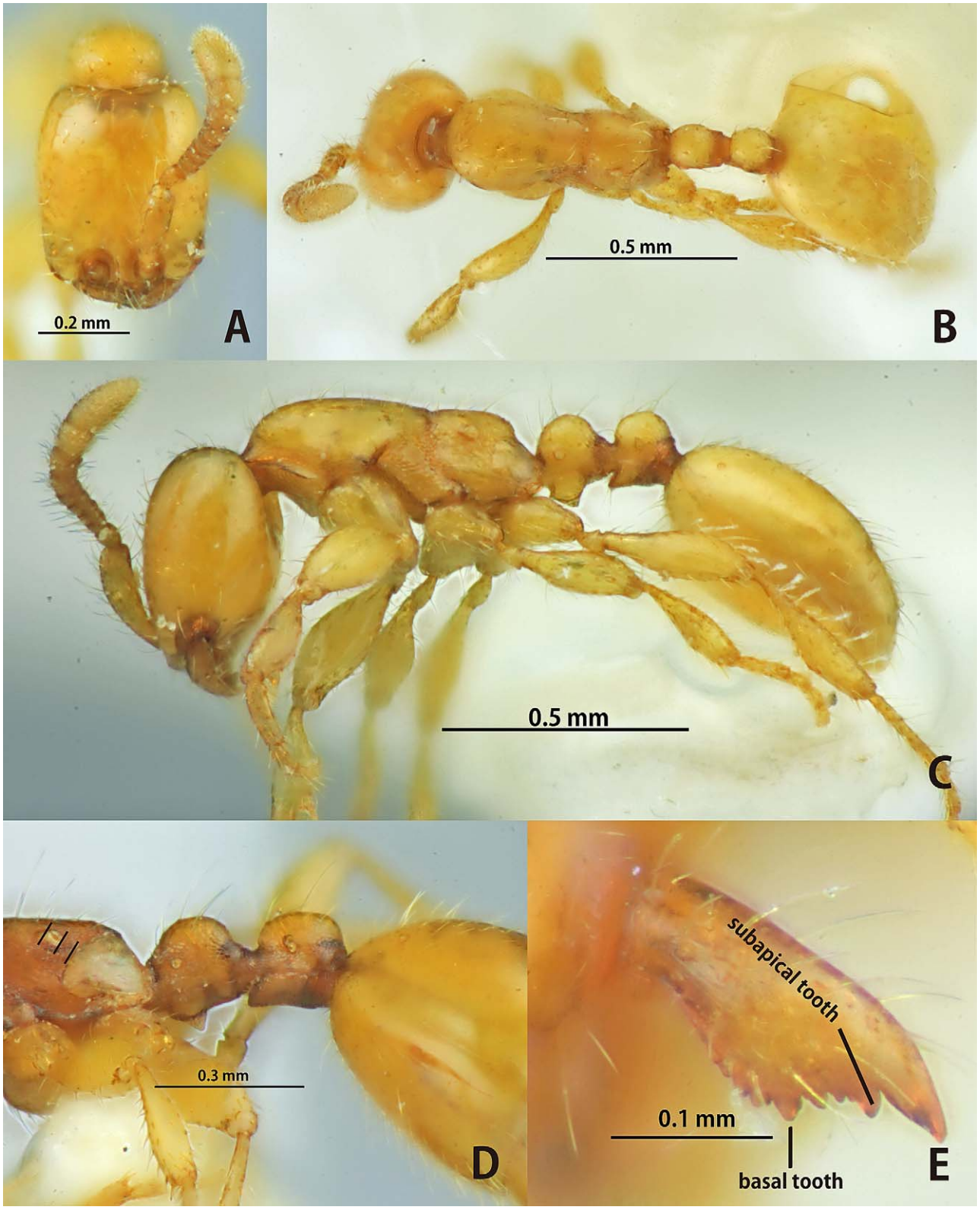

FIGURE 1. *Aenictus changmaianus* (A, B, C, paratype; D, E, non-type from Chiang Mai Province, N. Thailand). A, Head in full-face view; B, body in dorsal view; C, body in profile; D, propodeal junction, petiole and postpetiole in profile; E, mandible.

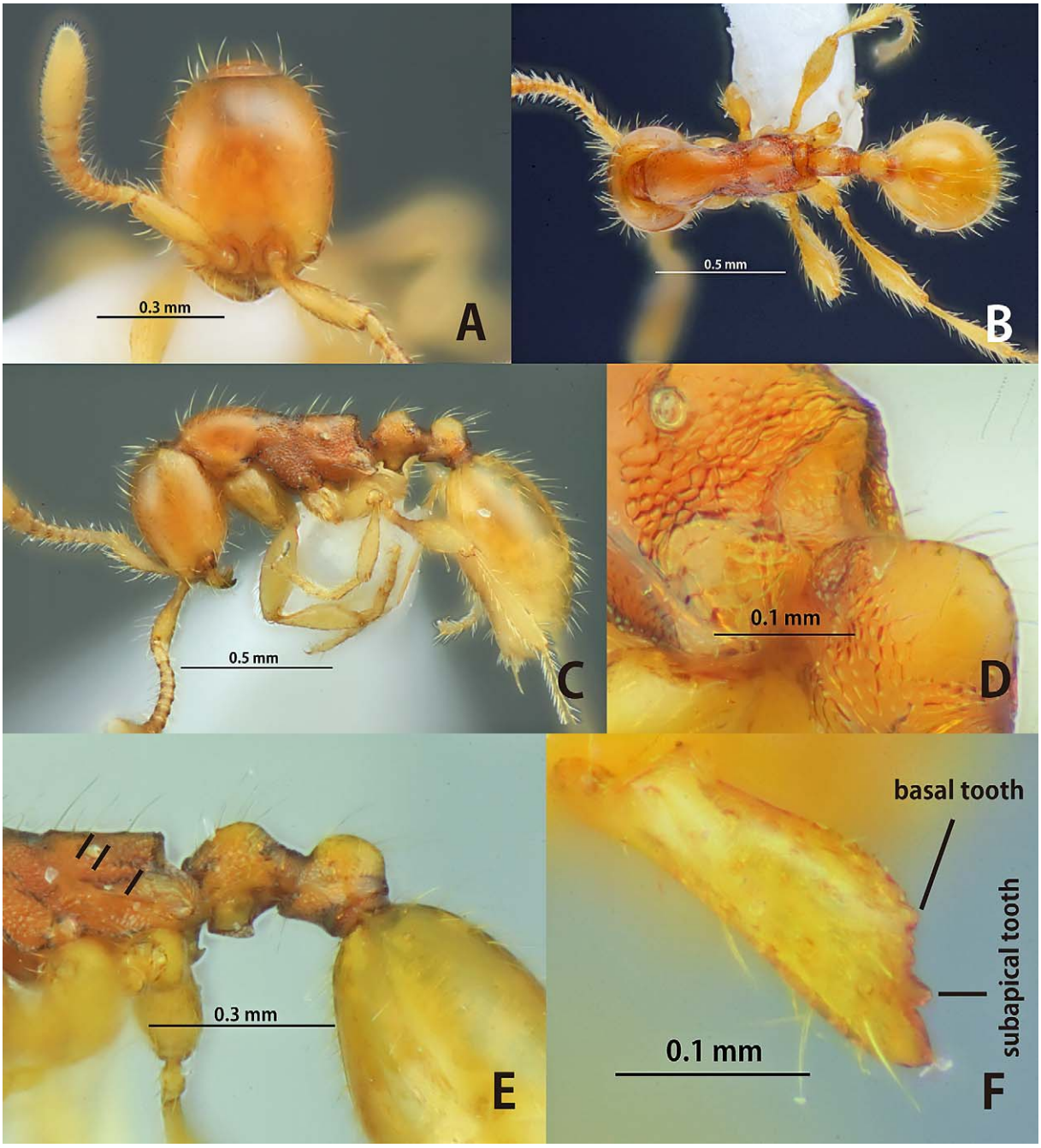

FIGURE 2. *Aenictus* sp. 56 of WJT (specimen from Borneo, FI92-337). A, Head in full-face view; B, body in dorsal view; C, body in profile; D, declivity of propodeum, obliquely posterior view; E, propodeal junction, petiole and postpetiole in profile; F, mandible.

***Aenictus minimus* sp. nov.**
(Figs 3A–E, 7)

Types. Holotype worker from N. Vietnam, Thai Nguyen, Na Hau Village, My Yen Comm. Forest, 8.XI.2001, Sk. Yamane leg., VN01-SKY-29 (VNMN). Four paratype workers, same data as holotype (SKYC, THNHM).

Measurements. Holotype: TL 2.15 mm; HL 0.50 mm; HW 0.44 mm; SL 0.28 mm; ML 0.66 mm; PL 0.15 mm; CI 88; SI 63.

Paratypes (n = 4): TL 1.80–2.15 mm; HL 0.45–0.50 mm; HW 0.35–0.44 mm; SL 0.23–0.28 mm; ML 0.55–0.66 mm; PL 0.14–0.15 mm; CI 78–88; SI 63–64.

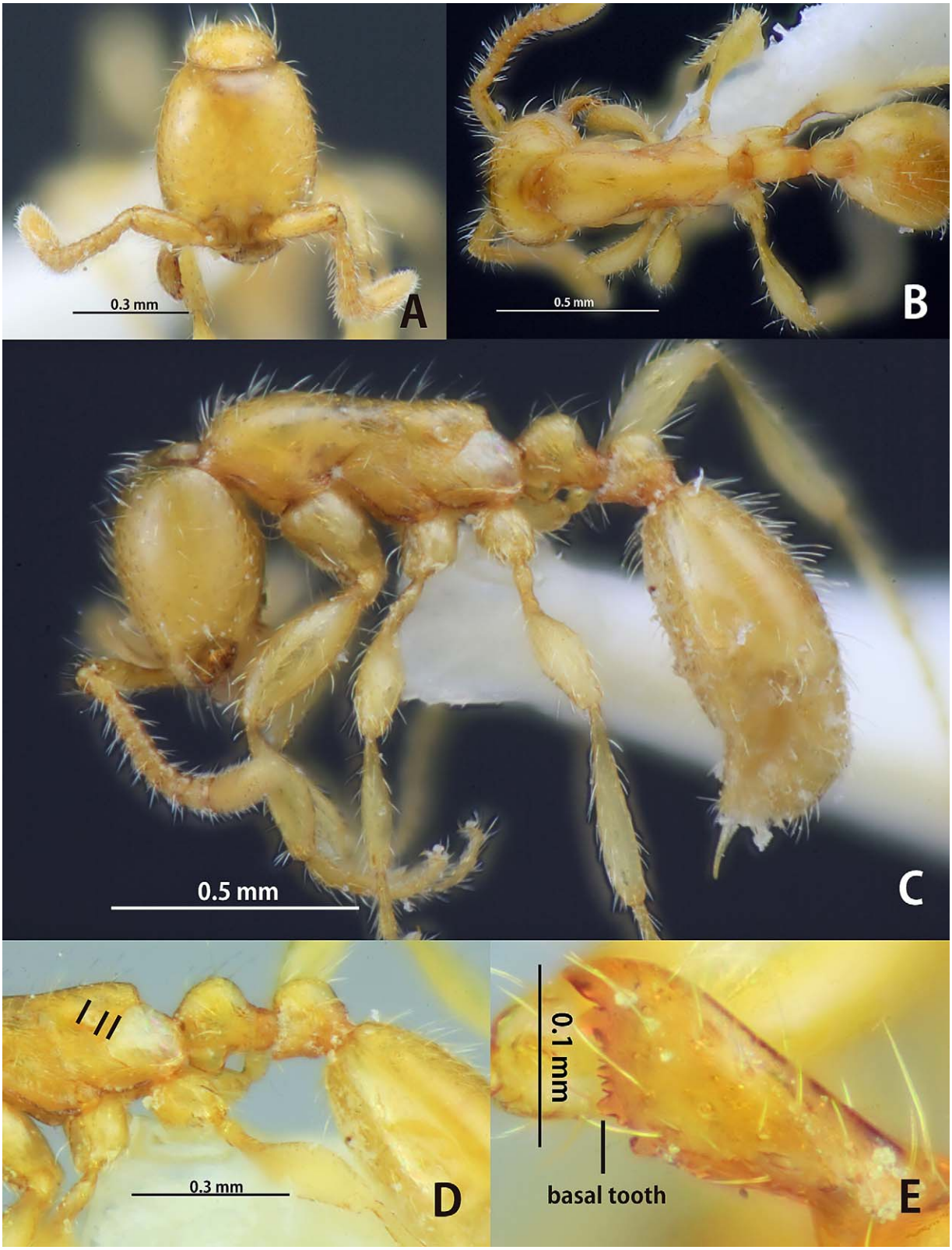

FIGURE 3. *Aenictus minimus* **sp. nov.** (holotype). A, Head in full-face view; B, body in dorsal view; C, body in profile; D, propodeal junction, petiole and postpetiole in profile; E, mandible.

Description of worker (holotype and paratypes). Head in full-face view subrectangular, clearly longer than broad, with feebly convex sides and shallowly concave posterior margin. Antennal scape reaching midlength of head in larger workers (not reaching midlength of head in smaller workers); antennal segment II longer than broad and almost as long as III+IV; III–VIII each broader than long; terminal segment distinctly longer than broad, 2.1

times as long as broad and longer than VII+VIII+IX. Frontal carina very short, not extending beyond the level of posterior margin of torulus. Masticatory margin of mandible with a large apical tooth followed by a medium-sized subapical tooth, 3–4 denticles, and a medium-sized basal tooth; basal margin with 1–2 small denticles next to basal tooth and followed by a larger denticle. Mesosoma in profile almost flat dorsally; metanotal groove indistinct or almost absent; metapleural gland bulla relatively large and transparent; distance between propodeal spiracle and metapleural gland bulla shorter than spiracular diameter (Fig. 3D). Propodeum in profile with straight dorsal outline; propodeal junction right-angled in larger workers (roundly convex in smaller workers); declivity of propodeum shallowly concave, with lateral carinae, but not demarcated basally by a transverse carina. Petiole slightly shorter than high, with its dorsal outline convex, slightly elevated posteriorly; subpetiolar process large, rectangular; anterior and posterior corners each acutely angulate. Postpetiole slightly shorter than petiole, its dorsal outline convex.

Head including mandible and antennal scape smooth and shiny; entire mesosoma smooth and shiny except mesopleuron, upper portions of metapleuron, and area between propodeal spiracle and metapleural gland bulla that are superficially reticulate. Petiole and postpetiole entirely smooth and shiny. Legs entirely smooth and shiny.

Head and mesosoma dorsally with relatively dense standing hairs mixed with sparse short hairs over the surface; longest pronotal hair 0.07–0.08 mm long. Ground color yellow; typhlatta spot absent.

Etymology. The species epithet "*minimus*" is a Latin word meaning minimum. This refers to this species being the smallest within this species group.

Distribution. Vietnam (Fig. 7).

Bionomics. So far *A. minimus* is known only from the type locality. The type series was collected from a disturbed forest in the daytime.

Remarks. *Aenictus minimus* is most similar in general appearance to *A. changmaianus* and *A. minutulus* (see under *A. changmaianus* for details).

Aenictus minutulus Terayama et Yamane, 1989

(Figs 4A–E, 7)

Aenictus minutulus Terayama et Yamane, 1989: 601, figs 7–10.
Aenictus minutulus: Bolton, 1995: 60.

Types. Holotype and three paratype workers from Indonesia, Mentawai Is., Pulau Sipora, 28.VII.1985, Sk. & S. Yamane leg. (MZB and SKYC; two paratypes examined).

Measurements. Paratype workers (n = 2): TL 1.90–1.95 mm; HL 0.45 mm; HW 0.38–0.39 mm; SL 0.25–0.26 mm; ML 0.63 mm; PL 0.15–0.16 mm; CI 83–86; SI 67–68.

Non-type workers (n = 10): TL 1.7–2.40 mm; HL 0.43–0.53 mm; HW 0.33–0.48 mm; SL 0.23–0.33 mm; ML 0.55–0.75 mm; PL 0.14–0.20 mm; CI 76–90; SI 65–71.

Description of worker (paratypes). Head in full-face view rectangular, clearly longer than broad, with almost parallel sides and almost straight or weakly concave posterior margin. Antennal scape reaching midlength of head; antennal segment II longer than broad; III as long as broad; IV–VI each slightly broader than long; VII–IX each as long as broad and III slenderer than IV–VI; terminal segment longer than broad, 2.0 times as long as broad. Frontal carina very short, not extending beyond the level of posterior margin of torulus. Masticatory margin of mandible with a large apical tooth followed by a medium-sized subapical tooth, 1–2 denticles, and medium-sized basal tooth; basal margin with 3–4 small denticles. Mesosoma in profile almost straight dorsally; metanotal groove indistinct; metapleural gland bulla relatively small; distance between propodeal spiracle and metapleural gland bulla clearly longer than spiracular diameter (Fig. 4D). Propodeum in profile with straight dorsal outline; propodeal junction bluntly angulate; declivity of propodeum shallowly concave, seen from back distinctly convergent above, with lateral carinae, but not demarcated basally by a transverse carina. Petiole almost as long as high, with its dorsal outline convex; subpetiolar process large, subretangular, with anterior and posterior corners each acutely angulate. Postpetiole almost as long as petiole, its dorsal outline convex.

Head including mandible and antennal scape smooth and shiny; mesonotum and lateral face of propodeum microreticulate; remainder of mesosoma smooth and shiny. Dorsa of petiole and postpetiole smooth and shiny; lower 1/2 of lateral faces of petiole and postpetiole microreticulate and opaque. Legs entirely smooth and shiny.

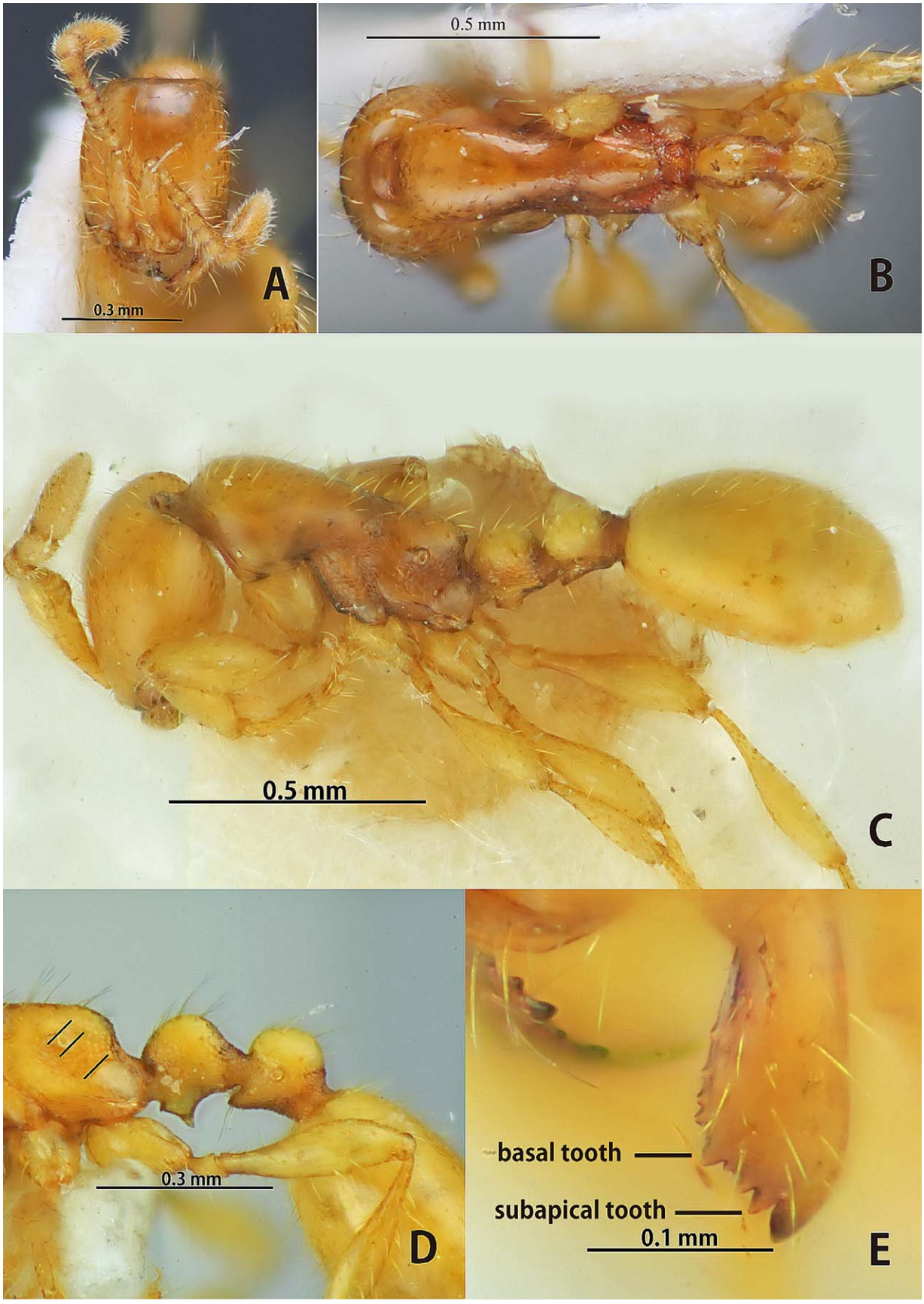

FIGURE 4. *Aenictus minutulus* (A, B, C, E, paratype; D, non-type from W. Java). A, Head in full-face view; B, body in dorsal view; C, body in profile; D, propodeal junction, petiole and postpetiole in profile; E, mandible.

Head and mesosoma dorsally with relatively dense standing hairs mixed with sparse short hairs over the surface; longest pronotal hair 0.10 mm long. Ground color light brownish yellow; antennae, legs and gaster yellow.

Non-type material examined. **INDONESIA:** West Sumatra, Mentawai Is., Pulau Sipora (same colony as holotype), 28.VII.1985, Sk & S. Yamane leg. (SKYC); C. Java, Yogyakarta, Campus of Gajah Mada Universty (100 m alt.), 29.XII.2002, Sk. Yamane leg., JV02/03-SKY-23 (SKYC, THNHM); W. Java, Cibinong, disturbed area, 26.XI.2009, Kei. Nakamura leg., CI09-KEI-001 (SKYC, THNHM).

Distribution. Sumatra and Java (new record) (Fig. 7).

Bionomics. This species is very probably sympatric with *Aenictus* sp.56 of WJT in at least Java. The type series and non-type material examined were collected from both primary and disturbed lowland rainforests.

Remarks. *Aenictus minutulus* is very similar in general appearance to *A. changmaianus*, and *A. minimus*. See under *A. changmaianus* for details.

Aenictus peguensis Emery, 1895

(Figs 5A–F, 7)

Aenictus peguensis Emery, 1895: 452.
Aenictus peguensis: Wilson, 1964: 471, figs 34, 35; Bolton, 1995: 60.

Types. Eighteen syntype workers from Palon, at Pegu, Burma, L. Fea leg., 8.IX.1887 (MCSN, examined). One worker among them is selected as lectotype.

Measurements. Lectotype: TL 3.25 mm; HL 0.73 mm; HW 0.60 mm; SL 0.48 mm; ML 1.00 mm; PL 0.23 mm; CI 83; SI 79.

Paralectotypes (n = 5): TL 2.95–3.15 mm; HL 0.60–0.70 mm; HW 0.52–0.58 mm; SL 0.40–0.45 mm; ML 0.88–0.95 mm; PL 0.20–0.23 mm; CI 82–96; SI 74–79.

Description of worker (lectotype and paralectotypes). Head in full-face view slightly longer than broad, with convex sides and feebly convex posterior margin; occipital margin bearing a carina. Antennal scape reaching mid-length of head; antennal segments II–X each longer than broad; II and III slenderer than IV–VI; terminal segment almost as long as VII+VIII+IX and 2.4 times as long as broad. Frontal carina short, posteriorly fused to form a single carina, slightly extending beyond the level of posterior margin of torulus. Masticatory margin of mandible with a large apical tooth followed by a medium–sized subapical tooth, 5–6 denticles, and a medium-sized basal tooth; basal margin with 4–5 small denticles. Promesonotum in profile strongly convex dorsally and sloping gradually to metanotal groove; metapleural gland bulla relatively small and transparent; distance between propodeal spiracle and metapleural gland bulla clearly longer than spiracular diameter (Fig. 5E). Propodeum in profile with convex dorsal outline; propodeal junction right-angled; declivity of propodeum seen from back convergent above. Petiole excluding subpetiolar process shorter than high, with its dorsal outline convex; subpetiolar process rather developed, with a sharply pointed lamellate appendage directed downward. Postpetiole clearly shorter than petiole, its dorsal outline convex.

Head including mandible and antennal scape smooth and shiny; basal portion of scape finely sculptured. Entire pronotum smooth and shiny except for its anteriormost portion punctate; mesothorax, petiole, and postpetiole entirely punctate but metapleuron at least partly impunctate. Legs entirely smooth and shiny.

Head and mesosoma dorsally with relatively sparse standing hairs mixed with sparse short hairs over the surface; longest pronotal hair 0.18–0.23 mm long. Head, pronotum and gaster yelwish-brown; methothrax, propodeum, waist darker and often slightly reddish.

Non-type material examined. **VIETNAM:** S. Vietnam, Dong Nai, S. Cat Tien N.P. (ca. 160 m), 21.X.2004, K. Eguchi leg., Eg04-VN-762 (SKYC).

Distribution. Vietnam and Myanmar (Fig. 7).

Bionomics. No biological information is available for *A. peguensis*. However, judging from the type locality and the locality of non-type material examined this species inhabits lowlands.

Remarks. *Aenictus peguensis* is most similar in general appearance to *A. subterraneus* but is distinguished from the latter as follows: distinctly larger than the latter (TL 2.95–3.25 mm, HW 0.52–0.60 mm in *A. peguensis*; TL 2.10–2.15 mm, HW 0.48–0.50 mm in the latter); propodeal junction angulated, right-angled (roundly angulated in the latter); with head in full-face view posterior margin convex (feebly concave in the latter).

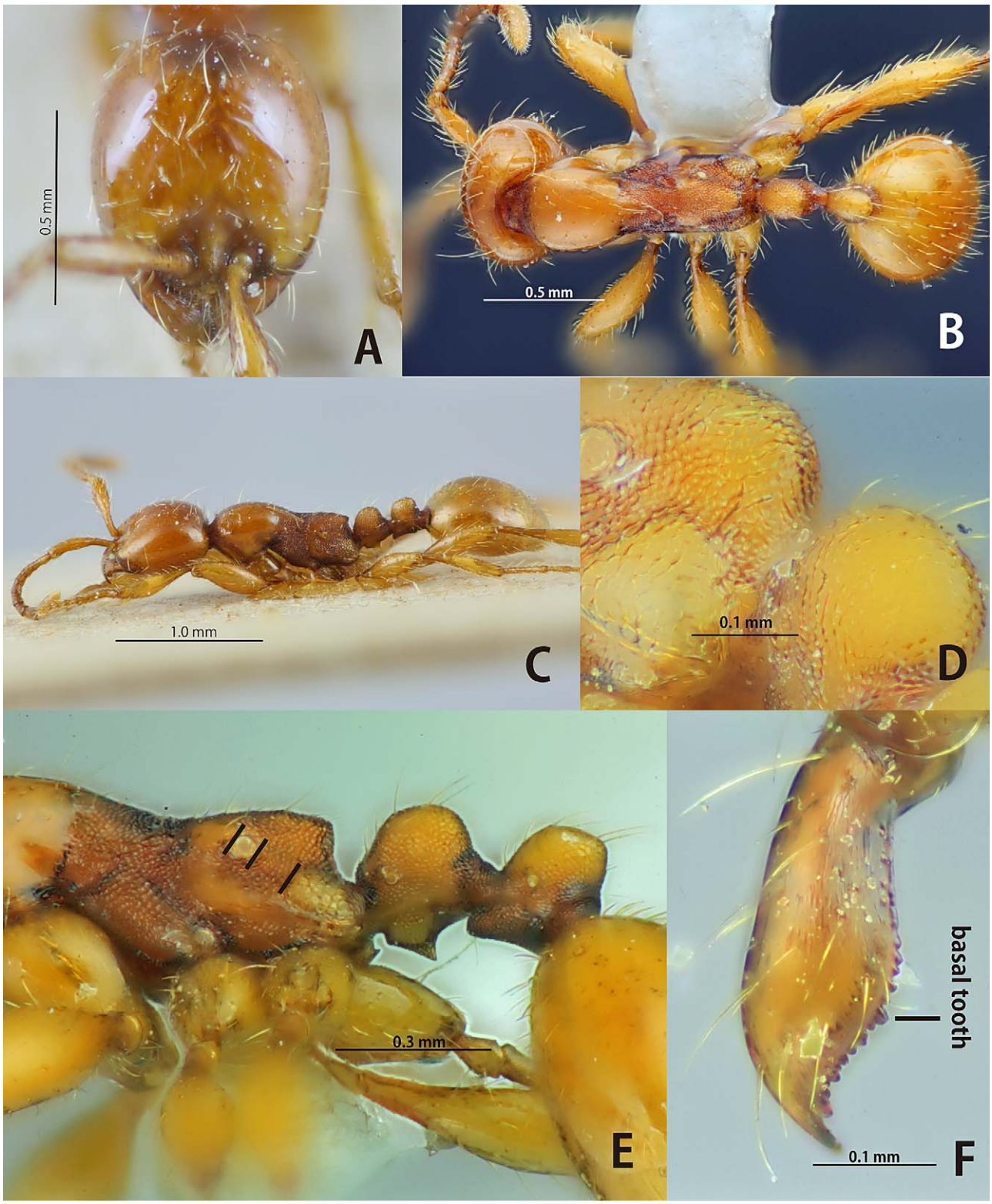

FIGURE 5. *Aenictus peguensis* (A, C, lectotype; B, D, E, non-type from S. Vietnam). A, Head in full-face view; B, body in dorsal view; C, body in profile; D, declivity of propodeum, obliquely posterior view; E, propodeal junction, petiole and post-petiole in profile; F, mandible.

***Aenictus subterraneus* sp. nov.**
(Figs 6A–E, 7)

Types. Holotype worker from Malaysia, Borneo, Sabah, Maliau Basin, 8.V.2001, Y. Hashimoto leg. (UMS). Five paratype workers, same data as holotype (MNHA, SKYC, THNHM).

Measurements. Holotype: TL 2.10 mm; HL 0.55 mm; HW 0.48 mm; SL 0.38 mm; ML 0.78 mm; PL 0.18–0 mm; CI 86; SI 79.

Paratypes (n = 2): TL 2.10–2.15 mm; HL 0.55–0.58 mm; HW 0.48–0.50 mm; SL 0.38 mm; ML 0.78–0.80 mm; PL 0.18–0.19 mm; CI 86–87; SI 75–79.

Description of worker (holotype and paratypes). Head in full-face view clearly longer than broad, with sides convex and posterior margin almost straight or feebly concave; occipital margin bearing a carina. Antennal scape reaching midlength of head; antennal segments II–X each longer than broad; II almost as long as each of III–VI; terminal segment clearly longer than broad and almost as long as VII+VIII+IX. Frontal carina short, slightly extending beyond the level of posterior margin of torulus. Masticatory margin of mandible with a large apical tooth followed by a medium-sized subapical tooth, 7–8 denticles, and a medium-sized basal tooth; basal margin with 4–5 denticles. Promesonotum in profile convex dorsally and sloping gradually to metanotal groove; metanotal groove distinct; metapleural gland bulla relatively small; distance between propodeal spiracle and metapleural gland bulla clearly longer than spiracular diameter (Fig. 6D). Propodeum in profile lower than promesonotum with weakly convex dorsal outline; propodeal junction obtusely angulate; declivity of propodeum shallowly concave, with lateral carinae, but not demarcated basally by a transverse carina. Petiole shorter than high, with petiole in profile its dorsal outline convex; subpetiolar process rather developed, with a sharply pointed lamellate appendage directed downward. Postpetiole clearly shorter than petiole, its dorsal outline slightly elevated posteriorly.

Head including mandible and antennal scape smooth and shiny; basal portion of the scape finely sculptured. Entire pronotum smooth and shiny except for its anteriormost portion punctate; mesothorax, metapleuron, and propodium entirely microreticulate; petiole and postpetiole entirely punctate except dorsal faces smooth and shiny. Legs entirely smooth and shiny.

Head and mesosoma dorsally with relatively sparse standing hairs mixed with sparse short hairs over the surface; longest pronotal hair 0.15–0.18 mm long. Body yellowish-brown, mandible darker than elsewhere; typhlatta spot absent.

Etymology. The specific name refers to the behaviour of this species that was collected from soil.

Distribution. Borneo (Sabah) (Fig. 7).

Bionomics. So far this species is known only from the type locality in a lowland primary forest.

Remarks. *Aenictus subterraneus* is most similar in general appearance to *A. peguensis*. See under *A. peguensis* for details.

***Aenictus* sp. 56 of WJT**
(Figs 2A–F, 7)

Measurements. workers (n = 10): TL 1.80–2.10 mm; HL 0.45–0.53 mm; HW 0.38–0.44 mm; SL 0.25–0.33 mm; ML 0.60–0.71 mm; PL 0.15–0.18 mm; CI 83; SI 67–74.

Description of worker. Head in full-face view clearly longer than broad, with convex sides and weakly concave posterior margin; occipital margin bearing a carina. Antennal scape reaching midlength of head; antennal segments II–X each slightly longer than broad; II slenderer than III–VI; terminal segment 2.5 times as long as broad and slightly longer than VII+VIII+IX. Frontal carina very short, posteriorly fused to form a single carina, not extending beyond the level of posterior margin of torulus. Masticatory margin of mandible with a large apical tooth followed by a medium-sized subapical tooth, 3–4 denticles, and a medium-sized basal tooth; basal margin with 5–6 small denticles. Promesonotum in profile convex dorsally and sloping gradually to metanotal groove; metanotal groove indistinct; metapleural gland bulla relatively small; distance between propodeal spiracle and metapleural gland bulla clearly longer than spiracular diameter (Fig. 2E). Propodeum in profile lower than promesonotum with straight dorsal outline; propodeal junction right-angled; declivity of propodeum shallowly concave, encircled with a thin rim. Petiole slightly longer than high, with its dorsal outline convex; subpetiolar process rather developed,

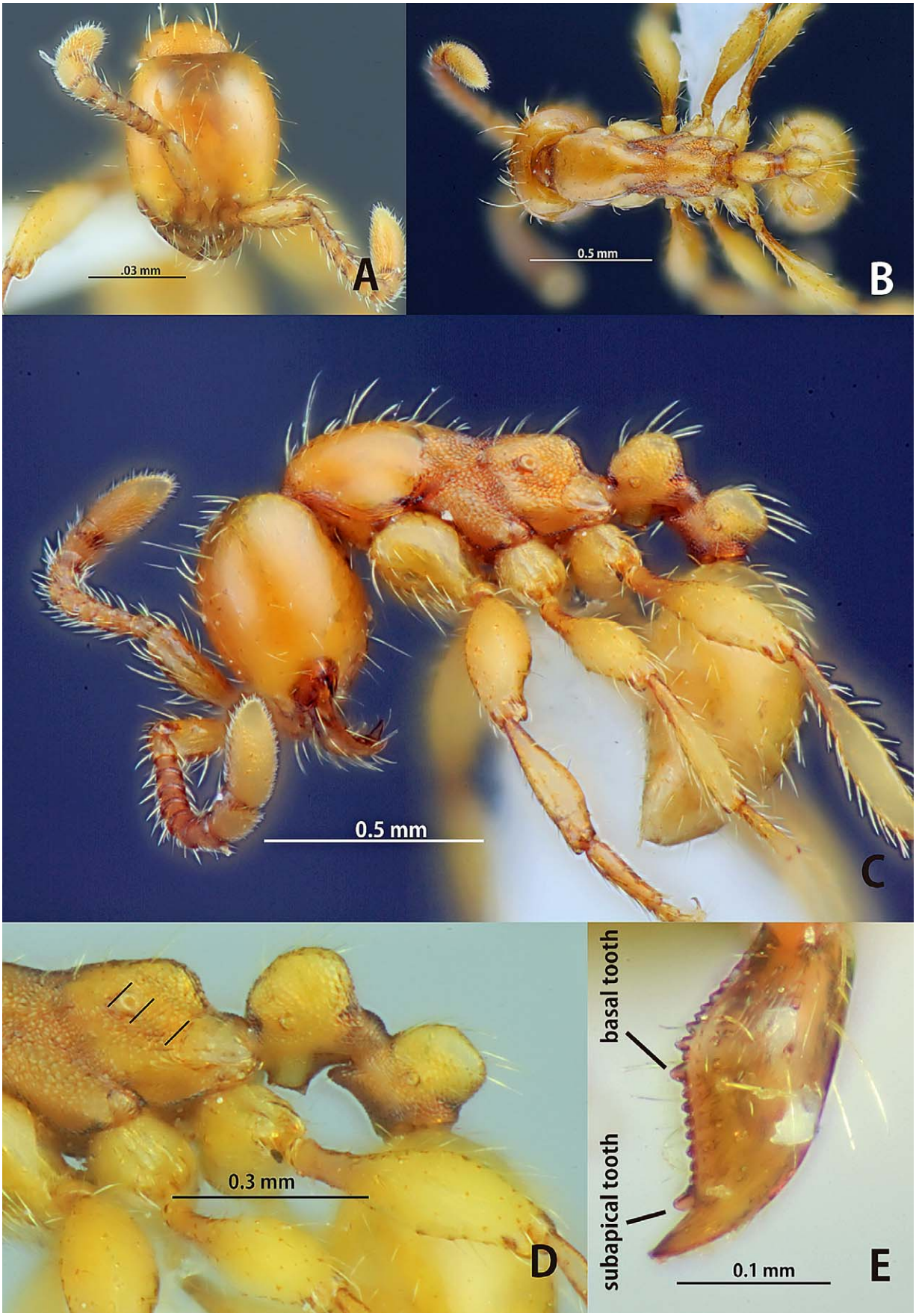

FIGURE 6. *Aenictus subterraneus* **sp. nov.** (holotype). A, Head in full-face view; B, body in dorsal view; C, body in profile; D, propodeal junction, petiole and postpetiole in profile; E, mandible.

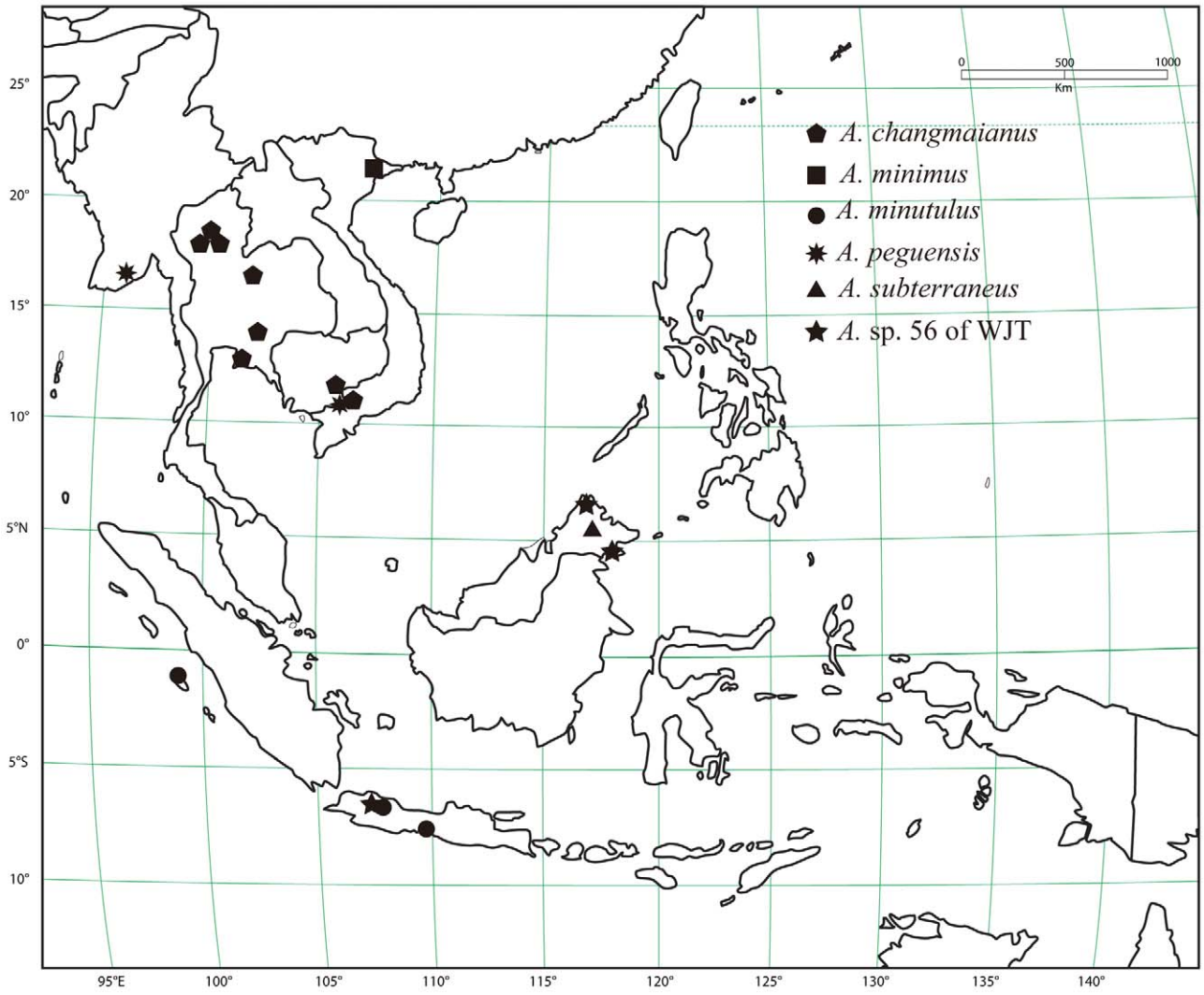

FIGURE 7. Distribution of the *Aenictus minutulus* group.

with sharply pointed lamellate appendage directed downward. Postpetiole smaller than petiole, its dorsal outline convex.

Head including mandible and antennal scape smooth and shiny; basal portion of scape finely micropunctate. Entire pronotum smooth and shiny except for its anteriormost portion punctate; dorsum of propodeum partly smooth and shiny; mesothorax, metapleuron, and lateral face of propodeum microreticulate; area in front of propodeal junction punctate; petiole reticulate except dorsal face smooth and shiny; postpetiole entirely smooth and shiny. Legs entirely smooth and shiny.

Head and mesosoma dorsally with relatively dense standing hairs mixed with sparse short hairs over the surface; longest pronotal hair 0.11–0.12 mm long. Body yellowish-brown; gaster and legs yellow. Typhlatta spot absent.

Material examined. MALAYSIA: E. Malaysia, Borneo, Sabah, Tawau Hills N.P., 7.VII.1996, K. Eguchi leg., Eg96-BOR-73 (SKYC, THNHM); E. Malaysia, Borneo, Sabah, Yoshina Ranau, logging area, 30.VI.1998, K. Eguchi leg., Eg98-BOR-853 (SKYC, THNHM). **INDONESIA:** W. Java, Bogor, Kebun Raya (Bogor Botanical Garden), 11–31.I.1992, F. Ito leg., FI92-337 (SKYC, THNHM).

Distribution. Borneo (Sabah) and Java (Fig. 7).

Bionomics. One colony was collected from Bogor Botanical Garden (lowland). On Borneo one colony was found in a lowland rainforest and another from a logging area. Thus, this species is probably inhabits lowland primary and disturbed forests.

Remarks. *Aenictus* sp.56 of WJT is easily distinguished from the other members of the group as follows:

propodeum in profile with straight dorsal outline, lower than promesonotum; propodeal junction right-angled; declivity of propodeum shallowly concave, encircled with a thin rim.

Discussion

Twenty-five male-based names are listed from Southeast Asia, 7 of which were described from Java (Wilson, 1964; Bolton, 1995). Among the Southeast Asian species, only the Javan species *Aenictus javanus* Emery, 1896 is known from both the worker and male (Wilson, 1964; Jaitrong & Yamane, 2012). So far we have no information about the male-worker combination for any species we are treating in this paper. Since more male-based species (7) have been described from Java than worker-based species (4), the "unnamed" species found from Java this time most probably corresponds to one of the male-based species. It is here treated with a species code (*Aenictus* sp. 56 of WJT) to avoid future confusion. On the other hand, from Borneo only one male-based species (*A. punctiventris* Emery, 1901) is known. We gave a new name (*A. subterraneus*) to our species from Borneo because risk of synonymy is much lower than in Javan cases.

The single species of the *Aenictus inflatus* species group, *A. inflatus* Yamane et Hashimoto, 1999, has discrete polymorphism in the worker caste, with major workers (with inflated propodeum and long antennal scape), minor workers (with normal propodeum and very short antennal scape) and intermediate workers (Yamane & Hashimoto 1999; Jaitrong & Yamane 2011). In contrast, the *Aenictus minutulus* group shows continuous size variation or at most weak dimorphism among workers. Four species (*A. changmaianus*, *A. minimus A. minutulus* and *Aenictus* sp.56 of WJT) are known from worker series large enough to evaluate size variation. They can be roughly sorted into two size classes, but they are not sharply differentiated. There is a general tendency for smaller specimens to have weaker punctation, more elongate head and shorter antennal scape than larger specimens. This size variation is the same as that observed in the other species groups comprising small species such as the *Aenictus javanus* and *A. ceylonicus* groups.

Three species of the species group (*A. changmaianus*, *A. minimus* and *A. peguensis*) are distributed in continental Southeast Asia. One of them, *A. minimus* has been known only from the type locality in northern Vietnam, while *A. changmaianus* is wide-ranging and sympatric with *A. peguensis* in at least southern Vietnam (Fig. 7). The distribution pattern of these three species, and also *A. dentatus* Forel, 1911 and *A. artipus* Wilson, 1964 (Jaitrong *et al.* 2010; Jaitrong *et al.* 2012), is rather similar to those of many bird and snake species inhabiting this region (Jaitrong *et al*. 2012 after Woodruff 2003). On the other hand, the other three species of this group (*A. minutulus*, *A. subterraneus* and *Aenictus* sp.56 of WJT) are confined to Sundaland (Borneo, Sumatra and Java). *Aenictus* sp.56 of WJT is probably sympatric with *A. subterraneus* in at least Sabah and with *A. minutulus* in western Java (Fig.7). These three species are sympatric with the *Aenictus silvestrii* and *Aenictus hottai* groups (Jaitrong & Nur-Zati 2010; Jaitrong & Yamane 2010; Wiwatwitaya & Jaitrong 2011) (but *A. jarujini* Jaitrong et Yamane, 2010 of the *A. silvestrii* group is known only from northern Thailand).

According to the collecting sites, *A. changmaianus*, *A. minimus* and *A. peguensis* are very probably restricted to the seasonal forest (hill evergreen forest, dry evergreen forest, mixed deciduous forest and/or dipterocarp forest) located northward from the Isthmus of Kra. *A. changmaianus* is known from lowland to highland and inhabits both primary and disturbed forests. On the other hand, *A. minutulus*, *A. subterraneus* and *Aenictus* sp.56 of WJT are distinctly Sundaland species inhabiting the perhumid evergreen rainforest.

The type series of *A. subterraneus*, four colonies of *A. changmaianus* (Thailand, WJT00-WPD01, WJT00-WPD02, WJT04-E51 and WJT05-NE50) and a colony of *A. minutulus* (Sarawak, SR11-SKY-12) were collected from soil samples. A colony of *A. minutulus* (Java, JV02/03-SKY-23) was collected from soil under a stone and a colony of *A. changmaianus* (Thailand, Eg01-TH-151B) was collected by soil sifting. Thus, the members of the *A. minutulus* group are very probably subterranean, and only occasionally appear above ground.

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