

# *AENICTUS SELETARIUS*, A NEW SPECIES OF HYPOGAEIC ARMY ANT FROM SINGAPORE, WITH AN UPDATED KEY TO THE *AENICTUS MINUTULUS* SPECIES GROUP (HYMENOPTERA: FORMICIDAE: DORYLINAЕ) FROM SOUTHEAST ASIA

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**Abstract.**— A new species of the army ant genus *Aenictus* (Hymenoptera: Formicidae: Dorylinae) is described. *Aenictus seletarius* sp. nov., belonging to the *Aenictus minutulus* species group, was discovered from a single subterranean pitfall trap in Singapore. Like *A. subterraneus* and *A. changmaianus* in this species group, *A. seletarius* displays substantial variation in body size within the worker caste. An updated key to the *Aenictus minutulus* species group from Southeast Asia is presented.



**Key words.**— *Aenictus*, army ant, body size variation, Malay Peninsula, Singapore

## INTRODUCTION

Among all 18 genera of the monophyletic army ant subfamily Dorylinae (Brady *et al.* 2014), the genus *Aenictus* Shuckard, 1840 is the most diverse, comprising a total of 184 valid species including the present addition and 30 valid subspecies (Bolton 2015). Most *Aenictus* species are specialized predators of other ant genera (Gotwald 1995, Shattuck 2008, Jaitrong and Yamane 2011, Jaitrong *et al.* 2012, Hashimoto and Yamane 2014), although the remains of spiders, flies and woodlice have been recorded in the nests of *Aenictus gracilis* Emery, 1893 (Hirosawa *et al.* 2000). Like other army ants, members of *Aenictus* are obligate collective foragers and utilise strategies of mass raiding to attack and overpower their prey. The genus *Aenictus* is widely distributed throughout the Old World tropics and subtropics, from Africa to the Middle East, India and Pakistan, South China, Southeast Asia, New

Guinea and Australia (Fig. 1; also see [www.antmaps.org](http://www.antmaps.org)). Globally, Southeast Asia supports the greatest diversity of *Aenictus* species, with a total of 118 species ([antmaps.org](http://antmaps.org)) comprising all twelve species groups that have been established for the genus (Jaitrong and Yamane 2011).

The *Aenictus minutulus* species group includes relatively small-sized species, measuring 1.80–3.20 mm in total body length. Based on the latest revision by Jaitrong and Hashimoto (2012), the group is restricted to Southeast Asia where it is represented by six species: *Aenictus changmaianus* Terayama et Kubota, 1993 (Vietnam, Thailand and Cambodia), *Aenictus minimus* Jaitrong et Hashimoto, 2012 (Vietnam), *Aenictus minutulus* Terayama et Yamane, 1989 (Thailand, Sumatra and Java), *Aenictus peguensis* Emery, 1895 (Vietnam and Myanmar), *Aenictus subterraneus* Jaitrong et Hashimoto, 2012 (Borneo) and an undescribed morphospecies *Aenictus* sp. 56 of WJT (Borneo and Java). Here we describe *Aenictus*

*seletarius* sp. nov. from Singapore, a new addition to the *A. minutulus* species group that displays substantial variation in the body size of its worker caste, from four individuals collected in a single subterranean pit-fall trap. We describe *A. seletarius* from the worker caste and provide an updated key to Southeast Asian species of the *A. minutulus* group.

## MATERIAL AND METHODS

Abbreviations of the type depositories and other material are as follows:

LKCNHM – Lee Kong Chian Natural History Museum, Singapore.

SBSHKU – Insect Biodiversity and Biogeography Laboratory, School of Biological Sciences, The University of Hong Kong, Hong Kong SAR.

Photographs of specimens were obtained with an incorporated digital camera, Leica DFC450, mounted on a Leica M205C dissecting microscope through the Leica Application Suite V4 software. A total of 14 to 45 images were taken and stacked together. Measurements of specimens were taken in mm (accurate to 0.001 mm and rounded to the nearest 20.01 mm for presentation) with the *Measure Tools* function of the Leica Application Suite V4 software on imaged specimens after proper placement for each body part measured. Measurements and morphological terminology follow: Jaitrong and Hashimoto (2012) for HW, HL and SL; Fischer *et al.* (2014) for PNH and PTH; Baroni Urbani (1977) for PI and PPI.

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

HW – Head Width. Maximum width of head in full-face view;

HL – Head Length. 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;

MaL – Mandible Length. Maximum length of mandible from the anterolateral margin of clypeus at outer side of mandibular insertion to mandibular apex;

SL – Scape Length. Maximum measurable length of scape, from the proximal point of scape shaft to the distal end of scape, excluding the basal of constriction and condylar bulb;

TL – Total Length. Maximum length of specimen measured from the tip of the mandibles to the tip of the abdominal segment VII, not including sting. Due to the position of the specimen, total length was measured as the sum of head length + thorax, petiole and postpetiole length + gaster length;

WL – Weber's Length of Mesosoma. Maximum diagonal distance in lateral view, from base of anterior slope of pronotum to metapleural lobe;

PNH – Pronotum Height. Maximum height of pronotum, measured in profile from the posterior base of the lateral sides of pronotum, where procoxa is attached, to the highest point of the pronotum;

PNW – Pronotal Width. Maximum width of pronotum measured in dorsal view;

PTL – Petiole Length. Maximum diagonal length of petiole, measured in lateral view, from most anteroventral point of the peduncle, at or below the propodeal lobe, to most posterodorsal point of tergite;

PTH – Petiole Height. Maximum height of petiole, measured in lateral view, from the highest (median) point of the node, orthogonally to the ventral outline of the node;

PTW – Petiole Width. Maximum width of the petiole in dorsal view;

PPL – Postpetiole Length. Maximum length of postpetiole, measured in lateral view;

PPH – Postpetiole Height. Maximum height of postpetiole, measured in lateral view from the highest point of the node;

PPW – Postpetiole Width. Maximum width of the postpetiole in dorsal view;

CI – Cephalic Index. Calculated as:  $HW / HL \times 100$ .

SI – Scape Index. Calculated as:  $SL / HW \times 100$ ;

MaI – Mandibular Index. Calculated as:  $MaL / HW \times 100$ ;

PI – Petiolar Index. Calculated as:  $PTW / PTL \times 100$ ;

PPI – Postpetiolar Index. Calculated as:  $PPW / PPL \times 100$ .

## SYSTEMATICS

### *Aenictus minutulus* species group

**Diagnosis.** The *A. minutulus* species group was established by Jaitrong and Hashimoto (2012) from their redefinition and renaming of the *Aenictus piercei* species group (Jaitrong and Yamane 2011). From the *A. piercei* species group, Jaitrong and Hashimoto removed two species (*Aenictus piercei* Wheeler et Chapman, 1930; *Aenictus lifuiae* Terayama, 1984) and added two new species and one undescribed morphospecies (see synoptic species list of *A. minutulus* species group below). Jaitrong and Hashimoto (2012) define the *A. minutulus* species group 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; parafacial ridge absent. With mesosoma in profile promesonotum convex dorsally and sloping gradually to the propodeum; metapleural groove present or absent (mesonotum and propodeum fused); propodeal junction angular. Subpetiolar process well developed, triangular or subrectangular. Head and first gastral segment entirely smooth and shiny. Body yellowish brown to reddish brown; typhlata spot absent. Size variation occurs among individuals from single colonies.”

### Synoptic species list of *A. minutulus* species group from Southeast Asia

*Aenictus changmaianus* Terayama et Kubota, 1993 (Vietnam, Thailand, Cambodia);

*Aenictus minimus* Jaitrong et Hashimoto, 2012 (North Vietnam);

*Aenictus minutulus* Terayama et Yamane, 1989 (Thailand, Sumatra, Java);

*Aenictus peguensis* Emery, 1895 (Vietnam, Myanmar);

*Aenictus seletarius* sp. nov. (Singapore);

*Aenictus* sp. 56 of WJT Jaitrong et Hashimoto, 2012 (Borneo, Java);

*Aenictus subterraneus* Jaitrong et Hashimoto, 2012 (Borneo).

### Updated key to *A. minutulus* species group from Southeast Asia

The key to *A. minutulus* group species from Southeast Asia (Jaitrong and Hashimoto 2012) is updated below with the inclusion of *A. seletarius* in key couplet 5 and transfer of the species *A. changmaianus* and *A. minutulus* to an additional key couplet.

1. Promesonotum in profile with clearly convex dorsal outline; propodeum dorsally distinctly lower than promesonotum ..... 2
- . Mesosoma dorsally almost flat or feebly convex ... 4
2. Declivity of propodeum shallowly concave, encircled with a distinct rim (Borneo and Java) ..... *A. sp. 56 of WJT* Jaitrong et Hashimoto
- . Declivity of propodeum with lateral carinae, but not demarcated basally by a transverse carina ..... 3
3. In full-face view posterior margin of head convex; propodeal junction angulated, right-angled; larger species (TL 2.95–3.15 mm; HW 0.52–0.58 mm) (Vietnam and Myanmar) ..... *A. peguensis* Emery

- . In full-face view posterior margin of head almost straight or feebly concave; propodeal junction roundly angulated; smaller species (TL 2.10–2.15 mm; HW 0.48–0.50 mm) (Borneo) ..... *A. subterraneus* Jaitrong et Hashimoto
4. Basal margin of mandible with 1–2 small denticles next to large basal tooth and followed by a larger denticle (North Vietnam) ..... *A. minimus* Jaitrong et Hashimoto
- . Basal margin of mandible with 3–5 denticles that gradually reduce in size toward base of mandible ..... 5
5. Head square-shaped and almost as wide as long (CI 91–96); antennal scape relatively short (SI 61–64); polymorphic worker caste with largest individuals exceeding 3.10 mm in TL (Singapore) ..... *A. seletarius* sp. n.
- . Head longer than wide (CI < 90); antennal scape relatively long (SI 67–72); relatively smaller species (TL < 2.60 mm) ..... 6
6. Metapleural gland bulla relatively large; distance between propodeal spiracle and metapleural gland bulla shorter than or almost as long as spiracular diameter (Thailand, Vietnam and Cambodia) ..... *A. changmaianus* Terayama et Kubota
- . Metapleural gland bulla relatively small; distance between propodeal spiracle and metapleural gland bulla clearly longer than spiracular diameter (Thailand, Java and Sumatra) ..... *A. minutulus* Terayama et Yamane

### DESCRIPTION OF NEW SPECIES

*Aenictus seletarius* Wong et Guénard sp. nov.

Figs 2–6

**Types.** Holotype. Worker from SINGAPORE, Seletar Trail, 1°23'N; 103°48'E, ca. 40m, subterranean pitfall trap, 25.vii.2015 (Mark K. L. Wong), label “MW250715-1.1” (ANTWEB1009000); deposited in LKCNHM. Paratypes. Three workers in total, all with the same collection data as holotype; deposited at SBSHKU.

**Diagnosis.** Worker caste with important size variation. Head almost as wide as long, with side margins broadly convex. Masticatory margin of mandibles, medium-sized subapical tooth followed posteriorly by a distinct medium-sized denticle, and both the subapical tooth and the posterior denticle are of similar size. Posterodorsal corner of the propodeum strongly angular and followed by a concave propodeal declivity. Subpetiolar process well-developed and plough-shaped.

Measurements and indices. Holotype: HL 0.57 mm; HW 0.52 mm; MaL 0.33 mm; SL 0.33 mm; WL 0.82 mm; PNW 0.32 mm; PNH 0.29 mm; MW 0.17 mm; PTL 0.24

mm; PTW 0.17 mm; PTH 0.27 mm; TL 2.83 mm (stinger not included); PPL 0.19 mm; PPW 0.16 mm; PPH 0.23 mm; CI 92, SI 64, MaI 65, PI 70, PPI 81. Paratypes (n=3 measured): HL 0.46–0.63 mm; HW 0.42–0.60 mm; MaL 0.27–0.36 mm; SL 0.26–0.37 mm; WL 0.67–0.91 mm; PNW 0.26–0.36 mm; PNH 0.22–0.34 mm; PTL 0.19–0.27 mm; PTW 0.14–0.19 mm; PTH 0.23–0.33 mm; TL 2.31–3.18 mm (sting not included); PPL 0.17–0.23 mm; PPW 0.14–0.18 mm; PPH 0.20–0.28 mm; CI 91–96, SI 61–64, MaI 59–64, PI 69–74, PPI 78–83.

**Worker description. Head.** Head in full-face view almost as wide as long (CI 91–96), side margins broadly convex, posterior margin slightly convex to almost straight and approximately  $\frac{3}{4}$  of HW, posterior corners broadly rounded. Antennal scape curved and enlarged in their posterior half, relative size to head moderate (SI 61–64), slightly extending to over the mid-point of head length; antennal segments longer than broad; length of segments II–IX continuously increasing; apical segment X longer than VIII and IX combined; last two segments forming indistinct club. Frontal carina distinct, surpassing posterior margin of antennal torulus. Clypeus short, its anterior margin convex and without denticles. Basal margin of mandible with denticles that gradually reduce in size toward base of mandible. Masticatory margin of mandible with large acute apical tooth, followed posteriorly by a medium-sized subapical tooth, one medium-sized denticle and one small denticle, a medium-sized basal tooth; basal margin with 3–4 small denticles.

**Mesosoma.** In profile, promesonotum convex, sloping gradually to the metanotal groove; mesopleuron relatively short, demarcated from metapleuron by distinct groove. In profile, dorsal outline of propodeum flat to weakly convex nearing the posterior

corner. Posterior part of propodeum forming the propodeal declivity nearly at right angle with propodeal dorsum, and separated from the latter by an angular edge; overhanging declivity of propodeum is strongly concave and encircled with thin but distinct rim. Metapleural gland bulla well-developed, its maximum diameter about 1.3 times as long as distance between propodeal spiracle and most proximate part of metapleural gland bulla.

**Metasoma.** In profile, petiole excluding subpetiolar process slightly higher than long and with triangular shape; petiole node with steep anterior face and broadly convex dorsal outline; subpetiolar process well-developed and of an irregular quadrilateral shape (plough-shaped) with roughly angular apex posteriorly oriented and a slightly concave posterior lateral margin. Size of subpetiolar process approximately  $\frac{1}{5}$  of petiole height and  $\frac{2}{5}$  of petiole length, its ventral outline broadly convex and its ventralmost part with thin almost transparent lamella. In profile postpetiole has a square shape with rounded corners; dorsal outline of postpetiole node flat to weakly convex; postpetiolar process developed and pointing anteriorly with rounded to weakly angular apex. First gastral tergite and sternite long, extending over half the total length of the gaster.

**Sculpture.** Head entirely smooth and shiny. Mandibles superficially striate at the base. Basal portion of antennal scape (approximately  $\frac{1}{3}$  of SL) reticulate transitioning to smooth and shiny on its last  $\frac{2}{3}$  portion. Mesosoma finely reticulate with exception of pronotum and parts of metapleuron; pronotum smooth and shiny on dorsum and sides but finely reticulate towards the posterior edge; metapleuron smooth and shiny on anterior median portion but otherwise finely

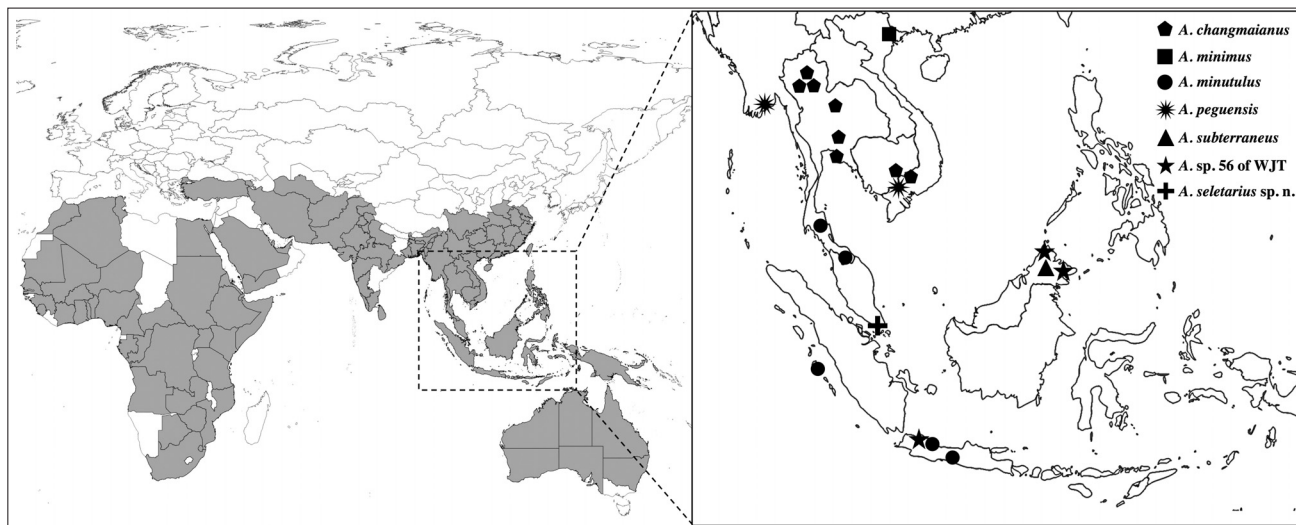
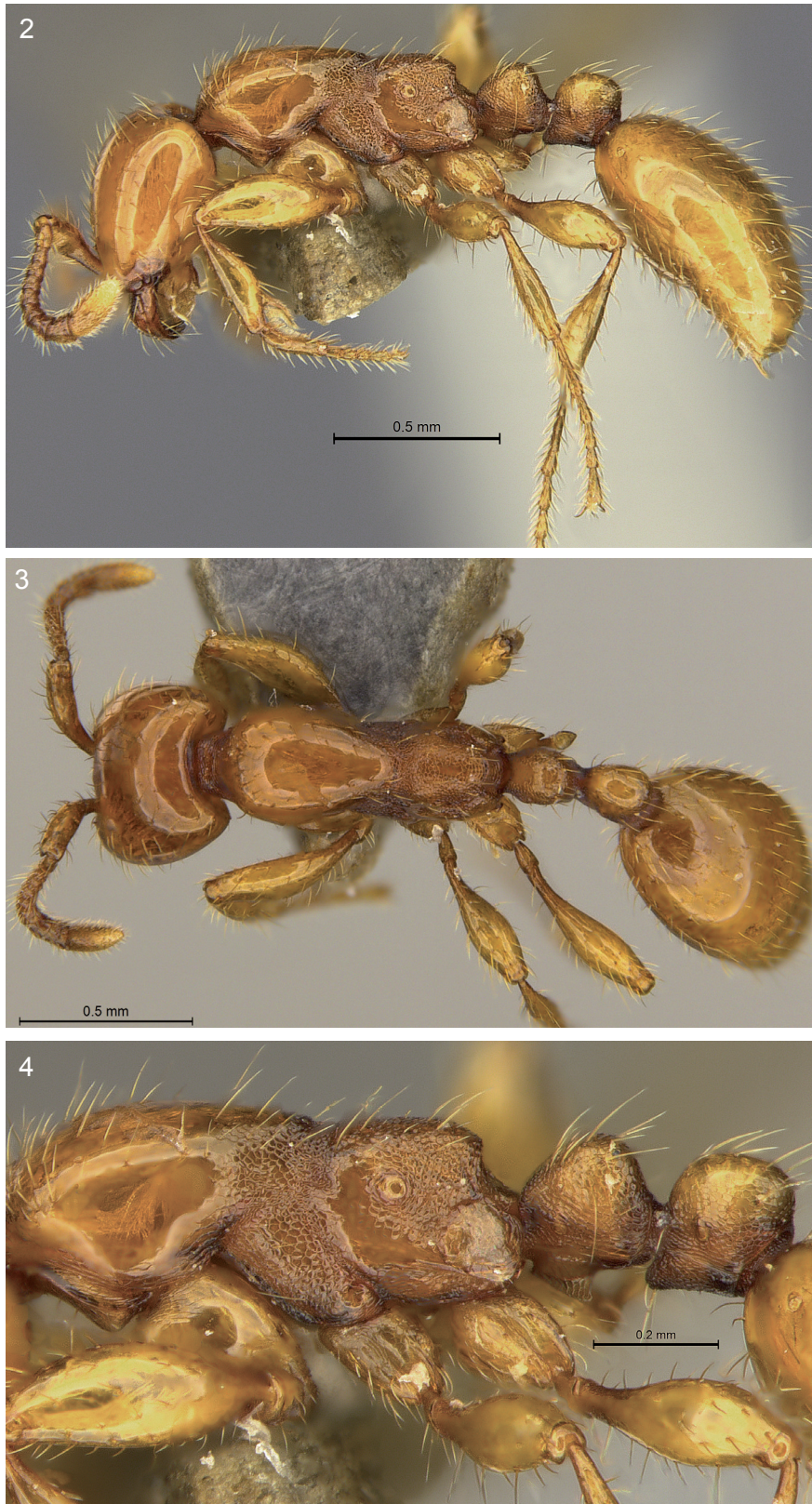


Figure 1. Left side map: Known global distribution of *Aenictus* species (modified from antmaps.org). Right side box: Distribution of *A. minutulus* group species in Southeast Asia with the inclusion of *A. seletarius* from Singapore (modified after Jaitrong and Hashimoto 2012, Jaitrong 2015).





Figures 2–4. *Aenictus seletarius* (holotype, ANTWEB1009000, LKCNHM) from Singapore. (2) Profile view; (3) dorsal view; (4) profile view focusing on the propodeum, petiole and subpetiole.



reticulate. Petiole including subpetiolar process finely reticulate with the exception of a smooth and shiny spot anterodorsally. Postpetiole finely reticulate, with flat surface on dorsum smooth and shiny. Gaster entirely smooth and shiny. Legs entirely smooth and shiny.

**Pubescence.** Head and body, except sides of mesosoma, with abundant suberect standing hairs with lengths of 0.7–0.8 mm on head dorsum and 0.1–0.13 mm on dorsum of meso- and metasoma. Shorter decumbent pubescence also present in between longer hairs. Antennal scapes and legs with abundant, decumbent pilosity.

**Colouration.** Dark amber colouration on head, most of antennae, mesosoma, petiole and most of postpetiole, with darkest brown colouration on the reticulated propodeum. Tip of antennal segment X, entire legs, entire gaster and dorsum of postpetiole node with lighter yellow colouration.

**Castes.** Worker caste displays variation in body size. Apart from size variation, values of the different measurement indices are generally consistent among the workers measured, thus indicating an absence of allometric growth. Other morphological features such as sculpture, pubescence and colouration remain constant among the specimens examined. Male and female are unknown.

**Etymology.** The species epithet is derived from the collection locality, Seletar forest, which contains some of Singapore's last primary and old secondary habitats. The species epithet is a noun, and thus invariant.

**Distribution.** Southeast Asia. Only known from Singapore.

**Ecology.** *Aenictus seletarius* was collected from a tropical lowland primary and old growth secondary rainforest in Singapore proximally located (<100 m) to a freshwater catchment. As individuals were collected with subterranean pitfall traps set 15 cm beneath the soil surface, *A. seletarius* likely exhibits a hypogaeic lifestyle similar to many other *Aenictus* species. Additionally, we found over thirty specimens of a small (TL ca. 4 mm), eyeless unidentified *Pseudolasius*



Figures 5–6. *Aenictus seletarius* (holotype, ANTWEB1009000, LKCNHM) from Singapore. (5) Full-face view; (6) head view focusing on mandibles.

species in the same traps in which the *A. seletarius* individuals were collected.

**Remarks.** The new species *A. seletarius* displays substantial variation in body size among workers (TL 2.31–3.18 mm). This was also observed by Jaitrong and Hashimoto (2012) in *A. minutulus* (TL 1.7–2.4 mm) and *A. changmaianus* (TL 1.95–2.6 mm). Among the *A. minutulus* species group, *A. seletarius* is morphologically most similar to *A. minutulus*. Excluding the latter, individual workers of *A. seletarius* can be distinguished from other species by the dentition on the masticatory margin of their mandibles, where the medium-sized subapical tooth is followed posteriorly by a distinct medium-sized denticle, and both the

subapical tooth and the posterior denticle are of similar size (Fig. 6). This is contrary to the pattern of mandibular dentition of *A. changmaianus*, *A. minimus*, *A. sp. 56* of WJT and *A. subterraneus*, where a medium-sized subapical tooth is followed posteriorly by a distinctly smaller denticle, as well as *A. peguensis*, where both the subapical tooth and subsequent denticles are small in size. However, important variation in mandibular patterns can be observed in ants as blunting of the denticles with usage what may result in slight variation in dentition patterns (as observed in some paratypes and non-type specimens). Therefore, relying on mandibular dentition alone for species determination is not ideal. In consideration of the above, *A. seletarius* may be further distinguished from the *A. minutulus* group species including the morphologically similar *A. minutulus* by several other notable characters outlined below.

In full face view (Fig. 5), *A. seletarius* displays the most square-shaped head among all *A. minutulus* group species, as its head is almost as wide as it is long, CI 91–96; the side margins of its head are broadly convex and its posterior occipital margin is approximately  $\frac{3}{4}$  the length of its HW. Although *A. peguensis* also possesses a head that is almost as wide as it is long, CI 82–96, the head shape of this species as well as that of *A. minimus* and *A. sp. 56* of WJT are all markedly rounded; the side margins of their heads are strongly convex and the respective lengths of their posterior occipital margins are no more than  $\frac{2}{3}$  the lengths of their HW. In relation to *A. seletarius*, the heads of the remaining *A. minutulus* group species are comparatively longer than wide (*A. changmaianus*, CI 75–89; *A. minutulus*, CI 76–90 *A. subterraneus*, CI 86–87) and their heads appear slightly more elongate than that of *A. seletarius*. The antennal scape of *A. seletarius* is also relatively short in comparison to its head width, SI 61–64, in contrast to most other species in the *A. minutulus* species group (*A. changmaianus*, SI 69–71; *A. minutulus*, SI 67–68; *A. peguensis*, SI 74–79; *A. subterraneus*, SI 75–79; *A. sp. 56* of WJT, SI 67–74), but similar to that of *A. minimus* (SI 63–64).

In profile view (Figs 2 and 4), a strongly angular posterodorsal corner of the propodeum, a concave propodeal declivity, and a flat anterior face of the petiole distinguish *A. seletarius* from *A. changmaianus* and *A. minutulus*, whose individuals have a more rounded posterodorsal corner of the propodeum, a weakly concave propodeal declivity, and a more rounded or broadly convex anterodorsal face of the petiole. In addition to the flat anterior face of the petiole in *A. seletarius*, a less pronounced postpetiolar process also distinguishes this new species from *A. subterraneus*, which has a rounded anterodorsal face and a longer and slightly more acute

postpetiolar process. Another subtle difference between the two species is the helcium, which appears to be more elongate in *A. subterraneus* than in *A. seletarius*.

## DISCUSSION

The discovery of *Aenictus seletarius* at the southernmost tip of the Malay Peninsula expands the known distribution of the *A. minutulus* species group in Southeast Asia (Fig. 1). *Aenictus seletarius* is the only member of the *A. minutulus* group known from Singapore; other species of *Aenictus* recorded from Singapore include *Aenictus laeviceps* Smith, 1857, which belongs to the *Aenictus laeviceps* species group, and an enigmatic species *Aenictus shuckardi* Forel, 1901, known only from the male caste. Based on observations by Jaitrong and Yamane (2011) in various parts of Southeast Asia, *A. laeviceps* individuals are reported to forage predominantly on the ground surface and occasionally on trees for ant prey, which include species of the genera *Anoplolepis*, *Camponotus*, *Euprenolepis* and *Polyrhachis*. In contrast to *A. laeviceps*, our collection of *A. seletarius* individuals from subterranean pitfall traps at a depth of 15 cm underground would suggest that this new species exhibits a hypogaeic lifestyle, which would be consistent with collection data reported for other species in the *A. minutulus* group (Jaitrong and Hashimoto 2012). Curiously, we found over thirty individuals of a small and eyeless unidentified species of *Pseudolasius* together with the *A. seletarius* individuals in a trap that was baited with tuna pieces. As many other *Aenictus* species are specialized predators of other ants (Hirosawa *et al.* 2000, Hashimoto and Yamane 2014), it is possible that the *A. seletarius* individuals we collected were preying on *Pseudolasius* individuals that were probably recruited to the tuna bait. Recently, Hashimoto and Yamane (2014) found interspecific differences in terms of foraging patterns and prey species among four sympatric *Aenictus* species in Borneo. While little data is available on the distributions of *A. laeviceps* and *A. seletarius* in Singapore's forests, it would not be surprising to uncover similar patterns of ecological niche and prey partitioning between these two related species. Additionally, it would be interesting to investigate the potential interactions between *A. seletarius* and another hypogaeic but seemingly more abundant Doryline species, *Dorylus laevigatus* Smith, 1857, which has been commonly observed as being recruited to baited subterranean traps at varying depths (5–25 cm underground) and in very large numbers (>1000 individuals per trap) (M. Wong, personal observation).



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