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Parvimyrma gen. nov. belonging to the *Solenopsis* genus group from Vietnam (Hymenoptera: Formicidae: Myrmicinae: Solenopsidini)

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Abstract

The myrmicine ant genus *Parvimyrma* is newly established for a single new species found from N. Vietnam. The genus is undoubtedly placed in the *Solenopsis* genus group, and it is distinguished from the other genera belonging to the genus group by a combination of the following features: posteromedian portion of clypeus narrowly inserted between frontal lobes; masticatory margin of mandible with 5 distinct teeth; antenna 11-segmented, with a 2-segmented club; eye completely absent; promesonotum in profile almost flat or very weakly convex dorsally; metanotal groove relatively shallowly impressed dorsally; propodeum unarmed; propodeal spiracle small, situated a little behind the midlength of the sides of propodeum; metapleural gland large; petiolar peduncle with a small anteroventral process; postpetiole narrowly attached to the anteriormost end of gaster; sting poorly developed.

Key words: Vietnam, Formicidae, Solenopsidini, *Parvimyrma* **gen. nov.**

Introduction

The myrmicine ant tribe Solenopsidini was established by Forel (1893). In the earlier stage of their taxonomic history the genus *Solenopsis* Westwood and its supposed relatives were put together into Solenopsidini (e.g., Wheeler, 1922), or divided into two tribes, Solenopsidini and Pheidologetini (e.g., Emery, 1922). Ettershank (1966) conducted a genus-level classification of the ants related to *Solenopsis* and *Pheidologeton* Mayr, and proposed four genus groups: the *Pheidologeton* genus group, the *Monomorium* genus group, the *Megalomyrmex* genus group, and the *Solenopsis* genus group. The *Pheidologeton* genus group corresponded almost exactly to the tribe Pheidologetini in the sense of Emery (1922), and the remaining three genus groups were subdivisions of the tribe Solenopsidini in the sense of Emery (1922). Bolton (1987), however, recombined those three into a single unit with the exclusion of the genera *Tranopelta* and *Ochetomyrmex*. In the recent classification of the family Formicidae by Bolton (2003), the following two units were recognized in the tribe Solenopsidini: the *Solenopsis* genus group consisting of *Allomerus*, *Anillomyrma*, *Bondroitia*, *Carebarella*, *Diplomorium*, *Epelysidris*, *Megalomyrmex*, *Monomorium*, *Nothidris*, *Oxyepoecus*, *Phacota* and *Solenopsis*, and the *Carebara* genus group consisting of *Adlerzia*, *Afroxyidris*, *Carebara*, *Machomyrma*, *Mayriella*, *Oligomyrmex*, *Paedalgus*, *Pheidologeton* and *Tranopelta*. *Ochetomyrmex* was included in the tribe Formicoxenini. Fernández (2004) placed *Afroxyidris*, *Oligomyrmex* and *Paedalgus* as junior synonyms of *Carebara*.

In Tay Yen Tu National Park, Bac Giang Province, in the northern part of Vietnam, we collected a tiny ant species from a cheese bait trap buried ca. 10 cm underground. Although the ant species is undoubtedly a member of the *Solenopsis* genus group as defined by Bolton (1987, 2003), it does not fit into any current genus. In the present paper we establish a new genus, *Parvimyrma*, for the new species.

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The tribe Solenopsidini seems to be artificial (see Moreau et al., 2006; Brady et al., 2006), and generic delimitations in the tribe remain unsatisfactory (see Heterick, 2006). This situation may force taxonomists into comprehensively reviewing the classification of the tribe in the future. For the present, our proposition of the new genus is valid, and our description may highlight the morphological diversity of the tribe.

Methods

The following measurements and indices are used in the present article: head length (HL, maximal length of head); head width (HW, maximal width of head); scape length (SL, length of scape shaft); mesosoma length (ML, diagonal length of mesosoma in profile from the anteriormost point of the pronotum to the posteriormost point of the metapleuron); length of hind femur (FL); cephalic index (CI=HW/HL x 100); scape index (SI=SL/HW x 100); hind femur index (FI=FL/HW x 100). Measurements are made at 80x using a Nikon SMZ-1000 microscope.

Source images for producing multi-focused montage images were taken with a Nikon Coolpix 8400 digital camera attached to a Nikon Eclipse E600 microscope. Figure 1, 2, 4, 7 and 8 were produced using Syncroscopy Auto-Montage Essentials 5.02. When fine hairs and other parts which were not recognized automatically were found, the focused parts from the source images were copied to the montage image using the Brush function of Auto-Montage. Artifacts (ghost images) and unnecessary parts (unfocused appendages, insect pin, etc.) surrounding or covering target objects were erased and cleaned up using the Brush function of Auto-Montage and the retouching functions of Adobe Photoshop CS2. Figure 3, 5, 6, 9 and 10 were produced using Helicon Focus 3.50.5 (30-day trial version). Color balance, contrast and sharpness were finally adjusted using Adobe Photoshop CS2.

Abbreviations of the specimen depositories are: IEBR, Entomological collection of the Institute of Ecology and Biological Resources, Vietnam; ACEG, Ant Collection of Katsuyuki Eguchi; BMNH, Natural History Museum, London, UK; MCZC, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; MHNG, Muséum d'Histoire Naturelle, Geneva, Switzerland; MNHA, Museum of Nature and Human Activities, Hyogo, Japan.

Parvimyrma gen. nov.

Type-species. *Parvimyrma sangi* **sp. nov.** (Figs. 1–10)

Worker diagnosis. Monomorphic myrmicine ants with the following combination of characteristics. *Frontal lobe in full-face view only partially concealing the toruli, not extending posteriorly as a frontal carina*; *antennal scrobe absent*; posteromedian portion of clypeus narrowly inserted between frontal lobes; *median clypeal seta well developed*; 1st paracarinal seta well developed; lateral portions of clypeus not forming a raised rim or shield wall in front of the antennal insertions; the position of anterior tentorial pit as in Fig. 4; *mandible triangular,* overlapping but not crossing over at full closure, *with 5 distinct teeth on the masticatory margin* but without any tooth/denticles on the basal margin; trulleum open; hypostoma with a conspicuous lateral tooth just mesal to each mandibular base; anterior margin of labrum broadly concave medially; palpal formula: maxillary 2 and labial 2; antenna 11-segmented, with a 2-segmented club (Fig. 6); the apical antennal segment elongated much more than the preapical segment; eye completely absent. Promesonotum low, in profile almost flat or very weakly convex dorsally, without conspicuous humerus; *promesonotal suture completely absent dorsally*; mesosoma in dorsal view constricted between promesonotum and propodeum; metanotal groove relatively shallowly impressed dorsally; propodeum unarmed but with a narrow cuticular rim on each

posterolateral corner of the dorsum; the rim running downward and connecting with metapleural lobe; each meso and metasternum without a conspicuous process; *metapleural lobes low and round*; propodeal spiracle small, situated a little behind the midlength of the sides of propodeum; metapleural gland large. Fore basitarsus with a long and thick seta on the posteroinner margin (*sbt* in Fig. 8); meso and *metatibial spur absent*. Petiole pedunculate anteriorly and with a distinct node; the peduncle with a small anteroventral process; postpetiole much shorter than petiole, in dorsal view a little broader than petiolar node, narrowly attached to the anteriormost end of gaster. *Abdominal tergite IV (= gastral tergite I) broadly overlapping the sternite IV on the ventral surface of abdomen*; *gastral shoulder present* (*gs* in Fig. 9); sting poorly developed (*st* in Fig. 9). *Body smooth to very weakly sculptured*.

Notes. The characteristics highlighted above in italics are good grounds for placing *Parvimyrma* **gen. nov.** in the *Solenopsis* genus group (sensu Bolton, 2003). The morphology of *Parvimyrma*, however, disagrees with the other known genera belonging to the genus group as follows.

1) *Allomerus* — posteromedian portion of clypeus broadly inserted between frontal lobes; eye quite well developed; palpal formula (PF) 3, 2; antenna with a 3-segmented club in which the proximal end of each segment forms a clear neck; promesonotum forming a dome (see Ettershank, 1966; Bolton, 1987).

2) *Anillomyrma* — masticatory margin of mandible with 3–4 teeth; mandibular blades crossing over at full closure; PF 2, 1; antenna 10-segmented, with a 3-segmented club; petiolar peduncle lacking an anteroventral process; postpetiole in dorsal view broadly attached to anterodorsal part of gaster; sting large (see Bolton, 1987).

3) *Bondroitia* — mandibular blades crossing over at full closure; antenna with a 3-segmented club; metapleural gland small and inconspicuous; propodeal spiracle enormous, very close to margin of posterior face of propodeum; petiolar peduncle lacking an anteroventral process (see Bolton, 1987).

4) *Carebarella* — median portion of clypeus sharply defined by a pair of lateral carinae and forming a raised, oblong, flat region; masticatory margin of mandible with 4 teeth; PF 1, 2; eye present (but poorly developed); metanotal groove deeply impressed on the dorsum of mesosoma (see Ettershank, 1966; Bolton, 1987).

5) *Diplomorium* — median portion of clypeus not suddenly raised; posteromedian portion of clypeus broadly inserted between frontal lobes; antenna with a weakly differentiated club of 3 segments; eye present and conspicuous; promesonotum convex but not flat; postpetiole very narrowly attached to gaster; sting well developed (see Bolton, 1987).

6) *Epelysidris* — anterior clypeal margin with a pair of stout triangular teeth; basal margin of mandible with two broad-based bluntly triangular lobes; PF 3, 2; antenna 12-segmented, with a strongly differentiated club consisting of 3 segments; eye present (but small); promesonotum strongly convex; sting long and strong (see Bolton, 1987).

7) *Megalomyrmex* — PF 4, 3 or 3, 2; antenna 12-segmented, with a 3-segmented club; eye well developed; metapleural lobes connected above by a distinct carina (see Ettershank, 1966; Bolton, 1987).

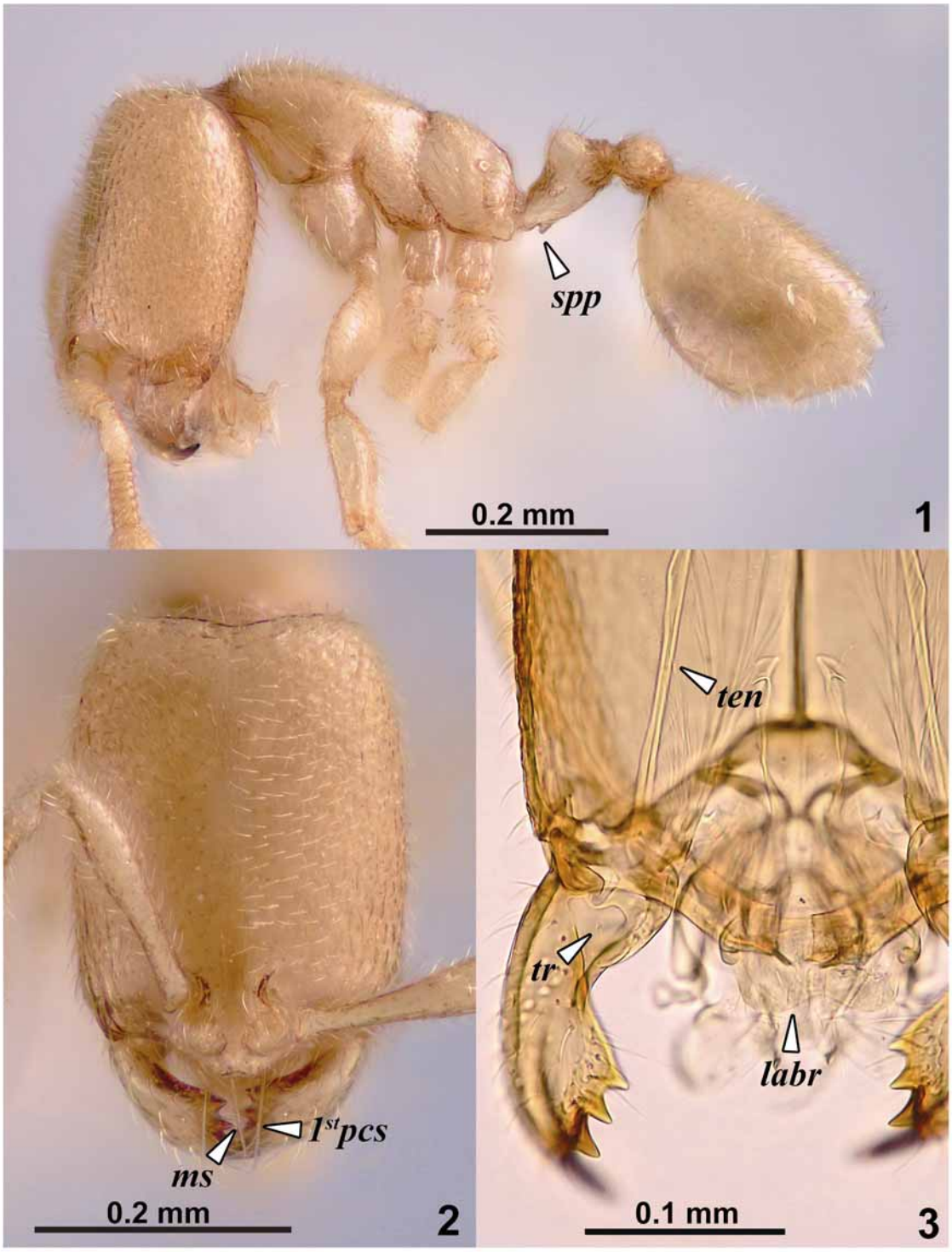
8) *Monomorium* — antennal club never of 2 segments; eye present (but reduced to a single ommatidium in the *fossulatum*-group) (see Bolton, 1987).

9) *Nothidris* — PF 4, 3; antenna 12-segmented, with a 3-segmented club; eye well developed (see Ettershank, 1966; Bolton, 1987).

10) *Oxyepoecus* — masticatory margin of mandible with 4 teeth; antenna with a 3-segmented club; eye well developed; propodeum with a pair of sharp angles or dents (propodeal spine) (see Bolton, 1987).

11) *Phacota* — masticatory margin of mandible with 4 teeth; eye present. The diagnosis of the genus is poor because the single specimen of the genus (the holotype of the single member, *Phacota sichelii*) appears to have been lost or destroyed (see Bolton, 1987).

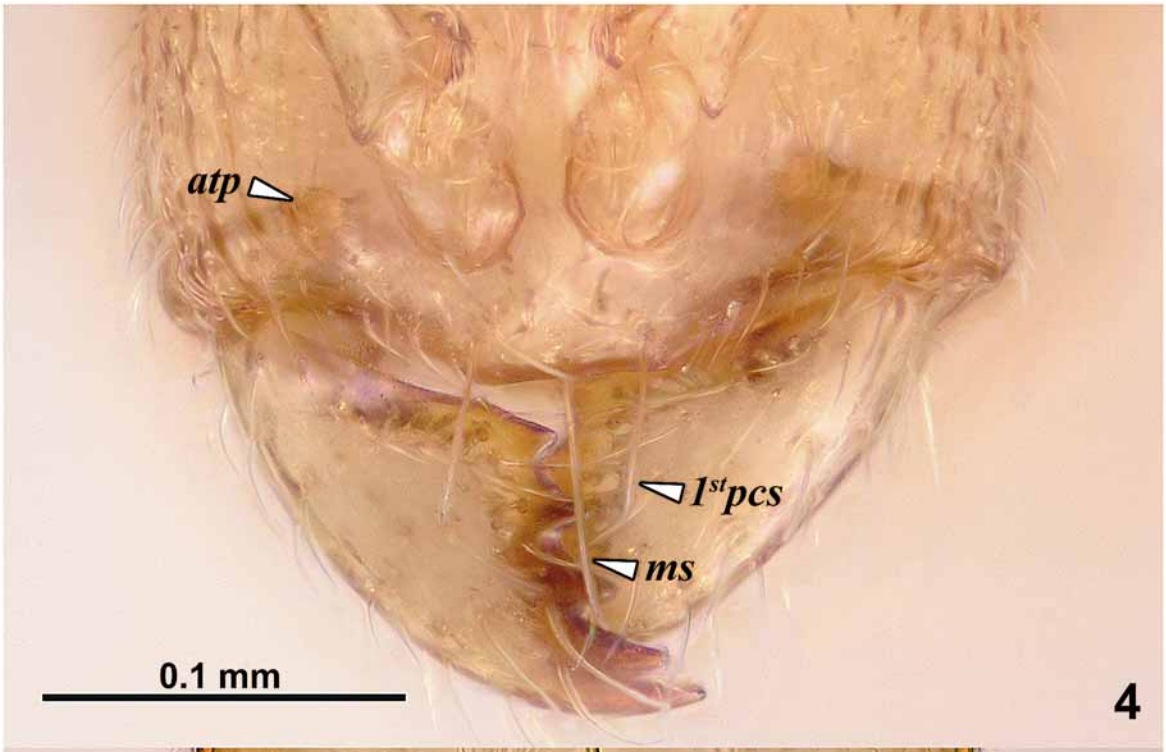
12) *Solenopsis* — masticatory margin of mandible at most with 4 teeth; antenna 9- or 10-segmented (see Ettershank, 1966; Bolton, 1987, 2003).

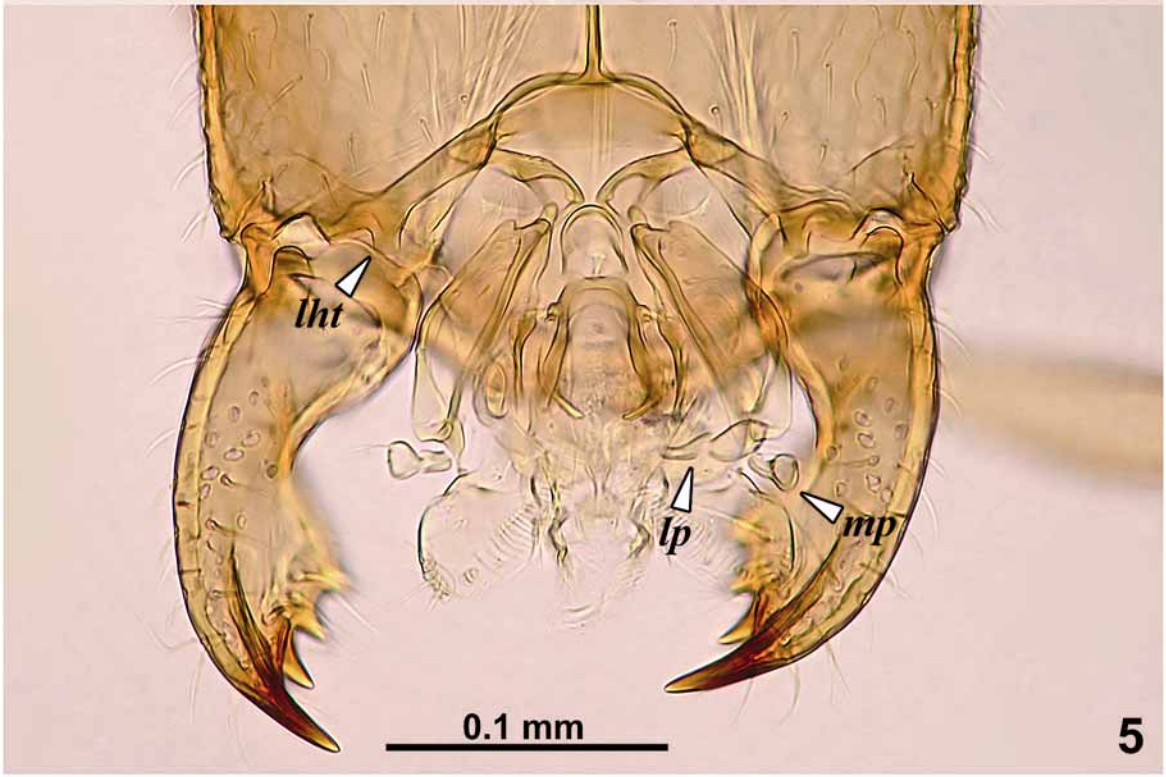


FIGURES 1–3. *Parvimyrma sangi*, worker — 1, holotype (point-mounted), body in profile; 2, paratype (point-mounted), head in full-face view; 3, paratype (slide-mounted), anterior part of head in ventral view. *labr*, labrum (anterior margin); *ms*, median seta of clypeus; *spp*, subpetiolar process; *ten*, tentorium; *tr*, trulleum; *1st pcs*, 1st paracarinal seta of clypeus.

The general habitus of *Parvimyrma* is very similar to that of some members of *Carebara*. Because the concept of the genus *Carebara* was broadened by Fernández (2004), the presence of a median clypeal seta is the only characteristic separating *Parvimyrma* from *Carebara*. Fernández (2004) subdivided *Carebara* into three species complexes: *C. concinna* species complex (= *Oligomyrmex* sensu Ettershank, 1966), *C. escheri-*

chi species complex (= *Paedalgus* sensu Bolton & Belshaw, 1993) and *C. lignata* species complex (= *Carebara* sensu Ettershank, 1966); and furthermore, he considered *Afroxyidris*, a monotypical genus established by Belshaw & Bolton (1994), to be highly apomorphic within *Carebara*. Below we provide characteristics of the three species complex and *C. crigensis* (= *Afroxyidris crigensis*) which disagree with the worker diagnosis of *Parvimyrma*.





FIGURES 4, 5. *Parvimyrma sangi*, worker — 4, paratype (point-mounted), anterior part of head in anterodorsal view; 5, paratype (slide-mounted), mouthparts in ventral view. *atp*, anterior tentorial pit; *lht*, lateral hypostomal tooth; *lp*, labial palp; *mp*, maxillary palp; *ms*, median seta of clypeus; *1stpcs*, 1st paracarinal seta of clypeus.

1) *C. concinna* species complex — worker dimorphic, major worker with massive head and mesosomal segmentation relatively well developed (see Ettershank, 1966; Fernández, 2004).

2) *C. escherichi* species complex — eye present (but reduced to 1–4 ommatidia); antenna 8- or 9-segmented; dorsum of propodeum very short, followed by a long steep posterior slope; sting strongly developed (see Ettershank, 1966; Bolton and Belshaw, 1993).

3) *C. lignata* species complex — antenna 9-segmented (see Ettershank, 1966; Fernández, 2004).

4) *C. crigensis* — Mandible with two apical teeth followed by a long oblique edentate margin and a smaller basal tooth; median portion of clypeus with a transverse step; antenna 10-segmented, with a 2-segmented club; sting well developed (see Belshaw & Bolton, 1994).

We found one Indo-Chinese species (worker, queen and male) and one Indo-Malayan species (worker only) which agree well with the concept of the *C. lignata* species complex despite the two species showing a critical diagnostic charasteristic of the *Solenopsis* genus group, i.e., a developed median clypeal seta present. The two species should be determined as *Solenopsis* by following Bolton (1994), but they show a series of characteristics which is seen in the typical worker of *C. lignata* species complex: antenna 9-segmented, with a 2-segmented club; eye completely absent; the median portion of clypeus in profile roundly and strongly swollen; clypeal carina evanescent or absent; clypeal teeth completely absent; the masticatory margin of their mandible with the apical and two distinct subapical teeth which are followed by one to three much reduced teeth (5–6 teeth in total); promesonotum in profile rather flat dorsally; in alates radial cell completely closed (see Ettershank, 1966; Bolton, 2003).

Fernández (2004) examined a *Carebara anophthalma* worker from Ecuador having a developed median clypeal seta, but he concluded that it is a local variation (*C. anophthalma* is a member of the *Carebara lignata* species complex). Furthermore, recent molecular phylogenetic studies of ants (Moreau et al., 2006; Brady et al., 2006) do not support the monophyly of the tribe Solenopsidini and the *Solenopsis* genus group. These facts mean that the presence or absence of a median clypeal seta has been over-weighted in the classification of myrmicine ants. Because "lumping genera" seems to be a trend, it may be inevitable that *Carebara*, *Solenopsis* and their neighboring taxa (including *Parvimyrma*) will be combined into a single genus which may be too large and too heterogeneous. However, for the present, our opinions are as follows: 1) the proposition of *Parvimyrma* under the *Solenopsis* genus group is valid; 2) the two "*Carebara*-like" species are tentatively treated as undetermined species of the genus *Solenopsis* (a comprehensive revision of Old World species of *Carebara lignata* species complex is needed); 3) *Parvimyrma* is distinguished from *Solenopsis*, the morphologically closest genus, by its 11-segmented antenna and its triangular mandible with 5 distinct teeth on the masticatory margin; 4) the concept of the tribe Solenopsidini and the delimitation between its two genus groups are preserved because of its large practical value for descriptive taxonomy.

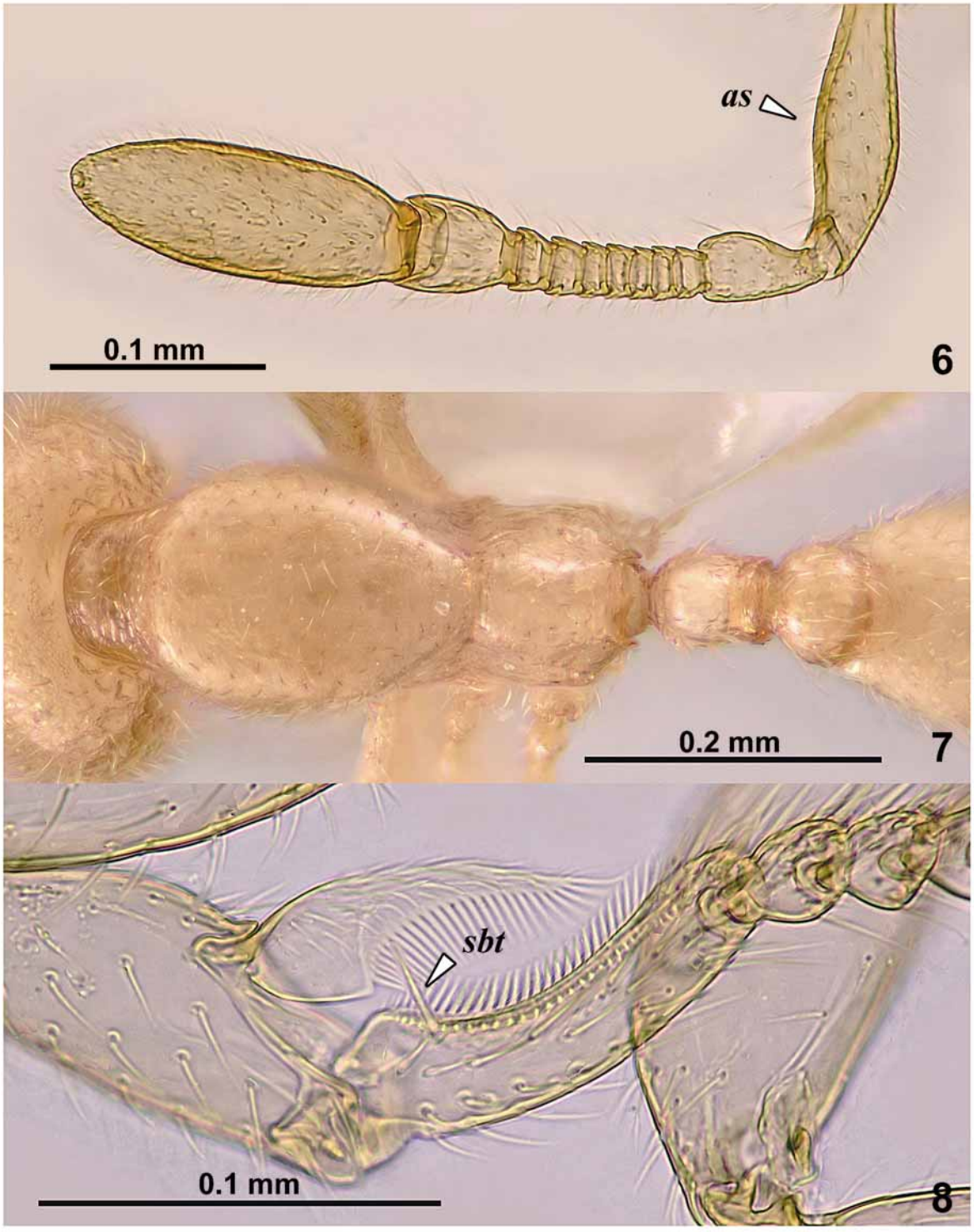
Parvimyrma is easily distinguished from the other myrmicine genera known from the Indo-Chinese subregion by a combination of the following features: median clypeal seta well developed; posteromedian portion of clypeus narrowly inserted between frontal lobes; masticatory margin of mandible with 5 distinct teeth; antenna 11-segmented, with a 2-segmented club; eye completely absent.

***Parvimyrma sangi* sp. nov.**
(Figs. 1–10)

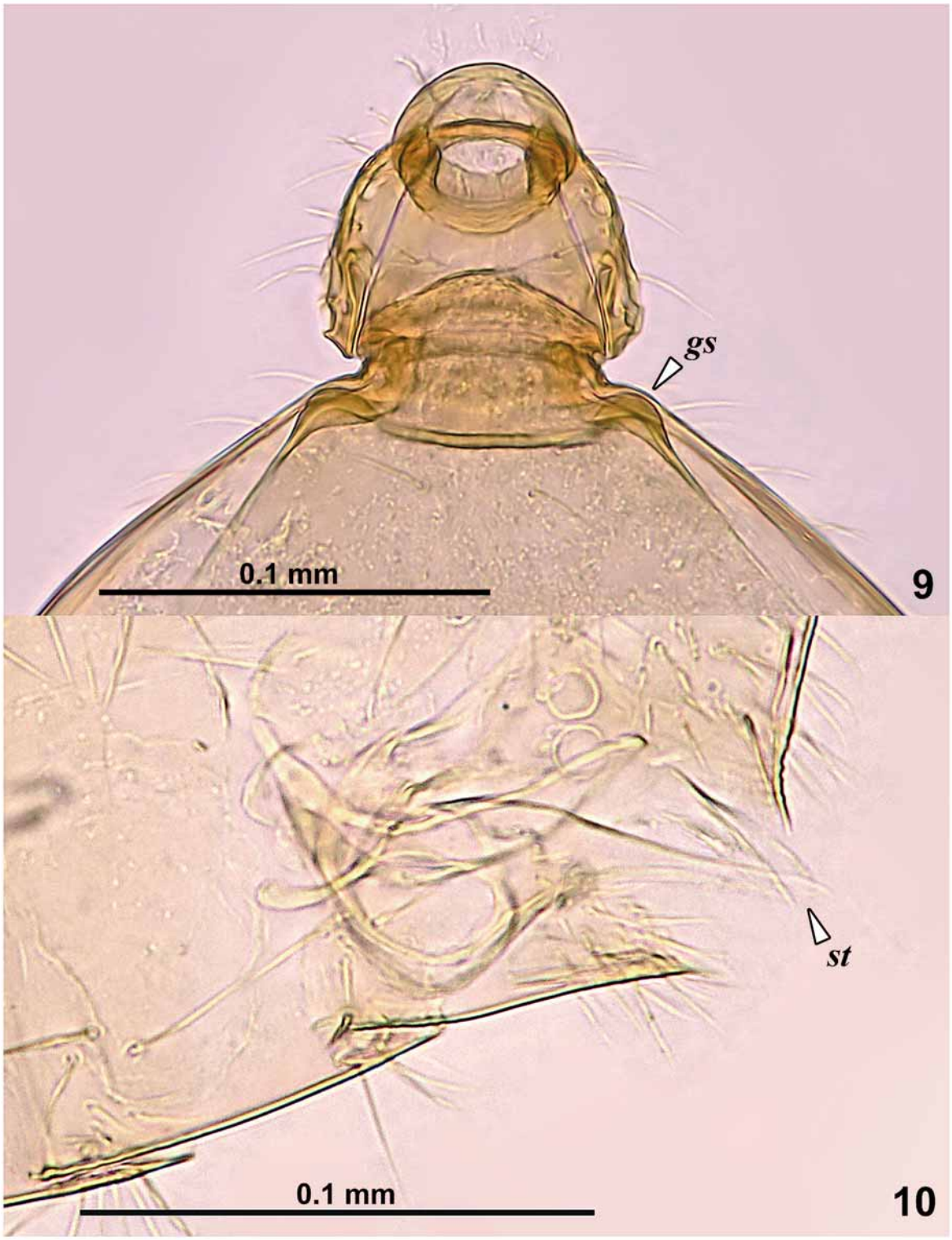
Holotype worker: Tay Yen Tu N. P., 21°10'11"N, 106°43'06"E, 435 m alt., Bac Giang Prov., N. Vietnam, 28 May 2004 (K. Eguchi leg., colony Eg04-VN-138) [IEBR]. Paratypes: 42 pinned and 2 slide-mounted workers from the same colony as holotype [IEBR, BMNH, MCZC, MHNG, MNHA, ACEG].

Worker description. Tiny species with characteristics given in the generic diagnosis. Body pale yellowish brown, much depigmented, covered with short standing hairs. Head in full-face view roughly elongate-rectangular, in profile thin dorsoventrally with flattened dorsal and ventral margin; the dorsum of head weakly

rugoso-reticulate except almost smooth anteromedian part of frons; the lateral face of head weakly rugoso-reticulate; clypeus largely smooth, with its anteromedian margin truncate; outer surface of mandible smooth; mandibular teeth triangular and sharp, gradually reduced in size from the apical teeth to the basal teeth; antennal scape short, reaching only 7/10–3/4 of the distance from the anterior margin of clypeus to the posterior margin of head (Fig. 2); antennal segments III–IX much shorter than broad; the apical antennal segment ca. 3 times as long as the preapical segment; mesosoma smooth except lower part of mesopleuron which is very weakly reticulate; gaster entirely smooth.



FIGURES 6–8. *Parvimyrma sangi*, worker — 6, paratype (slide-mounted), right antenna in ventral view; 7, holotype (point-mounted), mesosoma and waist in dorsal view; 8, paratype (slide-mounted), left foreleg in posterior view. *as*, antennal scape; *sbt*, seta on the posteroinner margin of fore basitarsus.



FIGURES 9, 10. *Parvimyrma sangi*, worker — 9, paratype (slide-mounted), the base of gaster in ventral view; 10, paratype (slide-mounted), the apex of gaster in profile. *gs*, gastral shoulder; *st*, sting.

Worker measurements and indices. Holotype: HL 0.37 mm, HW 0.26 mm, SL 0.21 mm, ML 0.42 mm, FL 0.19 mm, CI 71, SI 81, FI 71. Paratypes (n=4): HL 0.37 mm, HW 0.26–0.27 mm, SL 0.21 mm, ML 0.40–0.41 mm, FL 0.19–0.20 mm, CI 71–73, SI 78–79, FI 71–74.

Bionomics. The type series was obtained from one of ten cheese bait traps (small plastic tubes with several entrances containing powdered cheese as bait) buried ca. 10 cm underground in a well-developed forest at

ca. 435 m alt. The circumstantial evidence as well as its morphological features (depigmentation and flat body without eyes) suggest that *Parvimyrma sangi* is a subterranean nester and forager.

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