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## Taxonomic revision of the genus *Ponera* Latreille, 1804 (Hymenoptera: Formicidae) of Taiwan and Japan, with a key to East Asian species

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\**Ponera terayamai*\*: <http://zoobank.org/3D911AD9-18BB-4287-9820-514DD7F673E3>

\**Ponera wui*\*: <http://zoobank.org/325D05C9-0F30-4151-8AEA-F0BC098BDEA3>



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## Abstract

*Ponera* is a widespread genus of litter and soil ants. The highest diversity of the genus is found in Asia, with Taiwan and Japan being two of the most species-rich regions. Here, we systematically review the taxonomy of the 16 Taiwanese and Japanese *Ponera* species, two of which are new species from Taiwan: *Ponera terayamai* sp. n. and *P. wui* sp. n. A new key for *Ponera* species of East Asia is presented.

**Key words:** ant, Ponerinae, systematics, morphology, description, new species

## Introduction

The ant genus *Ponera* Latreille belongs to the *Ponera* genus group (Schmidt 2013) of the subfamily Ponerinae. Schmidt and Shattuck (2014) revised the subfamily Ponerinae and confirmed the diagnosis of *Ponera* provided by Taylor (1967). Females of *Ponera* can be distinguished from other genera by possessing a distinct fenestra in the subpetiolar process, a single pectinate spur on the metatibia, and a two-segmented maxillary palp. Morphological similarities between *Ponera* and *Hypoponera* represent convergence due to their subterranean/leaf litter habits, as these genera belong to two separate lineages of Ponerinae, determined with both molecular and morphological data (Schmidt 2013).

*Ponera* species are considered cryptobiotic, mostly foraging within the leaf litter or in soil. They mainly nest in rotting logs, in the leaf litter, under stones (Taylor 1967), and within decaying seeds and fruits (e.g. acorns, hickory nuts; Booher *et al.* 2017). Their diet consists mainly of small invertebrates such as diplurans, collembolans, spiders, and small annelids (*Enchytraeus*) (Taylor 1967; Liebig *et al.* 1997). Due to their ecology and nesting sites, they are often collected through leaf litter sampling methods such as Berlese funnels and Winkler extractors, or in pitfall traps.

Currently, 57 extant and 5 fossil species are known (Bolton, 2018), distributed within tropical and temperate regions, but noticeably absent from the Neotropical (except its northern portion) and the Afrotropical realms (antmaps.org 2017; Guénard *et al.* 2017). The understanding of the global biodiversity of *Ponera* is still incomplete. Within Southeast Asia coverage is patchy (see: antmaps.org 2017), probably reflecting differences in sampling and taxonomic efforts. Species that live in cryptic or humid microhabitats found at mid- or high elevation (see examples below) are undersampled. Also, *Ponera* species are likely undersampled within many countries (e.g. China: Guénard & Dunn 2012; India: Bharti *et al.* 2016; Laos: Jaitrong *et al.* 2016) because efficient methods to sample leaf-litter dwelling or subterranean species (subterranean traps, Winkler extractors; Wong and Guénard 2017) have not been used. For instance, in China, the use of Winkler extractors has not been integrated as a regular sampling method within ant surveys until very recently and has been used so far in rare occasions (Liu *et al.* 2015; Leong *et al.* 2017). Finally, many collected specimens or morphospecies are still in need of identifications or descriptions, as recently shown by the collection of five morphospecies from Vietnam (Eguchi *et al.* 2014). Borneo has a single formally recorded species (*P. borneensis* Taylor, Pfeiffer *et al.* 2011), yet two morphospecies from Borneo appear on Antweb.org (2017).

Although the sampling of *Ponera* globally is incomplete, the Sino-Japanese and Oriental realms (see: Holt *et al.* 2013) have the highest diversity, with 20 and 26 species recorded, respectively. Ten *Ponera* species are known from Taiwan and eight from Japan, and twelve of the 57 extant species (21%) have their type locality in Taiwan or Japan. No revision of Taiwanese or Japanese species has been produced since the global revision of Taylor (1967) over fifty years ago. Since then an additional 22 species have been described from East Asia (defined as Philippines, mainland China, Taiwan, South Korea, North Korea, and Japan). To foster discovery of new *Ponera* species in Asia and to encourage the taxonomic and ecological study of this genus, a revision of Taiwanese and Japanese species is presented, along with a key to the 32 known East Asian species, based on morphological characters of the worker caste. In addition, two new Taiwanese *Ponera* species are described. We introduce new diagnostic characters which can foster taxonomic study of *Ponera* and also discuss interspecific variation of these characters.

## Taxonomic history of *Ponera* in Taiwan and Japan

In Taiwan, Terayama (1986) described *Ponera alisana* from Fenchihu and *P. chiponensis* from Chihpen. Wang (1992) recorded *P. japonica* Wheeler, 1906 from Taiwan, but without further specific locality information. Terayama (1996), in a revision of Japanese *Ponera* species, reported paratypes of *P. tamon* Terayama, 1996 collected from Chihpen, Fenchihu and Jiuyuehtan in Taiwan. Lin and Wu (2003) recorded *P. takaminei* Terayama, 1996 from Taiwan on the Taiwanese ant checklist. Terayama (2009) described four new species: *P. rishen* from Riyuntan (Sun Moon Lake), *P. shennong* from Kenting, *P. taiyangshen* from Taipingshan, and *P. yuhuang* from Nanshan-Anleng. Terayama (2014) recorded *P. bishamon* Terayama, 1996 from Taiwan.

In Japan, Wheeler (1906) described *P. japonica* from Hakone Mountains and later, *P. scabra* Wheeler, 1928 from Kurio (Wheeler 1928b). In a revision of Japanese species, Terayama (1996) described *P. bishamon* from Iriomote-Jima, *P. kohmoku* Terayama, 1996 from Kurio, *P. takaminei* from Miyako-jima and *P. tamon* from Uken-son, and recorded *P. swezeyi* Wilson, 1933 from Japan. More recently, Yoshimura (2009) considered *P. yakushimensis* as a junior synonym of *P. scabra*, and recorded *P. alisana* in Yakushima Island.

## Collecting method

In addition to examining museum material, we carried out new field sampling in Taiwan. To collect all the castes for the different *Ponera* species, sampling was performed targeting specific humid microhabitats: under moss, under rocks, in rotten wood, and in leaf litter. Methods included insect aspirator, hand sifter (a metal mesh and a white plastic plate), and Winkler extractors. A total of 43 sites was sampled, covering all the counties/cities of Taiwan, at each site, six liters of sifted leaf litter (abundantly decomposed organic material) were collected with an approach to maximize the number of micro-habitats sampled (Ward 2000). Leaf litter was dried for seven days following the shuffling technique (see Guénard & Lucky 2011). All collected specimens were preserved in 75% or 95% ethanol before being point mounted and later processed for identification.

## Taxonomic key

We examined type specimens or images of types for 24 species, as listed below:

- (1) Taiwan (8 species; paratypes of *P. alisana* and *P. chiponensis* (NIAES, TARI); holotypes of *P. rishen*, *P. shennong*, *P. taiyangshen* and *P. yuhuang* (NIAES); *P. terayamai* sp. n. and *P. wui* sp. n. described in the present study);
- (2) Japan (4 species; syntype of *P. scabra* (MCZ); paratypes of *P. kohmoku*, *P. takaminei* and *P. tamon* (MTC));
- (3) Mainland China (12 species): Hong Kong (1 species; images of the holotype of *P. sinensis* Wheeler, 1928, were provided by Dr. David Lubertazzi [Museum of Comparative Zoology MCZ, Harvard University]); Guangxi (2 species; images of paratypes of *P. guangxiensis* Zhou, 2001 and *P. paedericera* Zhou, 2001 were provided by Dr. Shan-Yi Zhou with permission [Department of Biology, Guangxi Normal University]); Yunnan (9 species; images of the holotypes of *P. baka* Xu, 2001, *P. bawana* Xu, 2001, *P. diodonta* Xu, 2001, *P. longlina* Xu, 2001, *P. menglana* Xu, 2001, *P. nangongshan* Xu, 2001, *P. pentodontos* Xu, 2001, *P. pianmana* Xu, 2001, and *P. xantha* Xu, 2001 from Yunnan were provided by Dr. Zeng-Hui Xu with permission [Faculty of Conservation Biology, Southwest Forestry College]);
- (4) Other East Asian regions (2 species; images of the syntype of *P. oreas* Taylor, 1967 were provided by Dr. Gary D. Alpert, and the images of the holotype of *P. chapmani* Taylor, 1967 were examined from MCZ Type Database (2017) with permission);
- (5) In addition, the images of *P. incerta* Wilson, 1933, *P. scabra*, *P. swezeyi*, and *P. szaboi* Wilson, 1957 were examined from specimens imaged on AntWeb (2017).

## Photography

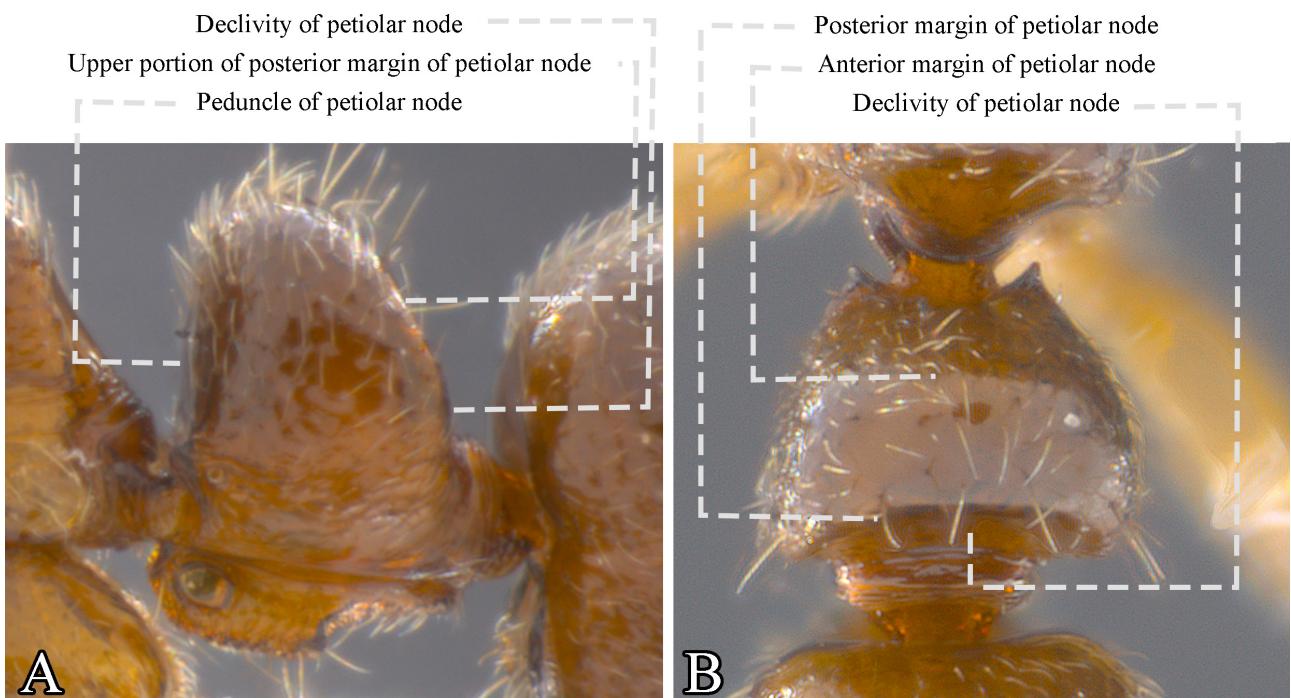
Specimens were examined under a stereomicroscope (Leica Z16 APO, Wetzlar, Germany), and photographed using digital cameras (Leica DFC490, Wetzlar, Germany). Stacked images, 20 to 40 images per view, were post-processed with the software Helicon Focus 6.3.5 (Helicon Soft Ltd.). For SEM images, specimens were sputter-coated and illustrated by using a sputter coater (SPI Module) and a scanning electron microscope (JSEM-5600, JEOL). Measurements of specimens were made by imaging relevant structures and obtaining measurements from the images using ImageJ software. Measurements were recorded with an accuracy of 0.001 mm and then rounded to the nearest 0.01 mm.

In addition, all the photographed specimens were point-mounted and given voucher codes (*CMPon-*, *LCM-*, and *LCM\_MT-Ponera-*).

## Terminology

Worker morphological terminology follows Keller (2011). The measurements and indices follow Taylor (1967). For specialised measurement of the antennal club, the measurement follows Longino (2003) and Wilson (1957).

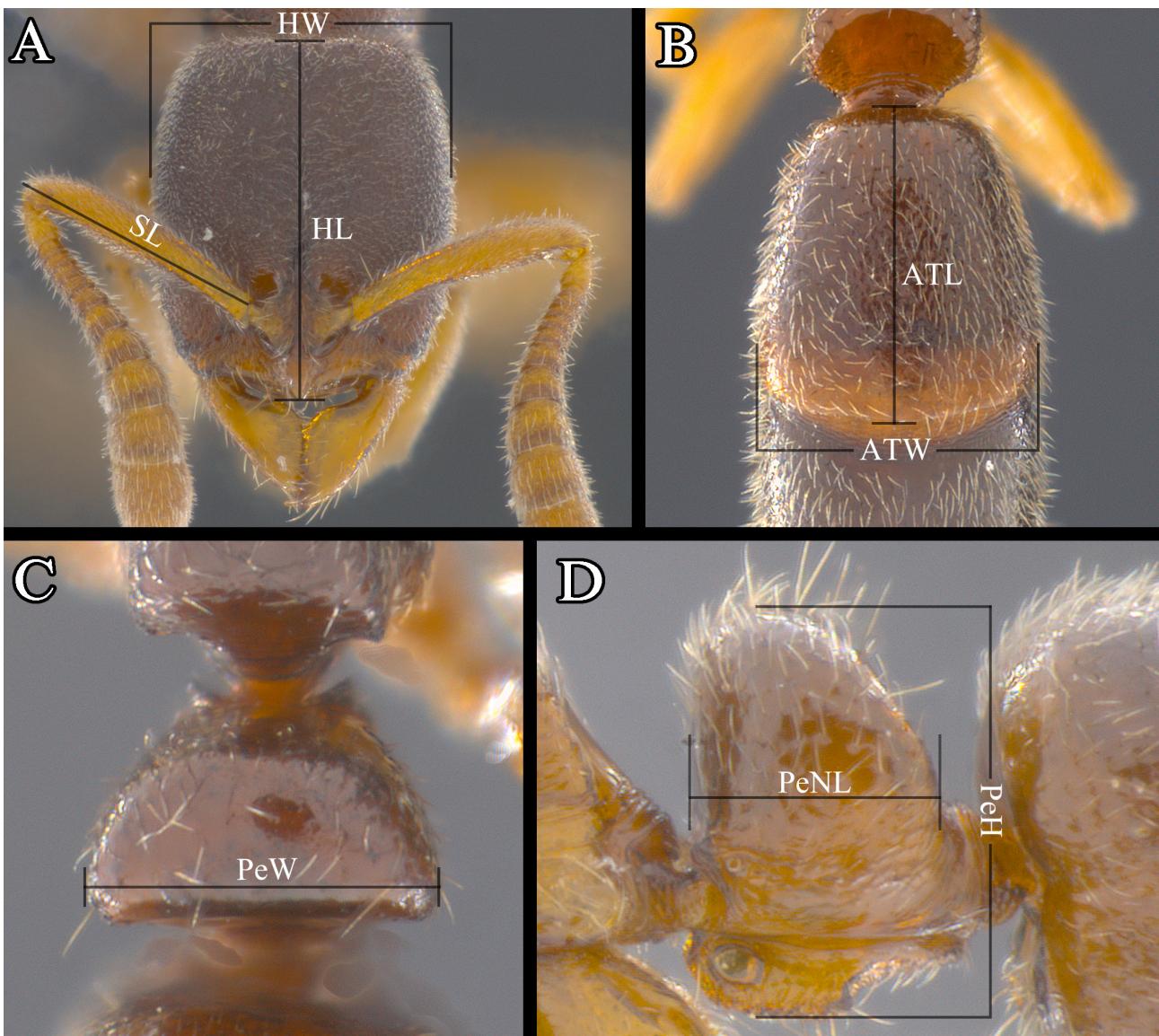
The identification of *Ponera* species is based on the worker caste because they are more frequently collected by various sampling methods (e.g. leaf litter extraction, pitfall traps, soil sifting) and have been commonly used in previous studies. Several morphological features deserve particular attention. First, the petiolar node shape in both lateral and dorsal views represents an important character for the identification of species as well as to capture intraspecific variation. When observed in profile view (Fig. 1A), the petiolar node should be positioned so that both the declivity and dorsum are not visible. Observed in dorsal view (Fig. 1B), the dorsum of the petiolar node should be positioned so both petiolar tubercles are at a similar level. Second, the position of the scape apex relative to the posterior margin of head should be viewed by laying the scape along the head, directed toward the posterior corner of the head. Third, the length-to-width ratio of abdominal segment III is important. Finally, the antennomere size ratios, pubescence, and sculpturing are important characters.



**FIGURE 1.** A: petiole, lateral view. B: petiole, dorsal view.

The following measurements and indices are used:

|             |   |
|-------------|---|
| <b>HL</b>   | Head length. Maximum length of head in full-face view, measured from the anterior-most point of median clypeal margin to the midpoint of the posterior margin (Fig. 2A).                    |
| <b>HW</b>   | Head width. Maximum width of head in full-face view excluding the eye (Fig. 2A).  |
| <b>SL</b>   | Scape length. Maximum length of scape excluding the basal neck and condyle (Fig. 2A).   |
| <b>AL</b>   | Length of 6 <sup>th</sup> to 11 <sup>th</sup> antennal segment, noted as A06L, A07L, A08L, A09L, A10L.  |
| <b>PrW</b>  | Pronotal width. Maximum width of pronotum in dorsal view.   |
| <b>WL</b>   | Weber's length. Maximum length of mesosoma in profile view, measured from the inflection of the pronotum to the posterior-most point of propodeum.  |
| <b>PeH</b>  | Petiole height. Maximum height of petiole in lateral view, measured as perpendicular distance from the top of the dorsal outline to the lowest point of the subpetiolar process (Fig. 2D).  |
| <b>PeNL</b> | Petiolar node length. Length of petiolar node in lateral view, measured as the horizontal distance from immediately above the anterior petiolar tubercle to the posterior margin (Fig. 2D). |
| <b>PeW</b>  | Petiolar node width. Maximum width of petiole in dorsal view (Fig. 2C).   |
| <b>ATL</b>  | Abdominal tergum length. Maximum length of the third abdominal posttergite in dorsal view, measured from the anterior to posterior margins (Fig. 2B).                                       |
| <b>ATW</b>  | Abdominal tergum width. Maximum width of the third abdominal posttergite in dorsal view (Fig. 2B).  |
| <b>CI</b>   | Cephalic Index, $(HW/HL) \times 100$ .  |
| <b>SI</b>   | Scape Index, $(SL/HW) \times 100$ .   |
| <b>PeI</b>  | Petiole Node Index, $(PeW/PrW) \times 100$ .  |
| <b>LPeI</b> | Lateral Petiole Index, $(PeNL/PeH) \times 100$ .  |
| <b>DPeI</b> | Dorsal Petiole Index, $(PeW/PeNL) \times 100$ .   |
| <b>ATI</b>  | Abdominal Tergum Index, $(ATL/ATW) \times 100$ .  |



**FIGURE 2.** Measurements of *Ponera* worker. A: head, full-face view. B: third abdominal segment, dorsal view. C: petiole, dorsal view. D: petiole, lateral view.

## Morphology

In this section, we discuss new morphological characters which we identified as valuable for the diagnosis and identification of *Ponera* species. These include the relative distance between the apex of the antennal scape and the posterior margin of head, pubescence, sculpturing, size ratio of antennomeres, number, position and shape of teeth on the mandible, and wing venation for alates. After systematically reviewing eastern Asian species, interspecific differences show that these characteristics can be useful and reliable to distinguish *Ponera* species.

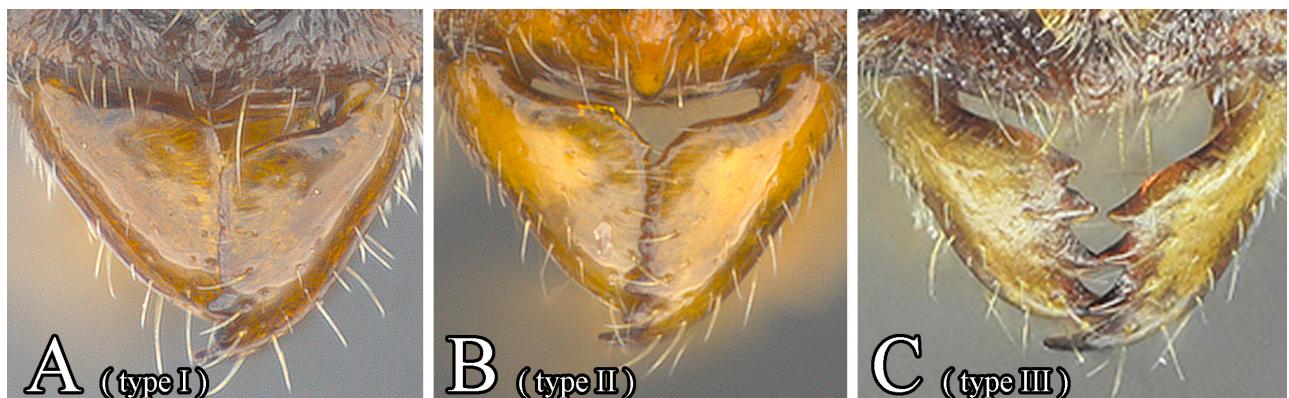
Firstly, in a majority of *Ponera* species, the antennal scapes do not reach or exceed the posterior margin of the head, and the relative distance between the apex of the antennal scape and the posterior margin of the head was widely used in the diagnosis of previous studies. However, this distance had not been accurately defined or quantified. We hereby define this distance using the remaining distance between the apex of the antennal scape and the posterior corner of the head, divided by the scape length (SL), when the scape is laid backward.

Secondly, little information on sculpture and pubescence is available in previous keys, diagnoses, or descriptions. We therefore systematically studied previous publications and compared type specimens or images, when available, to define these characters. The results suggest that sculpturing and pubescence represent interspecific characters that are helpful to delimit and identify *Ponera* species. Another character of importance is

the shape of the mesosoma in profile view, which presents important variation of the mesopleuron, metapleuron, and the lateral portion of the propodeum, and is easily observed. As a result, we describe these characters for fifteen Taiwanese and Japanese species in order to provide clear morphological features defining these species and define the foundation for a broader use of these characters.

Thirdly, our study confirms past observations on the absence of a distinct segmented club in several large *Ponera* (e.g. *P. alisana*, *P. kohmoku*, *P. scabra*), but for a few species, a clear antennal club with three to five segments can be distinguished. As a result, the ratio of the lengths of the 7th and 8th antennomeres is a useful indicator to differentiate species groups of *Ponera* as well as for species delimitation (Wilson 1957, Taylor 1967). However, most recent taxonomic descriptions of *Ponera* did not provide this ratio. The use of antennomere length ratios is confirmed and recommended in this study. In particular, diagnostic information on *Ponera* species is provided by the length ratios of the 7th through 10th segments to the 6th (i.e.,  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}}$ ).

Fourthly, three mandibular tooth patterns can be distinguished and used to separate species (Fig. 3); terminology follows Bolton, 1994: (I) Masticatory margin of mandible edentate followed by three apical teeth (*t<sub>3</sub>*, *t<sub>2</sub>*, and *at*); as in *P. guangxiensis* and *P. sinensis*. (II) Masticatory margin of mandible with a row of denticles followed by three apical teeth (*t<sub>3</sub>*, *t<sub>2</sub>*, and *at*); basal teeth present or absent; the size of denticles show high variation among different species; most *Ponera* species belong to this type of mandible. (III) Five enlarged teeth without denticles, only known from *P. pentodontos*. While the tooth pattern is a useful character, it is important to note that it can be difficult to perceive on older specimens due to dental erosion. The use of multiple workers or ideally of nest series and the comparison of setae on the mandibles between young and old individuals (Khalife *et al.* 2018), is thus recommended here.



**FIGURE 3.** Mandible, A: *P. sinensis*, B: *P. wui* sp. n., C: *P. pentodontos*.

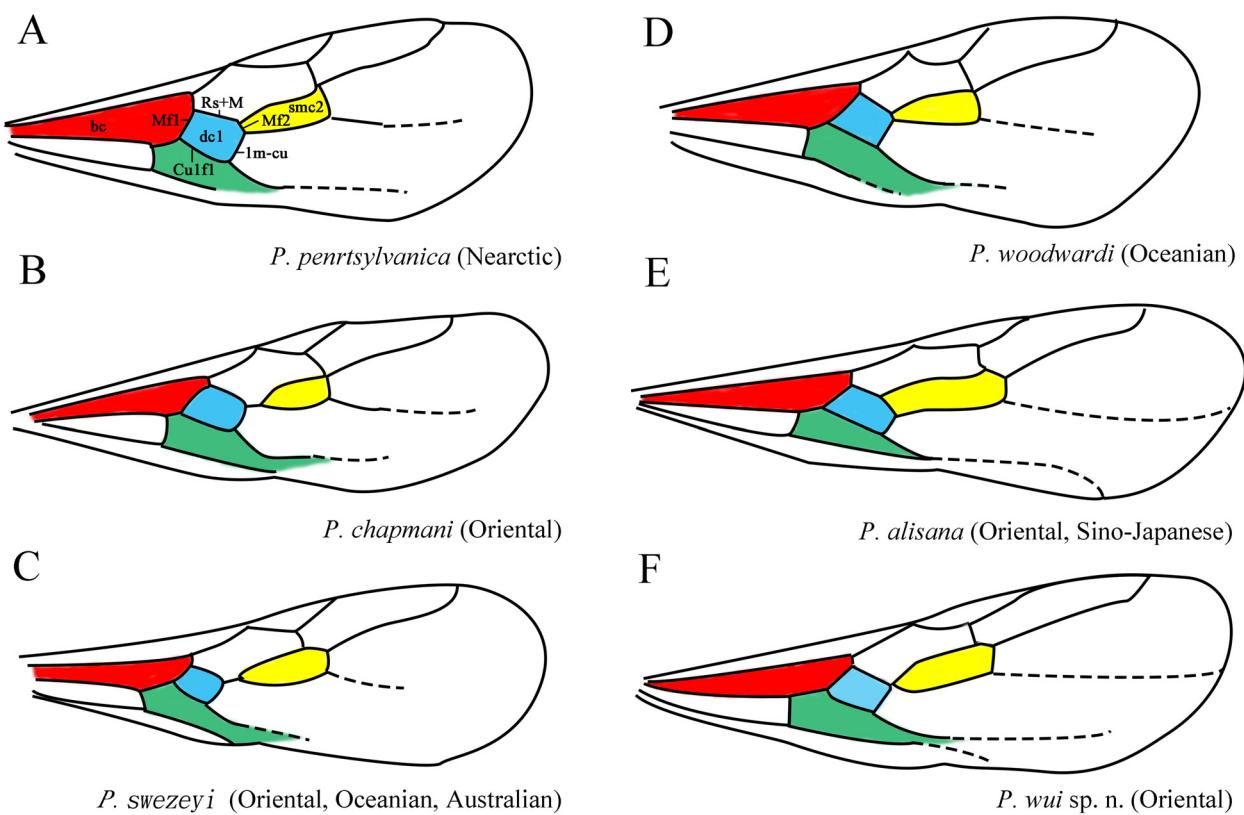
Fifthly, the venation of alate castes also provides insight, as shown in Figure 4 (alate queen). *Ponera pennsylvanica* Buckley, 1866 (Fig. 4A) can be distinguished from other species by the distinct protruding posterior region of cell bc. *Ponera alisana* (Fig. 4E) can be distinguished by the distinct and long Mf2 vein, which is short in other species. *Ponera chapmani* Taylor, 1967 (Fig. 4B) and *Ponera swazeyi* Wheeler, 1933 (Fig. 4C) can be distinguished by the two-segmented Rs+M vein from other species, Rsf4 is absent in *P. chapmani*. *Ponera wui* (Fig. 4 F) and *Ponera woodwardi* Taylor, 1967 (Fig. 4D) can be distinguished by the single Rs+M vein, short Mf2 vein, and non-protruding posterior region of cell bc, Rsf4 is absent in *P. woodwardi*. In addition, the presence of cell Cu1f1 varies among *Ponera* species, and is another interspecific venation character that should be explored further to separate species. Considering the high interspecific differences observed, alate venation could be used as a reliable character for discriminating between *Ponera* species, in particular if alates can be captured as part of nest series to be directly associated with other castes.

#### Abbreviation of institutes/collections

The institutes/collections cited in the present study are abbreviated as below:

**CAS** California Academy of Sciences, San Francisco, CA, USA

- HKUBM** The University of Hong Kong Biodiversity Museum, School of Biological Sciences, The University of Hong Kong, Hong Kong SAR  
**MCZ** The Department of Entomology, Harvard Museum of Comparative Zoology, USA  
**MTC** Maromu Terayama's Collection, Tokyo Pref., Japan  
**NHMB** Natural History Museum of Basel, Switzerland  
**NIAES** National Institute for Agro-Environmental Sciences, Tsukuba, Japan  
**NMNS** National Museum of Natural Science, Taichung, Taiwan  
**NTU** Department of Entomology, National Taiwan University, Taipei, Taiwan  
**TARI** Taiwan Agricultural Research Institute, Taichung, Taiwan



**FIGURE 4.** Wing venation of *Ponera* alata queen (A–D redrawn from Taylor, 1967).

#### Synoptic species list of East Asian *Ponera* species

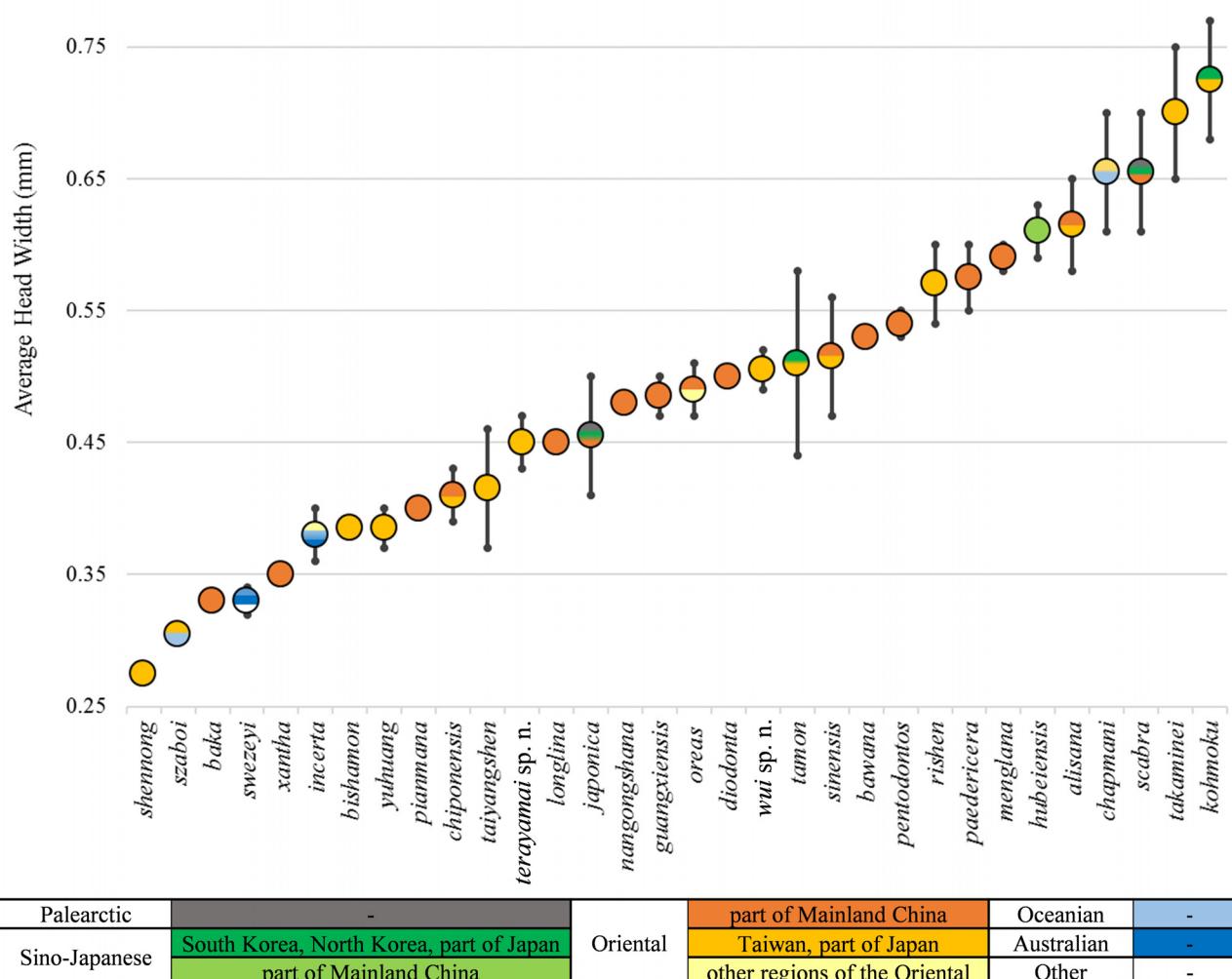
Distribution data are extracted from antmaps.org (Janicki *et al.* 2016; Guénard *et al.* 2017). The record of *P. tenuis* from Guizhou by Zhou (2006) is here considered doubtful because this species is distributed in the tropical regions of Australasia, including New Guinea and North Queensland, and is thus excluded from the following list.

The records of *P. takaminei* and *P. bishamon* by Lin & Wu (2003) and Terayama (2004) in Taiwan are provisionally excluded from the Taiwanese fauna. The type localities of *P. bishamon* and *P. takaminei* are all located in the Iriomote-jima and Miyako-jima islands (Okinawa Prefecture), and though these islands are geographically close to Taiwan, we were unable to confirm their presence in Taiwan from recent sampling or through the examination of existing collections. Moreover, voucher specimens of these two species could not be located within Dr. Maromu Terayama or Dr. Chung-Chi Lins' collections when examined by the first author (CML).

This synoptic list of East Asian *Ponera* contains 32 species. The 16 species from Taiwan and Japan are highlighted in bold. W = worker, Q = queen, M = male, — = previously described, x = examined in this study, √ = redescribed in this study, \* = newly described.

|   | W | Q | M |
|---|---|---|---|
| <b><i>P. alisana</i> Terayama, 1986</b>   | √ | √ | * |
| - China (Yunnan), Japan (Satsunan Islands), Taiwan  |   |   |   |
| <i>P. baka</i> Xu, 2001a  |   |   |   |
| - China (Xizang , Yunnan)   |   |   |   |
| <i>P. bawana</i> Xu, 2001b  |   |   |   |
| - China (Yunnan)  |   |   |   |
| <b><i>P. bishamon</i> Terayama, 1996</b>  | √ | * |   |
| - Taiwan, Japan (Kyushu, Okinawa Islands, Yaeyama Islands)  |   |   |   |
| <i>P. chapmani</i> Taylor, 1967   |   |   |   |
| - Oceanian region: New Guinea; Oriental region: Philippines   |   |   |   |
| <b><i>P. chiponensis</i> Terayama, 1986</b>   | √ | x |   |
| - Taiwan  |   |   |   |
| <i>P. diodonta</i> Xu, 2001b  |   |   |   |
| - China (Xizang , Yunnan)   |   |   |   |
| <i>P. guangxiensis</i> Zhou, 2001   |   |   |   |
| - China (Guangxi)   |   |   |   |
| <i>P. hubeiensis</i> Wang & Zhou, 2009  |   |   |   |
| - China (Hubei)   |   |   |   |
| <i>P. incerta</i> (Wheeler, 1933)   |   |   |   |
| - Australian region: Australia (Queensland); Oceanian region: New Guinea, Bismarck Archipelago, Solomon Islands, Vanuatu, Fiji; Oriental region: Philippines, Borneo, Malaysia, Singapore, Java |   |   |   |
| <b><i>P. japonica</i> Wheeler, 1906</b>   | √ | — |   |
| - China (Guizhou), Japan, South Korea, North and Eastern Russia, Taiwan   |   |   |   |
| <b><i>P. kohmoku</i> Terayama, 1996</b>   | √ | √ |   |
| - Japan (Kyushu, Satsunan Islands, Shikoku, Tsushima Island)  |   |   |   |
| <i>P. longlina</i> Xu, 2001a:   |   |   |   |
| - China (Xizang , Yunnan)   |   |   |   |
| <i>P. menglana</i> Xu, 2001a  |   |   |   |
| - China (Xizang , Yunnan)   |   |   |   |
| <i>P. nangongshana</i> Xu, 2001a  |   |   |   |
| - China (Yunnan)  |   |   |   |
| <i>P. oreas</i> (Wheeler, 1933)   |   |   |   |
| - Philippines   |   |   |   |
| <i>P. paedericera</i> Zhou, 2001  |   |   |   |
| - China (Guangxi, Yunnan), India (Arunachal Pradesh)  |   |   |   |
| <i>P. pentodontos</i> Xu, 2001a   |   |   |   |
| - China (Shaanxi, Yunnan)   |   |   |   |
| <i>P. pianmana</i> Xu, 2001b  |   |   |   |
| - China (Xizang , Yunnan)   |   |   |   |
| <b><i>P. rishen</i> Terayama, 2009</b>  | √ | * |   |
| - Taiwan  |   |   |   |
| <b><i>P. scabra</i> Wheeler, 1928b</b>  | √ | — | — |
| - China (Guizhou, Henan, Yunnan), Japan, North and South Korea  |   |   |   |
| <b><i>P. shennong</i> Terayama, 2009</b>  | √ |   |   |
| - Taiwan  |   |   |   |
| <b><i>P. sinensis</i> Wheeler, 1928a</b>  | √ | * |   |
| - China (Guangxi, Hong Kong, Yunnan)  |   |   |   |
| <b><i>P. swazeyi</i> Wheeler, 1933</b>  |   |   | x |
| - Africa (Tanzania), Christmas Island, Fiji, Japan (Ogasawara Islands), Madagascar, Solomon Islands   |   |   |   |

|  |  |   |   |
|--|--|---|---|
| <i>P. szaboi</i> Wilson, 1957  |  | ✓ | * |
| - Oceanian region: New Guinea; Oriental region: Philippines                  |  |   |   |
| <i>P. taiyangshen</i> Terayama, 2009   |  | ✓ | * |
| - Taiwan   |  |   |   |
| <i>P. takaminei</i> Terayama, 1996   |  |   |   |
| - Japan (Okinawa Islands, Yaeyama Islands), Taiwan                           |  |   |   |
| <i>P. tamon</i> Terayama, 1996   |  | ✓ | ✓ |
| - Japan (Kyushu, Okinawa Islands, Satsunan Islands, Yaeyama Islands), Taiwan |  |   |   |
| <i>P. terayamai</i> sp. n.   |  | * | * |
| - Taiwan   |  |   |   |
| <i>P. wui</i> sp. n.   |  | * | * |
| - Taiwan   |  |   |   |
| <i>P. xantha</i> Xu, 2001b   |  |   |   |
| - China (Yunnan)   |  |   |   |
| <i>P. yuhuang</i> Terayama, 2009   |  | ✓ |   |
| - Taiwan   |  |   |   |



**FIGURE 5.** Average head width of 32 *Ponera* species from the East Asia. Error bars are the range (Taylor 1967; Terayama 1986; Xu 2001a, b; Zhou 2001; Terayama 2004; Wong 2009; Yoshimura *et al.* 2009). Color of point refers to known distribution, extracted from antmaps.org, 2017. The zoogeographic definition refers to Holt *et al.* (2013).

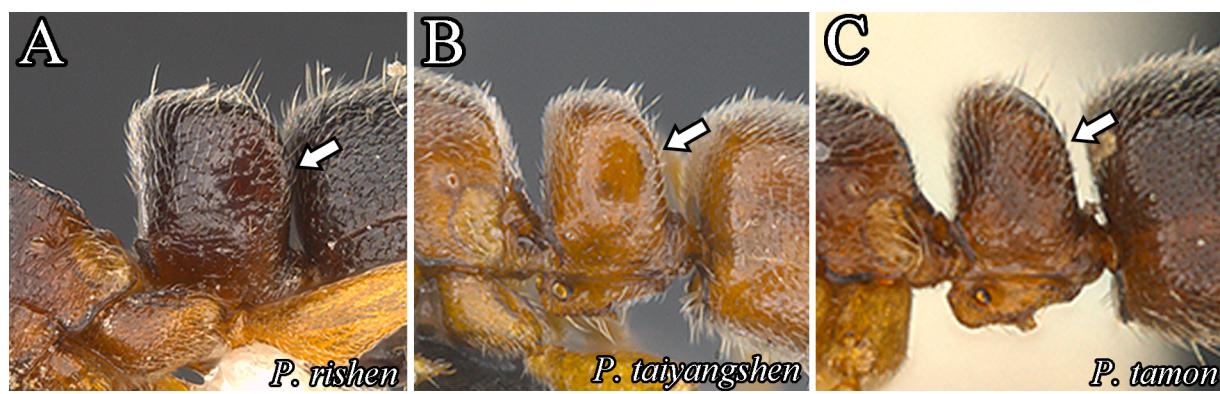
## Revised worker key to the East Asian species of *Ponera*

The worker key to East Asian *Ponera* species is modified and updated based on the previous keys and species descriptions provided in Wheeler (1928a, b), Taylor (1967); Xu (2001a, b), Zhou (2001), Terayama (1986, 1996, 2009), Wang *et al.* (2009) and Yoshimura *et al.* (2009).

The key provides general directions for the identification of *Ponera* species in Eastern Asia. However, due to a potentially high number of undescribed species in the region, the readers should refer to specific species diagnoses to confirm their identification.

Head width (HW), which has been widely used for diagnosis in past studies, and which is positively correlated with body size (e.g. Taylor 1967, Terayama 1996), is an important identification aid. We plotted mean and range of HW for all the species included in this study (Figure 5). The simultaneous use of the key and figure 5 is suggested.

- 1a. In lateral view, petiolar node very thick with convex posterior margin; with upper portion of posterior margin bulging (Fig. 6A) ..... 2
- 1b. In lateral view, petiolar node not as developed and presenting straight to convex posterior margin; with upper portion of posterior margin not bulging (Fig. 6B, C) ..... 3



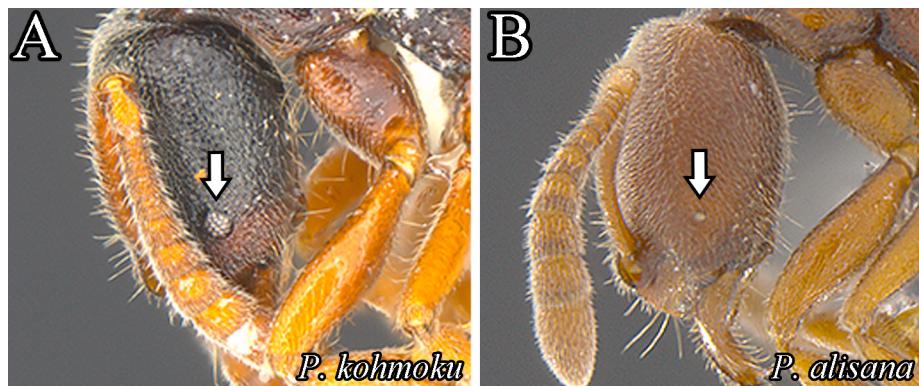
**FIGURE 6.** Lateral view of petiolar node (the arrow indicates the upper portion of posterior margin of petiolar node), A: *P. rishen*, B: *P. taiyangshen*, C: *P. tamon*.

- 2a. Petiolar node in dorsal view with slightly convex anterior margin and slightly concave posterior margin (Fig. 7A). Smaller species, HW: 0.54–0.60 mm. Body color dark. .... *P. rishen* Terayama, 2009
- 2b. Petiolar node in dorsal view with strongly convex anterior margin and strongly concave posterior margin (Fig. 7B). Larger species, HW: 0.65–0.75 mm. Body color reddish brown. .... *P. takamenei* Terayama, 1996



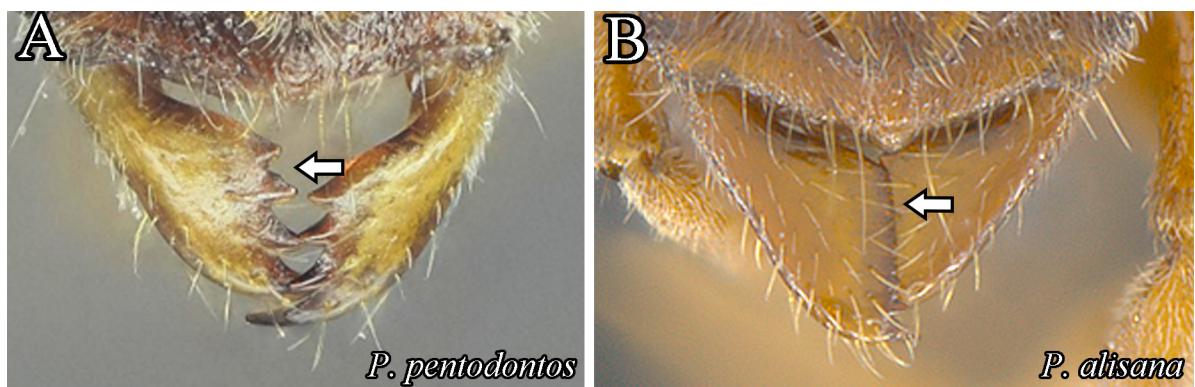
**FIGURE 7.** Dorsal view of petiolar node (the arrow indicates the posterior margin of petiolar node), A: *P. rishen*, B: *P. takamenei*.

- 3a. Eye large, each consisting of 20 or more facets (Fig. 8A). Larger species, HW: ca. 0.68 mm. .... *P. kohmoku* Terayama, 1996
- 3b. Eye small, each consisting of 10 or fewer facets (Fig. 8B). Size variable ..... 4



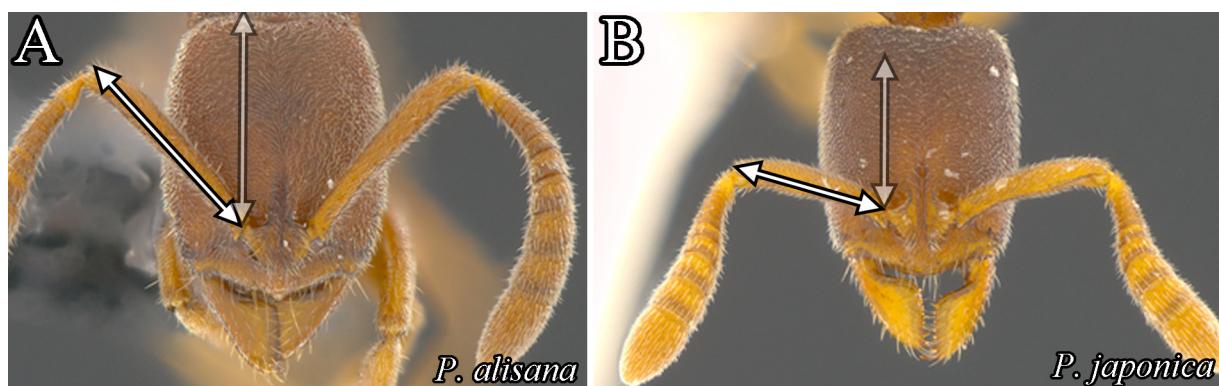
**FIGURE 8.** Lateral view of head (the arrow indicates the compound eye), A: *P. kohmoku*, B: *P. alisana*.

- 4a. Masticatory margin of mandible with 5 subequal large teeth (Fig. 9A). Smaller species, HW: 0.53–0.55 mm. .... *P. pentodontos* Xu, 2001a
- 4b. Masticatory margin of mandible with 3 enlarged apical teeth followed by a series of small to indistinct denticles (Fig. 9B). Size variable ..... 5



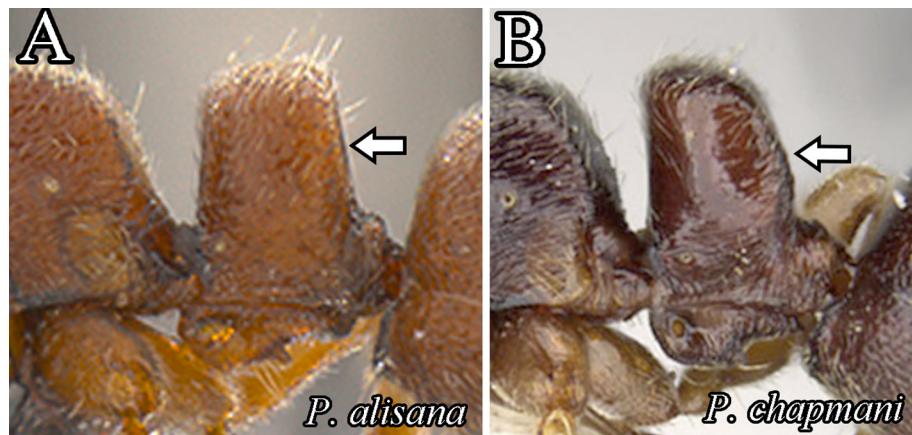
**FIGURE 9.** Mandible (the arrow indicates the basal teeth), A: *P. pentodontos*, B: *P. alisana*.

- 5a. Antennal scape, when laid backward, exceeding posterior margin of head in full-face view (Fig. 10A) ..... 6
- 5b. Antennal scape, when laid backward, not exceeding posterior margin of head in full-face view (Fig. 10B) ..... 8



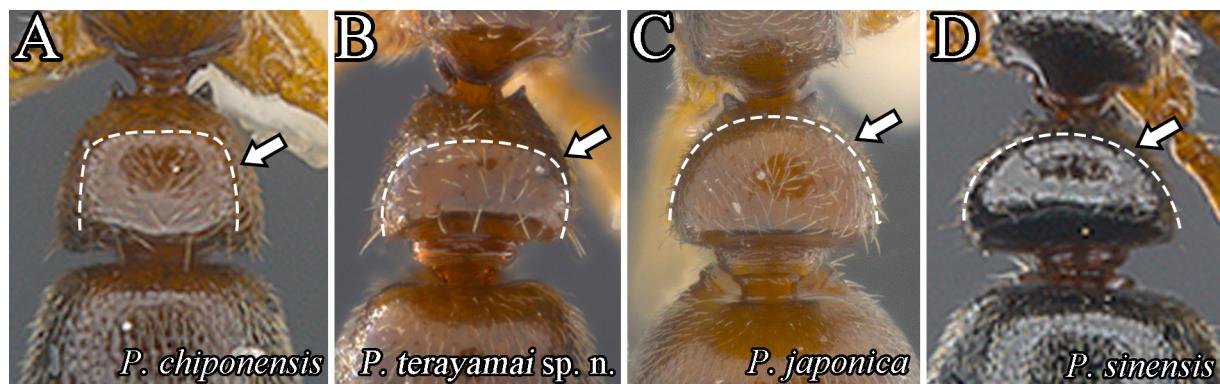
**FIGURE 10.** Full-face view of head (the line indicates the scape length), A: *P. alisana*, B: *P. japonica*.

- 6a. Scape exceeding posterior border of head by nearly 34% of scape length..... *P. hubeiensis* Wang & Zhou, 2009
- 6b. Scape exceeding posterior border of head by < 10% of scape length..... 7
- 7a. Petiolar node in lateral view with straight posterior margin (Fig. 11A). HW: 0.58–0.65 mm ..... *P. alisana* Terayama, 1986
- 7b. Petiolar node in lateral view with convex posterior margin (Fig. 11B). HW: 0.61–0.70 mm ..... *P. chapmani* Taylor, 1967



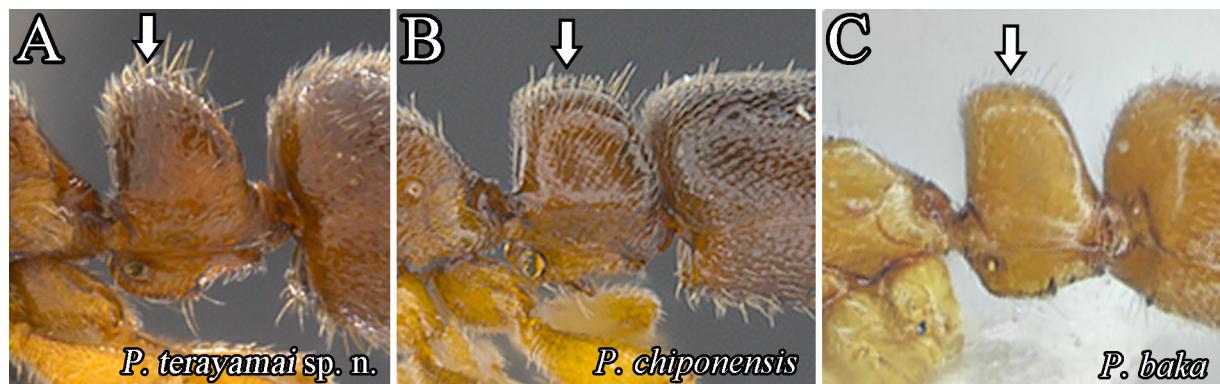
**FIGURE 11.** Lateral view of petiole node (the arrow indicates the posterior margin of petiolar node), A: *P. alisana*, B: syntype of *P. chapmani* (MCZ-ENT00030919, © The Museum of Comparative Zoology).

- 8a. Petiolar node in dorsal view subrectangular or subtrapezoidal, anterior and lateral margins not forming a single arch (Fig. 12A, B: the dotted line not forming a continuously circular arc; lateral margins present), with slightly convex or almost straight anterior margin..... 9
- 8b. Petiolar node in dorsal view semi-circular or oval, anterior and lateral margins constituting a single arch (Fig. 12C, D: the dotted line forming a continuously circular arc), with distinctly convex anterior margin..... 12



**FIGURE 12.** Dorsal view of petiole node (the dotted line and arrow indicate the anterior and lateral margins of petiolar node), A: *P. chiponensis*, B: *P. terayamai* sp. n., C: *P. japonica*, D: *P. sinensis*.

- 9a. Dorsum of petiolar node in lateral view convex and relatively acute, with broadly convex posterior margin (Fig. 13A)..... *P. terayamai* sp. n.
- 9b. Dorsum of petiolar node in lateral view slightly convex, blunt, with straight and sloping posterior margin (Fig. 13B, C).... 10



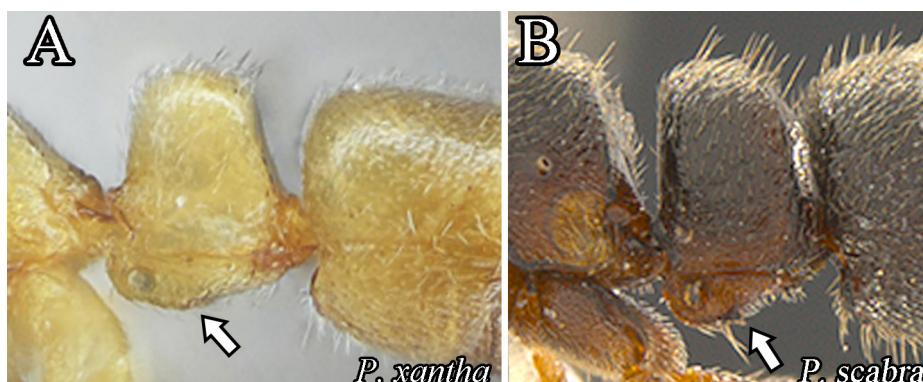
**FIGURE 13.** Lateral view of petiole node (the arrow indicates the dorsal margin of petiolar node), A: *P. terayamai* sp. n., B: *P. chiponensis*, C: *P. baka*.

- 10a. Subpetiolar process with large posteroventral teeth and large circular fenestra (Fig. 13B). Larger species, HW: 0.39–0.43 mm. Body color dark brown ..... *P. chiponensis* Terayama, 1986
- 10b. Subpetiolar process with small or indistinct posteroventral teeth, and small circular fenestra (Fig. 13C). Smaller species, HW: ≤ 0.35 mm. Body color yellowish brown ..... 11
- 11a. Petiolar node in dorsal view rectangular, broader than long, with slightly convex anterior margin (Fig. 14A). Larger species, HW: ca. 0.33 mm ..... *P. baka* Xu, 2001a
- 11b. Petiolar node in dorsal view subquadrate, about as wide as long, with straight anterior margin (Fig. 14B). Smaller species, HW: 0.27–0.28 mm ..... *P. shennong* Terayama, 2009



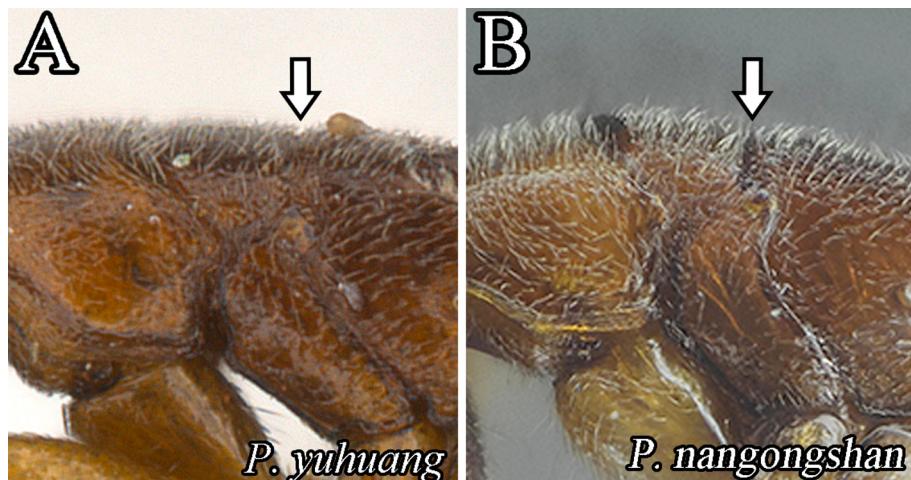
**FIGURE 14.** Dorsal view of petiolar node (the arrow indicates the anterior margin of petiolar node), A: *P. baka*, B: *P. shennong*.

- 12a. Subpetiolar process without developed posteroventral teeth (Fig. 15A) ..... 13
- 12b. Subpetiolar process with developed posteroventral teeth (Fig. 15B) ..... 16



**FIGURE 15.** Lateral view of petiolar node (the arrow indicates the posteroventral teeth in subpetiolar process), A: *P. xantha*, B: *P. scabra*.

- 13a. Metanotal groove in lateral view indistinctly or weakly incised (Fig. 16A). Petiolar node in lateral view anterior and posterior margins converging, not parallel ..... 14
- 13b. Metanotal groove in lateral view deeply and broadly incised (Fig. 16B). Petiolar node in lateral view with parallel anterior and posterior margins ..... *P. nangongshan* Xu, 2001a



**FIGURE 16.** Lateral view of mesosoma (the arrow indicates the metanotal groove), A: *P. yuhuang*, B: *P. nangongshan*.

- 14a. In full-face view, posterior margin of head distinctly concave (Fig. 17A). Petiolar node in lateral view thick (LPeI: 63), with sloping and straight posterior margin. Smaller species, HW: ca. 0.35 mm. Body yellowish brown ..... *P. xantha* Xu, 2001b
- 14b. In full-face view, posterior margin of head slightly concave or straight (Fig. 17B, C). Petiolar node in lateral view relatively thin (LPeI: ca. 50), with almost vertical and slightly convex posterior margin. Larger species, HW  $\geq$  0.40 mm. Body brown to dark brown..... 15



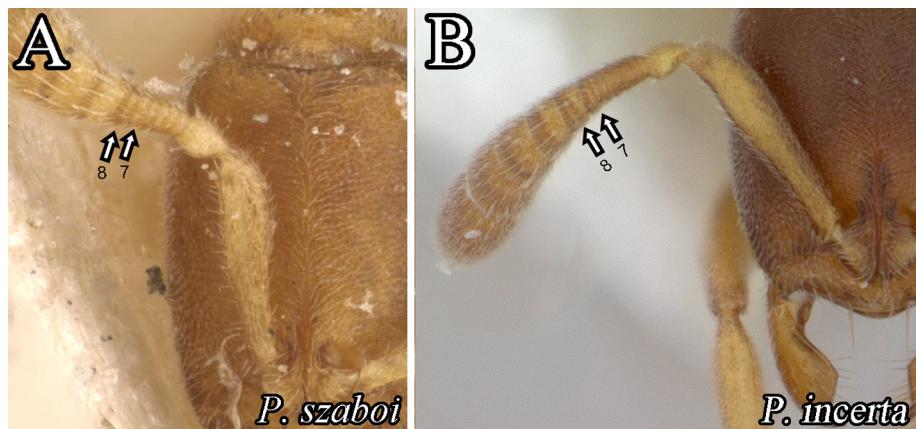
**FIGURE 17.** Full-face view of head, A: *P. xantha*, B: *P. yuhuang*, C: *P. bawana*.

- 15a. Petiolar node in dorsal view oval, with slightly convex posterior margin (Fig. 18A). Larger species, HW: ca. 0.53 mm. .... *P. bawana* Xu, 2001b
- 15b. Petiolar node in dorsal view arched, with straight posterior margin (Fig. 18B). Smaller species, HW: ca. 0.40 mm ..... *P. yuhuang* Terayama, 2009



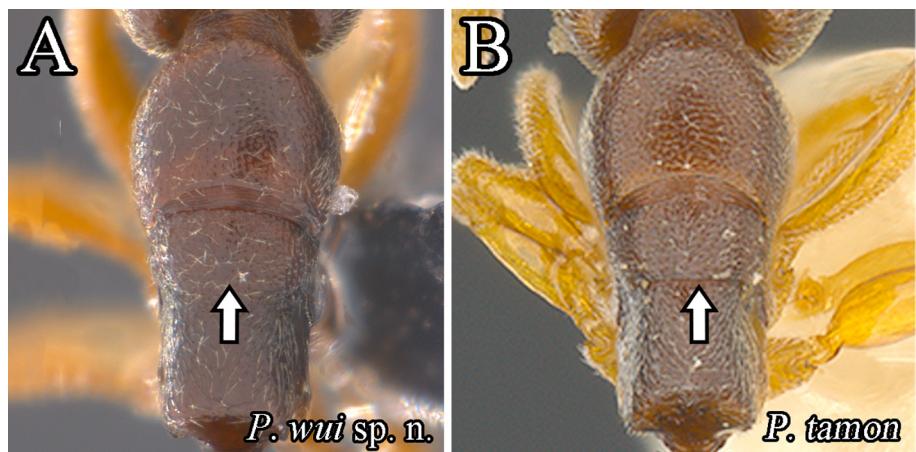
**FIGURE 18.** Dorsal view of petiolar node (the arrow indicates the posterior margin of petiolar node), A: *P. bawana*, B: *P. yuhuang*.

- 16a. Length of 8<sup>th</sup> antennal segment as long as 7<sup>th</sup> antennal segment (Fig. 19A) Metanotal groove indistinctly incised. Smaller species, HW: 0.30–0.31 mm. .... *P. szaboi* Wilson, 1957
- 16b. Length of 8<sup>th</sup> antennal segment ≥ 1.5 times length of 7<sup>th</sup> antennal segment (Fig. 19B) ..... 17



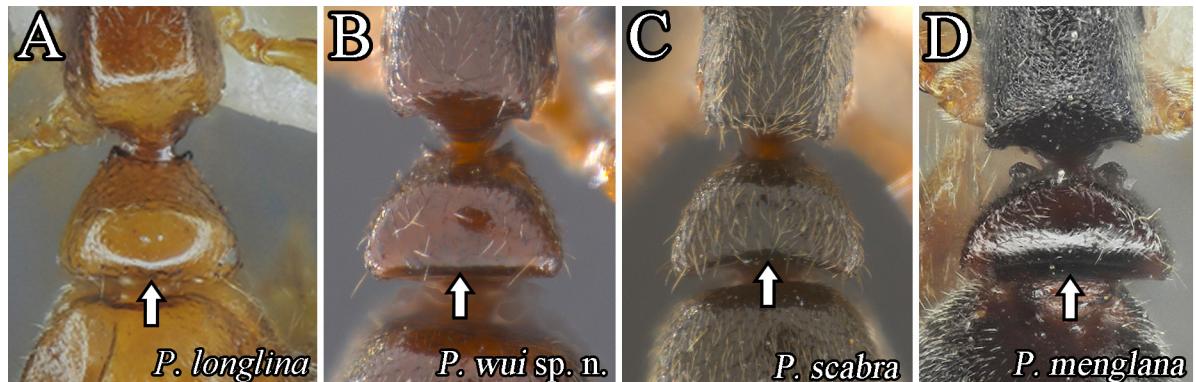
**FIGURE 19.** Full-face view of head (the arrow indicates the antennal segment), a: *P. szaboi* (CASENT0907297, Zach Lieberman, AntWeb, 2017), b: *P. incerta* (CASENT0178448, April Nobile, AntWeb, 2017).

- 17a. Metanotal groove in dorsal view indistinctly incised or almost obliterated (Fig. 20A) ..... 18  
 17b. Metanotal groove in dorsal view weakly incised (Fig. 20B) ..... 22



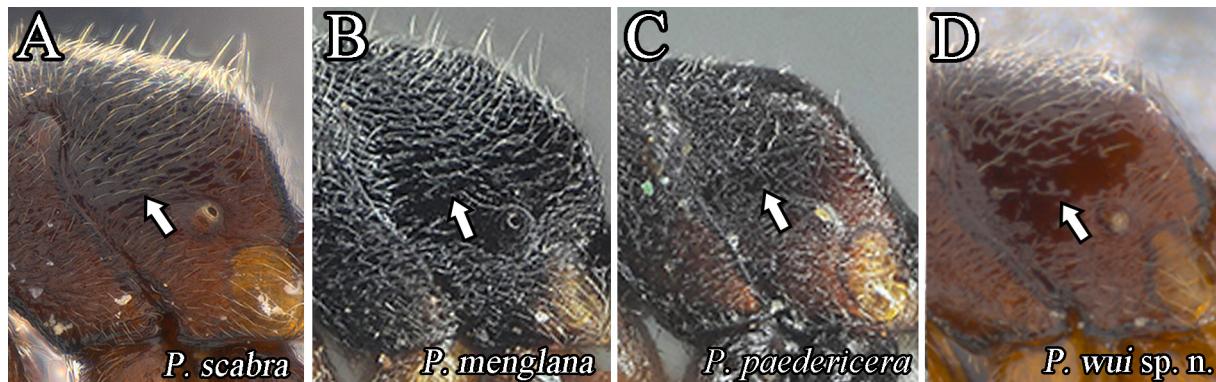
**FIGURE 20.** Dorsal view of mesosoma (the arrow indicates the metanotal groove), A: *P. wui* sp. n., B: *P. tamon*.

- 18a. Petiolar node in dorsal view oval, with convex posterior margin (Fig. 21A). Smaller species, HW: ca. 0.45 mm ..... *P. longlina* Xu, 2001a  
 18b. Petiolar node in dorsal view not oval, with straight to slightly concave posterior margin (Fig. 21B, C, D). Larger species, HW ≥ 0.49 mm ..... 19



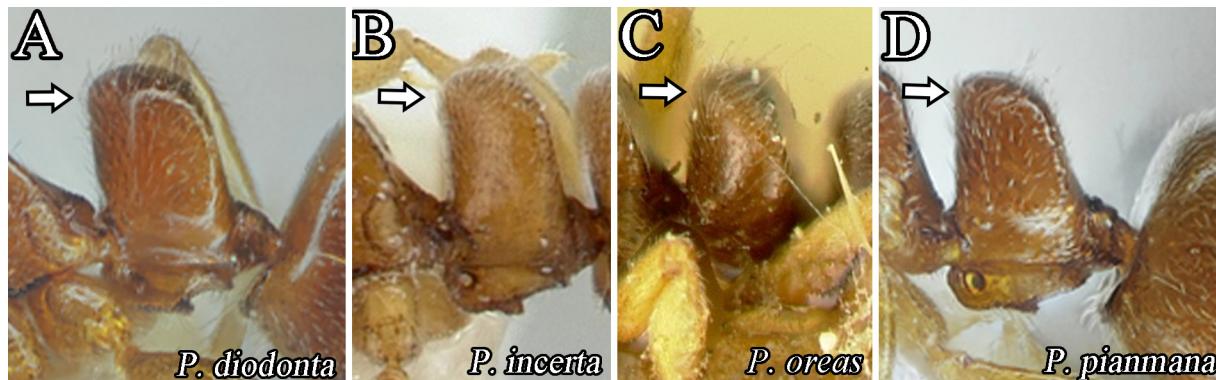
**FIGURE 21.** Dorsal view of petiolar node (the arrow indicates the posterior margin of petiolar node), A: *P. longlina*, B: *P. wui* sp. n., C: *P. scabra*, D: *P. menglana*.

- 19a. Side of propodeum with weak to strong striae and hairs in lateral view (Fig. 22A, B, C). Body color variable. Larger species, HW  $\geq$  0.55 mm ..... 20  
 19b. Side of propodeum shining and smooth (Fig. 22D). Body color reddish brown. Smaller species, HW: 0.49–0.52 mm ..... *P. wui sp. n.*



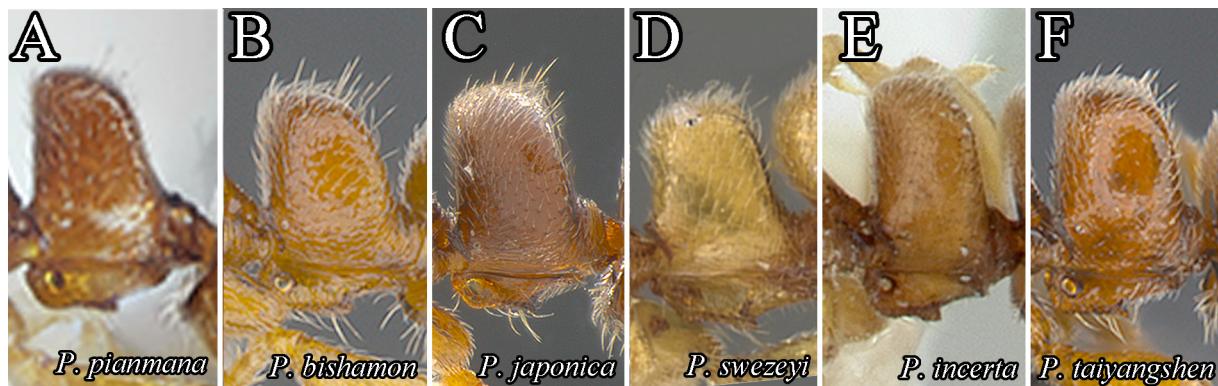
**FIGURE 22.** Lateral view of propodeum (the arrow indicates the contained portion between metapleuron and propodeum), A: *P. scabra*, B: *P. menglana*, C: *P. paedericera*, D: *P. wui sp. n.*

- 20a. Lateral faces of metapleuron and propodeum weakly striate (Fig. 22AC) ..... 21  
 20b. Lateral faces of metapleuron and propodeum strongly striate (Fig. 22B) ..... *P. menglana* Xu, 2001a  
 21a. Apex of antennal scape, when laid backward, with a remaining distance to the posterolateral corner of ca. 10% of the scape length. Lateral faces of metapleuron and propodeum weakly striate (Fig. 22C) ..... *P. paedericera* Zhou, 2001  
 21b. Apex of antennal scape, when laid backward, with a remaining distance to the posterolateral corner of  $\leq$  5% of the scape length. Metapleuron and propodeum with relatively strong striae and abundant hairs in lateral view (Fig. 22A) ..... *P. scabra* Wheeler, 1928b  
 22a. Anterodorsal corner of petiolar node in lateral view protruding forward (Fig. 23A) ..... *P. diodonta* Xu, 2001b  
 22b. Anterodorsal corner of petiolar node in lateral view not protruding forward (Fig. 23B, C, D) ..... 23



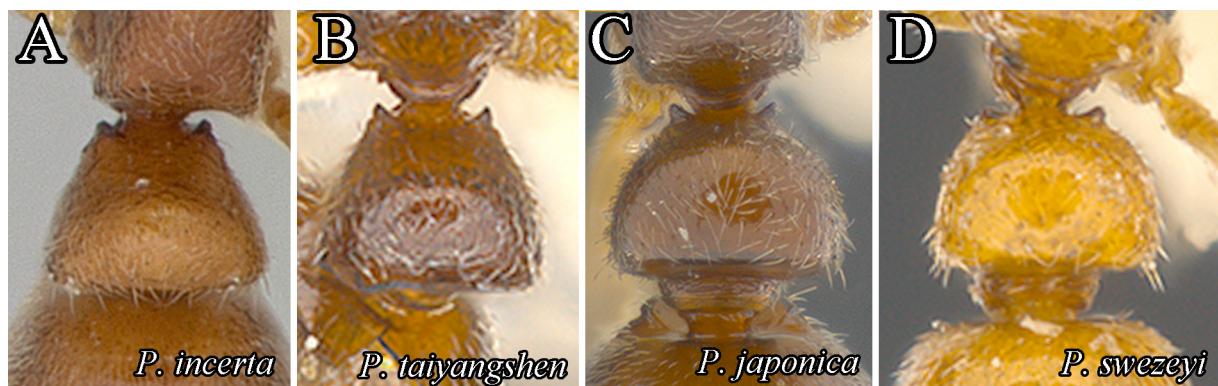
**FIGURE 23.** Lateral view of petiole (the arrow indicates the anterodorsal corner of petiolar node), A: *P. diodonta*, B: *P. incerta* (CASENT0178448, April Nobile, AntWeb, 2017), C: *P. oreas*, D: *P. pianmana*.

- 23a. Apex of antennal scape, when laid backward, with a remaining distance to the posterolateral corner of  $\leq$  5% of the scape length ..... 29  
 23b. Apex of antennal scape, when laid backward, with a remaining distance to the posterolateral corner of  $\geq$  10% of the scape length ..... 24  
 24a. Dorsum of petiolar node in lateral view convex without forming distinct angle on posterodorsal corner; anterodorsal corner clearly much higher than posterodorsal corner (Fig. 24AB) ..... 25  
 24b. Dorsum of petiolar node in lateral view slightly convex without forming distinct angle on posterodorsal corner; anterodorsal corner slightly higher, or as high as posterodorsal corner (Fig. 24CDEF) ..... 26



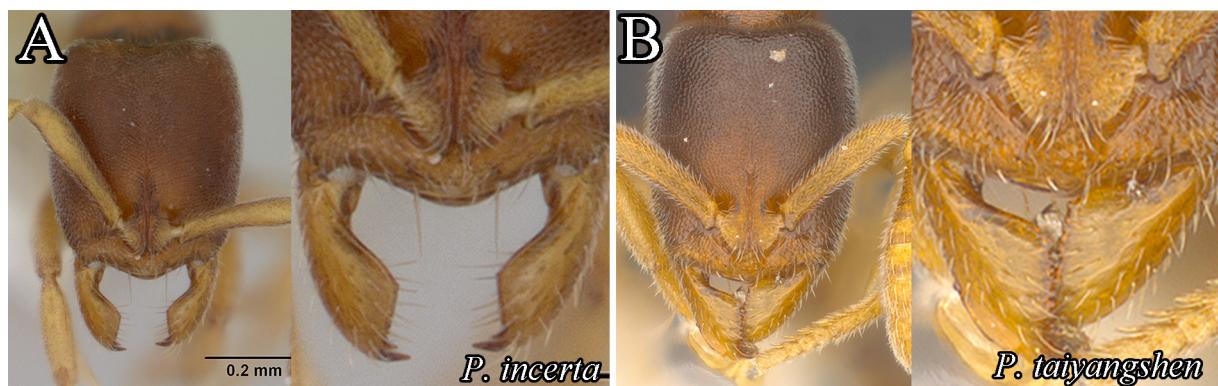
**FIGURE 24.** Lateral view of petiole, A: *P. pianmana*, B: *P. bishamon*, C: *P. japonica*, D: *P. swezeyi* (CASENT0900367, Will Ericson, AntWeb, 2017), E: *P. incerta* (CASENT0178448, April Nobile, AntWeb, 2017), F: *P. taiyangshen*.

- 25a. Third abdominal tergum distinctly longer than broad in dorsal view (ATI  $\geq$  105) ..... *P. bishamon* Terayama, 1996
- 25b. Third abdominal tergum broader than long in dorsal view (ATI  $\leq$  96) ..... *P. pianmana* Xu, 2001b
- 26a. Petiolar node in dorsal view relatively thicker (Fig. 25A) ..... 27
- 26b. Petiolar node in dorsal view relatively thin (Fig. 25B) ..... 28



**FIGURE 25.** Dorsal view of petiole, A: *P. incerta* (CASENT0178448, April Nobile, AntWeb, 2017), B: *P. taiyangshen*, C: *P. japonica*, D: *P. swezeyi*.

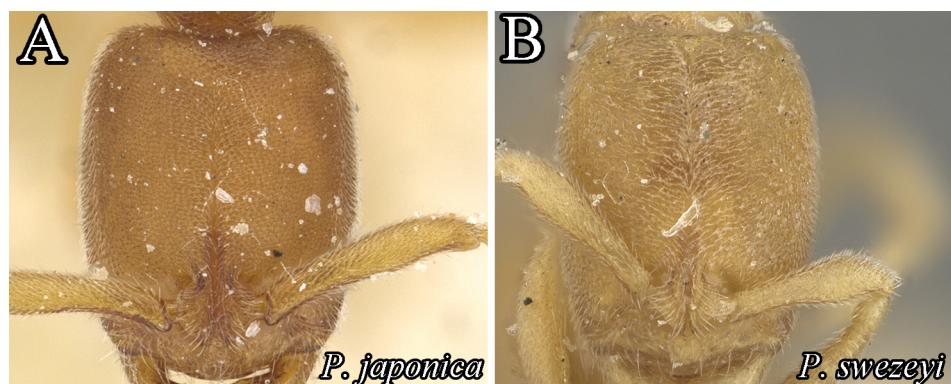
- 27a. Petiolar node in dorsal view relatively thin (Fig. 24E). Posterior margin of head slightly concave (Fig. 26A). Clypeus without distinct median tooth ..... *P. incerta* (Wheeler, 1933)
- 27b. Petiolar node in lateral view relatively thicker (Fig. 24F). Posterior margin of head more concave (Fig. 26B). Clypeus with distinct median tooth present (observation of the specimen using various angles needed) ..... *P. taiyangshen* Terayama, 2009



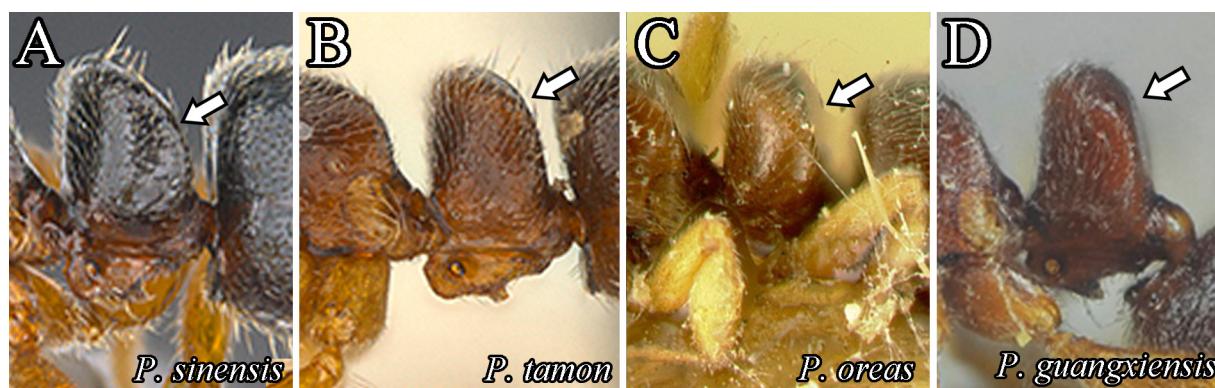
**FIGURE 26.** Full-face view of head, A: *P. incerta* (CASENT0178448, April Nobile, AntWeb, 2017), B: *P. taiyangshen*.

- 28a. Posterior margin of head concave (Fig. 27A). Anterior margin of petiolar node in dorsal view well convex (Fig. 25C). Larger species, HW: 0.41–0.50 mm. Body color brown ..... *P. japonica* Wheeler, 1906

- 28b. Posterior margin of head almost straight (Fig. 27B). Anterior margin of petiolar node in dorsal view well convex (Fig. 25D). Smaller species, HW: 0.32–0.34 mm. Body color yellowish brown ..... *P. swezeyi* (Wheeler, 1933)

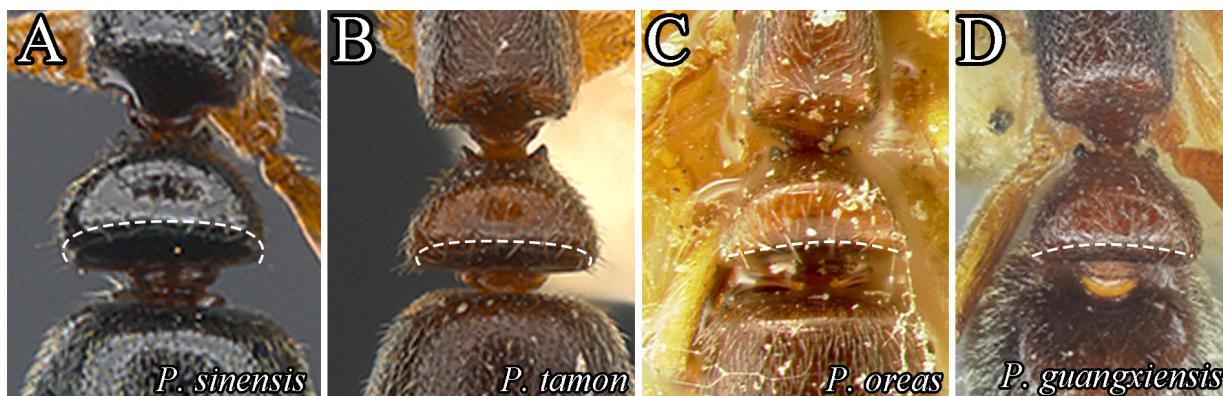


**FIGURE 27.** Full-face view of head, A: *P. japonica* (CASENT0915295, Zach Lieberman, AntWeb, 2017), B: *P. swezeyi* (MCZ-ENT00593416, Michele Esposito, AntWeb, 2017).



**FIGURE 28.** Lateral view of petiole (the arrow indicates the posterior margin of petiolar node), A: *P. sinensis*, B: paratype of *P. tamon*, C: syntype of *P. oreas*, D: paratype of *P. guangxiensis*.

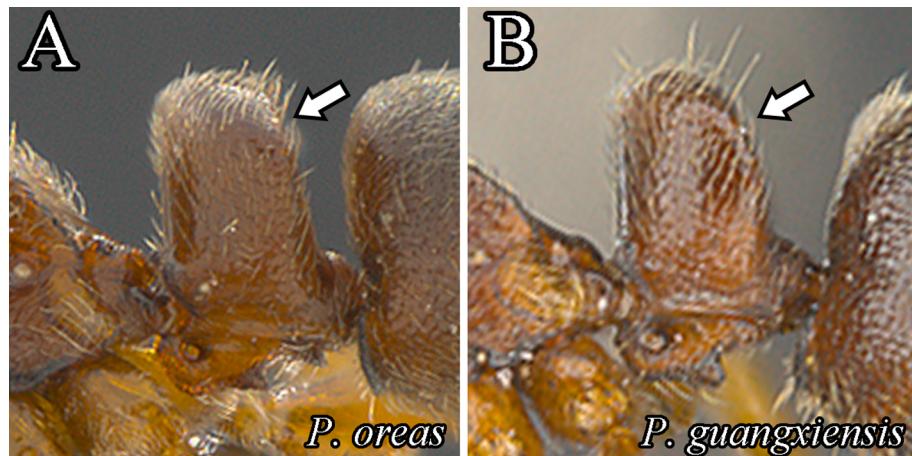
- 29a. Petiolar node in lateral view with strongly convex posterior margin (Fig. 28A, B). Petiolar node in dorsal view with concave posterior margin, and large portion of the declivity clearly visible (Fig. 29A, B) ..... 30  
 29b. Petiolar node in lateral view with straight to slightly convex posterior margin (Fig. 28C, D). Petiolar node in dorsal view with straight or slightly concave posterior margin, and small portion of the declivity visible (Fig. 29C, D) ..... 31



**FIGURE 29.** Dorsal view of petiole (the dotted line indicates the posterior margin of petiolar node), A: *P. sinensis*, B: *P. tamon*, C: *P. oreas*, D: *P. guangxiensis*.

- 30a. Petiolar node in lateral view with broadly convex posterior margin (Fig. 28A). Petiolar node in dorsal view thin (Fig. 29A). Body color dark brown ..... *P. sinensis* Wheeler, 1928a  
 30b. Petiolar node in lateral view with convex posterior margin (Fig. 28B). Petiolar node in dorsal view relatively thicker (Fig. 29B). Body color lighter brown ..... *P. tamon* Terayama, 1996

- 31a. Posterodorsal corner of petiolar node forming a blunt angle in lateral view (Fig. 30A specimen collected in Sarawak, Malaysia; also see Taylor 1967, Fig. 71). Subpetiolar process with small posteroventral teeth ..... *P. oreas* (Wheeler, 1933)
- 31b. Posterodorsal corner of petiolar node convex in lateral view (Fig. 30B specimen collected in Vietnam; also see Zhou 2001, Fig. 74). Subpetiolar process with larger posteroventral teeth ..... *P. guangxiensis* Zhou, 2001



**FIGURE 30.** Lateral view of petiole, A: *P. oreas* collected in Sarawak, Malaysia, B: *guangxiensis* collected in Vietnam.

## Systematics

### *Ponera* Latreille, 1804

*Ponera* Latreille, 1804: 179. Type-species: *Formica coarctata*, by subsequent designation of Westwood, 1840: 83.

*Pseudocryptopone* Wheeler, 1933: 12. Type-species: *Cryptopone tenuis*. Synonymized by Wilson, 1957: 356.

*Selenopone* Wheeler, 1933: 19. Type-species: *Ponera selenophora*. Synonymized by Wilson, 1957: 356.

*Pteroponera* Bernard, 1950: 3. Type-species: *Pteroponera sysphinctoides*. Synonymized by Brown, 1973: 184 (provisional); Bolton, 1994: 164.

### *Ponera alisana* Terayama, 1986

(Fig. 31: worker; Figs. 32, 33: dealate queen; Figs. 34, 35: male)

*Ponera alisana* Terayama, 1986: 591 (w. q.). Type locality: Taiwan, Chiayi Hsien, Fenchihu. Yoshimura *et al.* 2009: 198 (w. q.).

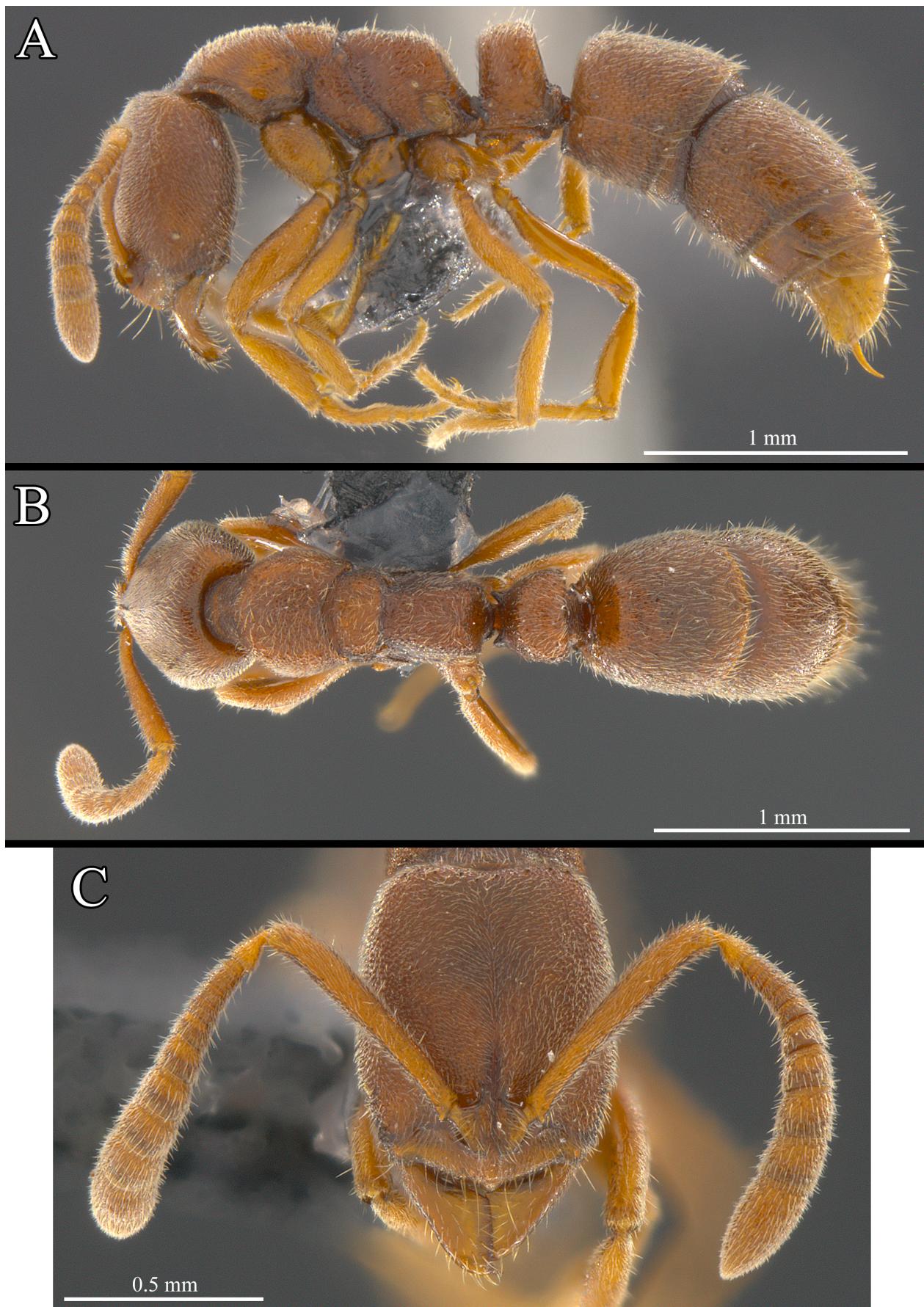
**Type material examined:** TAIWAN. Paratypes, 1 worker and 1 alate queen, Chiayi county, Fenchihu, ca. 1400 m alt., 3 III 1980, M Terayama leg (TARI), 1 worker and 1 alate queen, same collecting data (NIAES).

**Non-type material examined:** TAIWAN. 3 workers, 6 alate queens and 1 male, Chiayi county, Fenchihu, ca. 1400 m alt., 8 X 1997, WH Tsai leg (NTU: CMPon046, CMPon047, CMPon048, CMPon049, CMPon050, CMPon051, CMPon052, CMPon053, CMPon054, CMPon055).

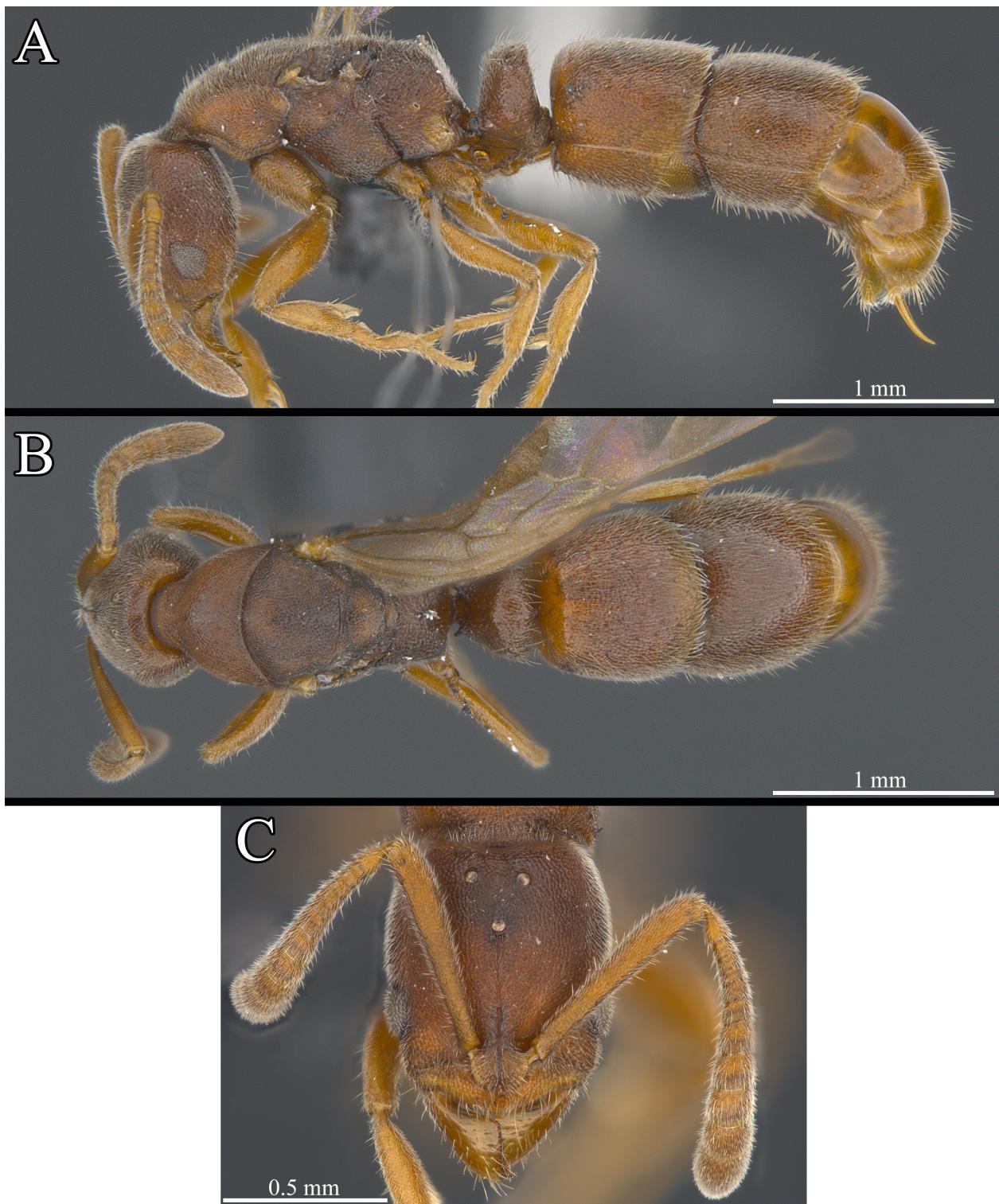
Measurements (mm) and indices. Workers (n=4): HL 0.76–0.81; HW 0.62–0.65; SL 0.61–0.66; A06L 0.05; A07L 0.06; A08L 0.09; A09L 0.10; A10L 0.11; PrW 0.45–0.53; WL 1.05–1.16; PeH 0.45–0.49; PeNL 0.24–0.27; PeW 0.35–0.38; ATL 0.53–0.55; ATW 0.61–0.65; CI 78–83, SI 98–105, PeI 70–79, LPeI 51–60, DPeI 141–151, ATI 85–89.

Queens (n=6): HL 0.82–0.84; HW 0.65–0.70; SL 0.64–72; A06L 0.06; A07L 0.07; A08L 0.09; A09L 0.10; A10L 0.12; PrW 0.60–0.65; WL 1.28–1.32; PeH 0.53–0.56; PeNL 0.25–0.29; PeW 0.42–0.43; ATL 0.62–0.64; ATW 0.72–79; CI 79–83, SI 103–106, PeI 66–72, LPeI 45–52, DPeI 146–171, ATI 81–87.

Male (n=1): HL 0.62; HW 0.55; SL 0.06; PrW 0.77; WL 1.27; PeH 0.37; PeNL 0.20; PeW 0.30; ATL 0.62; ATW 0.60; CI 88, SI 11, PeI 39, LPeI 53, DPeI 151, ATI 104.



**FIGURE 31.** *P. alisana* worker (CMpon045), A: body, lateral view, B: body, dorsal view, C: head, full-face view.



**FIGURE 32.** *P. alisana* alate queen (CMPon050), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

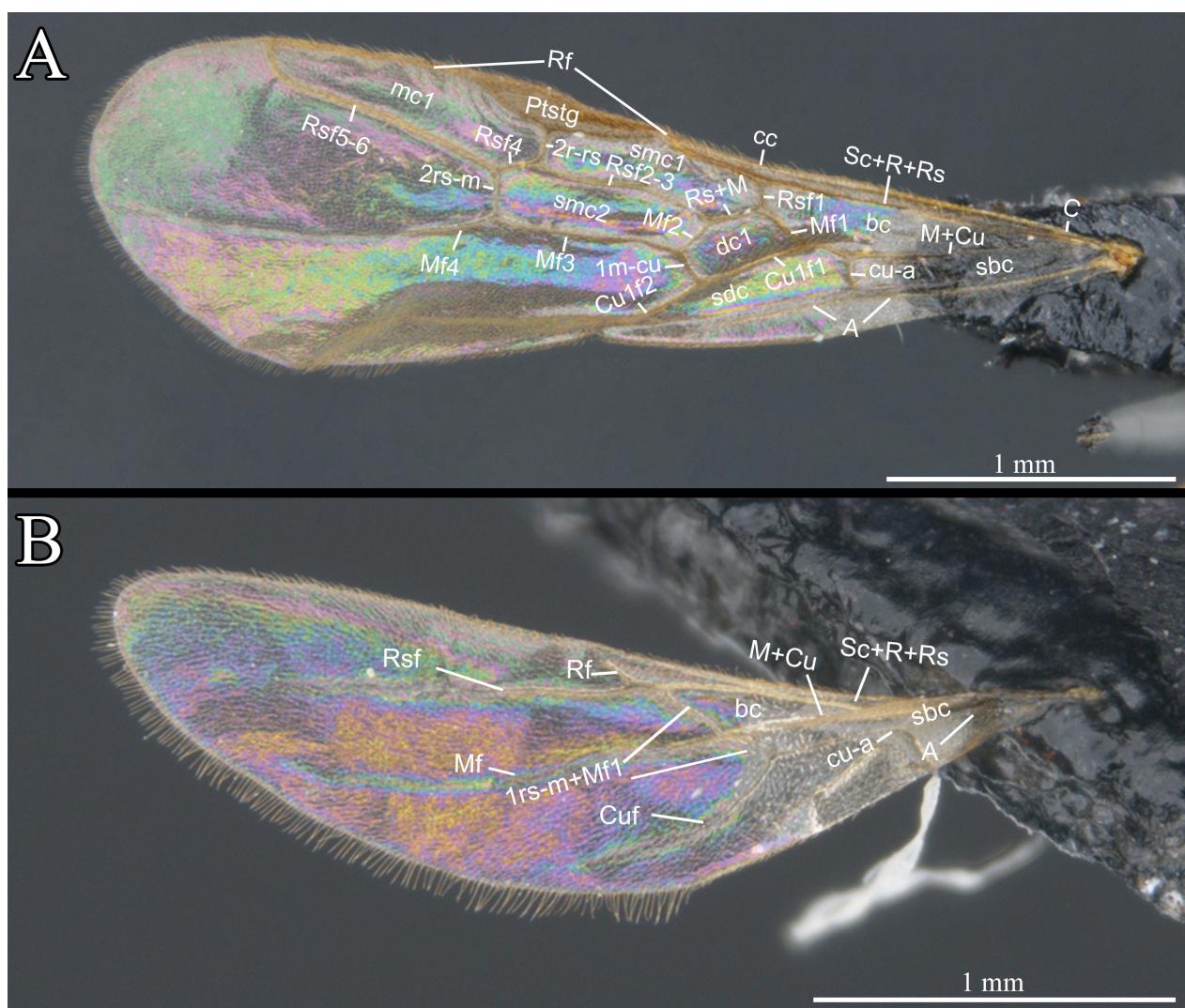
**Diagnosis (worker).** This large species (HW: 0.58–0.65 mm) is characterized by a long antennal scape exceeding the posterior margin of the head; a clypeus with acute medial tooth; a subpetiolar process with large teeth; and a deeply incised metanotal groove. *Ponera alisana* presents similarities with *P. nangonshan* but can be distinguished from the latter by the long antennal scape, which exceeds the posterior margin of head and the presence of an acute medial tooth on the clypeus (blunt medial tooth in *P. nangonshan*).

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 78–83), with concave posterior margin, convex lateral margins and strongly rounded posterolateral corners (Fig.

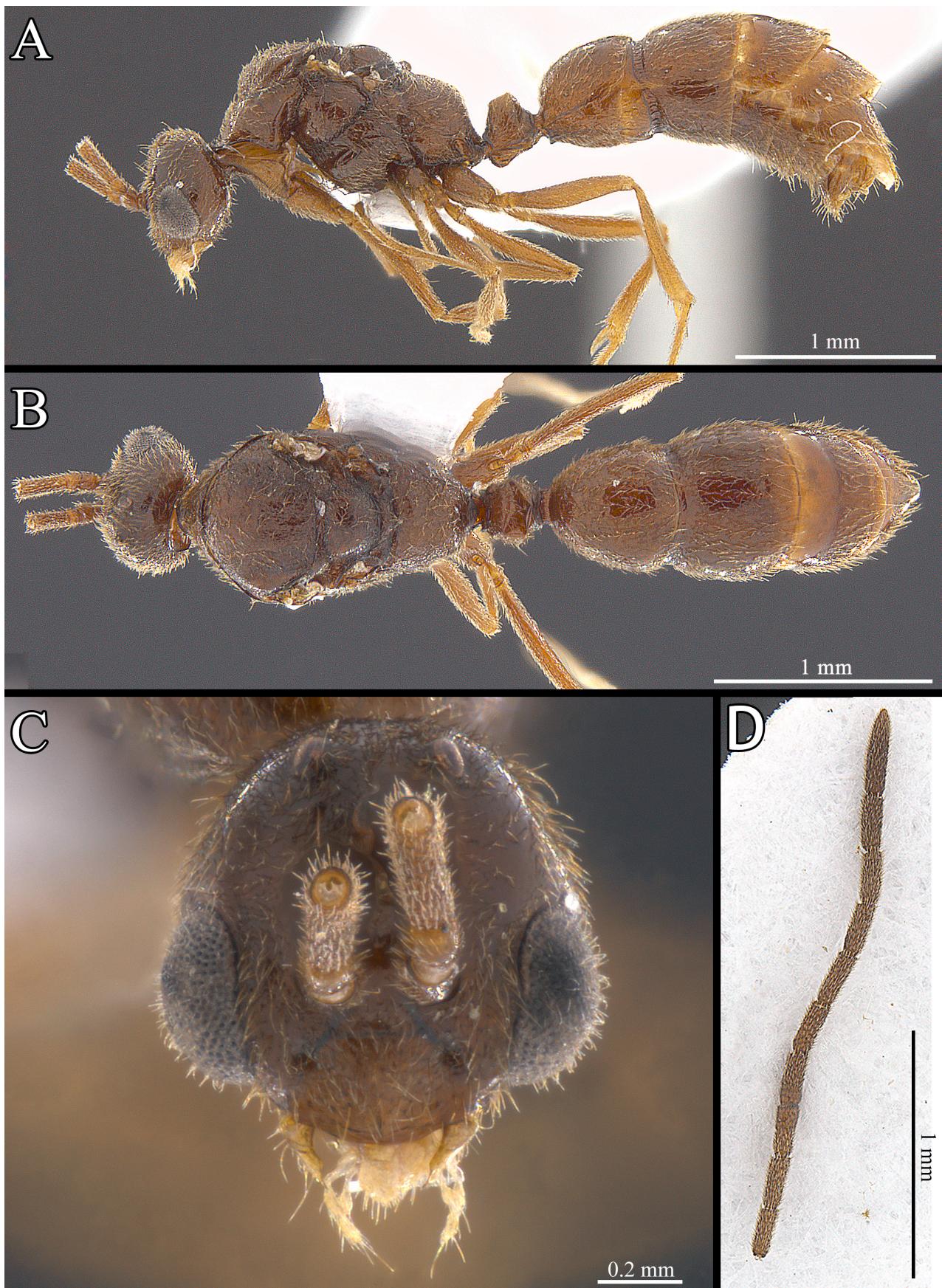
31C). Eye small; composed of a total of 3–4 indistinct facets. Anterior clypeal margin with strong and acute medial tooth. Masticatory margin of mandible with a series of about 15 indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, exceeding by about 10% of the scape length past the posterodorsal corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.19 : 1.93 : 2.17 : 2.26$  (n=4).

**Mesosoma.** Mesosomal dorsum in lateral view almost straight (Fig. 31A). Pronotum in dorsal view with acutely convex anterior margin, and broadly convex lateral margins (Fig. 31B). Metanotal groove in dorsal view and lateral view strongly and broadly incised. Lateral mesopleural suture in lateral view deeply incised. Propodeal dorsum in dorsal view broad with straight lateral margins, narrow anteriad. Posterodorsal corner of propodeum in lateral view angular, propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and arched, with slightly convex anterior margin, almost straight posterior margin, and broadly convex lateral margins (Fig. 31B). Petiolar node in lateral view moderately thick and rectangular, with straight anterior and posterior margins, and slightly convex dorsum, posterodorsal corner higher than anterodorsal corner (Fig. 31A). Subpetiolar process with big and oval fenestra, anteroventral corner blunt, concave ventral margin, and posteroventral corner concave with a pair of developed teeth. Third abdominal tergum distinctly broader than long (ATI: 85–89), with straight anterior margin and slightly convex lateral margins.



**FIGURE 33.** *P. alisana* alate queen (CMPon050), A: left-forewing, B: left-hindwing.



**FIGURE 34.** *P. alisana* male (CMPon049), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: antennae.



**FIGURE 35.** *P. alisana* male (CMPon049), A: left-forewing, B: right-hindwing.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Pronotum and mesonotum evenly punctate. Mesopleuron and metapleuron weakly striate. Propodeal dorsum sparsely punctate. Propodeum in lateral view with weakly striate lower portion and evenly punctate upper portion. Propodeal declivity smooth with few punctures. Lateral and anterior faces of petiole evenly punctate, smooth posterior face, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs; mesopleuron, metapleuron, propodeum and lateral face of petiole with scattered short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node and gaster with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color reddish brown. Mandible, clypeus, antennae, legs, and apex of gaster lighter.

**Description of queen. Head.** (Fig. 32C) Similar to worker caste, but with large and oval eye, maximum diameter of each eye about 0.20 mm with 11 ommatidia along the maximum diameter. Three ocelli present, and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.20 : 1.54 : 1.82 : 2.07$  ( $n=6$ ).

**Mesosoma.** Mesosomal dorsum in lateral view broadly convex (Fig. 32A). Pronotum in dorsal view with acutely convex anterior margin and broadly convex lateral margins (Fig. 32B). Scutum subtrapezoidal and narrow posteriad, with moderately convex anterior margin and straight posterior margin. Transcutal suture distinct. Scutellum oval. Anapleural sulcus distinctly incised. Propodeal-metapleural suture indistinct. Propodeal dorsum in dorsal view broad with straight lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively 115 degree angle.

**Metasoma.** Petiolar node in dorsal view thin and broader than long, with broadly convex anterior margin and slightly convex posterior margin (Fig. 32B). Petiolar node in lateral view thin and trapezoidal, with straight anterior and posterior margins; posterodorsal corner higher than anterodorsal corner (Fig. 32A). Subpetiolar process with

big and oval fenestra, anteroventral corner blunt, distinctly concave ventral margin, and posteroventral corner concave with a pair of developed teeth. The third abdominal segment similar to worker caste (ATI: 81–87).

**Sculpture.** Similar to worker caste; except metapleuron and lateral propodeum with increased puncture and striation.

**Pubescence.** Similar to worker caste; except metapleuron and lateral propodeum with increased short decumbent hairs.

**Wing.** Forewing (Fig. 33A): Rs<sub>f</sub>1 and M<sub>f</sub>1 forming a blunt angle; Rs<sub>f</sub>1 long, M<sub>f</sub>1 distinctly straight. M<sub>f</sub>2 long and straight, Rs+M juncture M<sub>f</sub>2 with distad 1m-cu, cell dc<sub>1</sub> subrectangular. 2rs-m juncture with Rs<sub>f</sub>4 distad 2r-rs; Rs<sub>f</sub>4 and Rs<sub>f</sub>2–3 with triangular gap. M<sub>f</sub>1 diverging from M+Cu distad cu-a. Cell smc<sub>2</sub> distinctly shorter than cell mc<sub>1</sub>. Hindwing (Fig. 33B): A vein reaching wing outer margin, but Rs<sub>f</sub>, Cuf, M<sub>f</sub> almost reaching outer margin.

**Color.** Similar to worker caste.

**Description of male. Head.** In full-face view, head circular and longer than broad (CI: 88), excluding eye (Fig. 34C). Three ocelli present, and forming an equilateral triangle. Compound eye in lateral view big and oval, with convex anterior margin and straight posterior margin, the maximum diameter of each eye about 0.28 mm with 20 ommatidia along the maximum diameter. Labrum suboval, with convex anterior margin, and as long as the mandible. Palpal formula 4, 2; third maxillary palpomere slightly shorter than fourth maxillary palpomere; second labial palpomere broader than first labial palpomere, and 1/3 times as long as first labial palpomere. Mandible subtriangular with convex medial margin and straight lateral margins, masticatory margin edentate with sharp apex. A total of 13 antennal segments, scape short; the average ratio of the length of antennomeres approximately 1<sup>st</sup> to 13<sup>th</sup> = 1.0: 1.3: 4.1: 3.4: 3.9: 3.7: 3.7: 3.7: 4.2: 3.6: 3.6: 3.6: 5.9 from base (n=1).

**Mesosoma.** Mesosomal dorsum in lateral view uneven, with sub-right anterior corner (Fig. 34A). Scutum in dorsal view well-developed and large, with broadly convex anterior margin, slightly convex lateral and posterior margins (Fig. 34B). Scutum in lateral view broadly convex. Transcutal suture distinct and broad. Scutellum subcircular. Anapleural sulcus distinctly and clearly incised. Propodeal-metapleural suture weakly incised. Propodeal dorsum in dorsal view broad. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 130 degree angle. Each fore, middle and hind leg bearing one pectinate tibial spur.

**Metasoma.** Petiolar node in dorsal view thin, and broader than long. Petiolar node in lateral view look subtriangular (broken), with straight and sloping anterior and posterior margins (Fig. 34A). Subpetiolar process subtriangular without fenestra. Third abdominal tergum arched (ATI: 64), and third abdominal sternum prior with a small spine. Helcium broad and crossribbed. Pygidium triangular, apex forming a median spine. Hypopygium subtriangular.

**Sculpture.** Head sparsely punctate. Pronotum in dorsal view with abundance short striae forming two striped lines, with longitudinal striae on their posterior portion. Posterior portion of scutum with longitudinal striae. Anepisternum evenly punctate. Katepisternum and mesopleuron with scattered striae. Posterdorsal portion of propodeum evenly punctate. Propodeal declivity smooth with few punctures. Dorsal face of petiole smooth evenly punctate, smooth posterior face. The third and fourth abdominal segments with sparsely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Body with evenly distributed short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node and gaster with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Wing.** Similar to gyne caste, except for Cu<sub>1f</sub>1 slightly convex in forewing (Figs. 33, 35).

**Color.** Body color reddish brown; mandible, antennae, legs, and apex of gaster lighter.

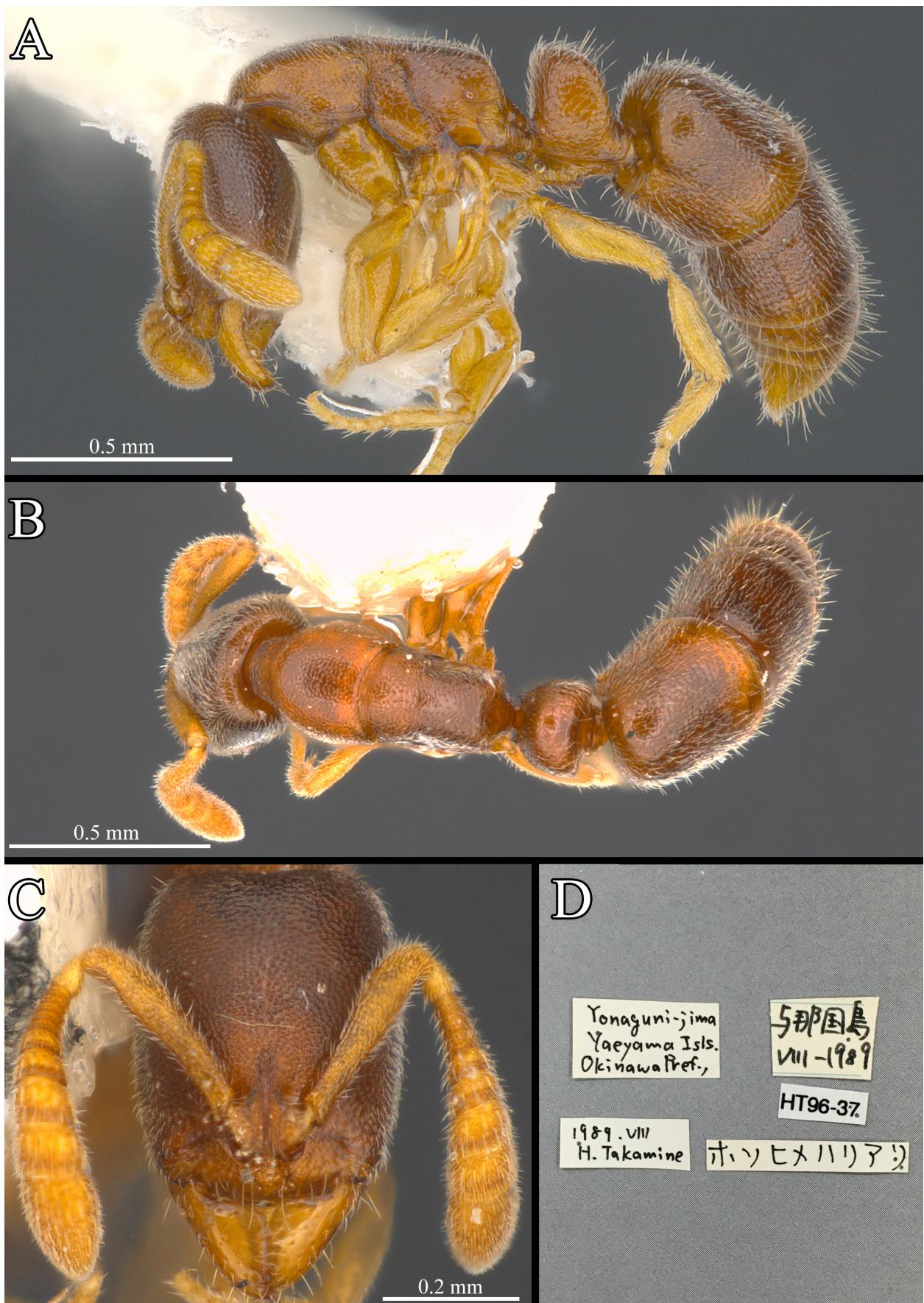
**Distribution.** Japan (Yakushima Island), Taiwan (Chiyai county: Fenchihu).

### ***Ponera bishamon* Terayama, 1996**

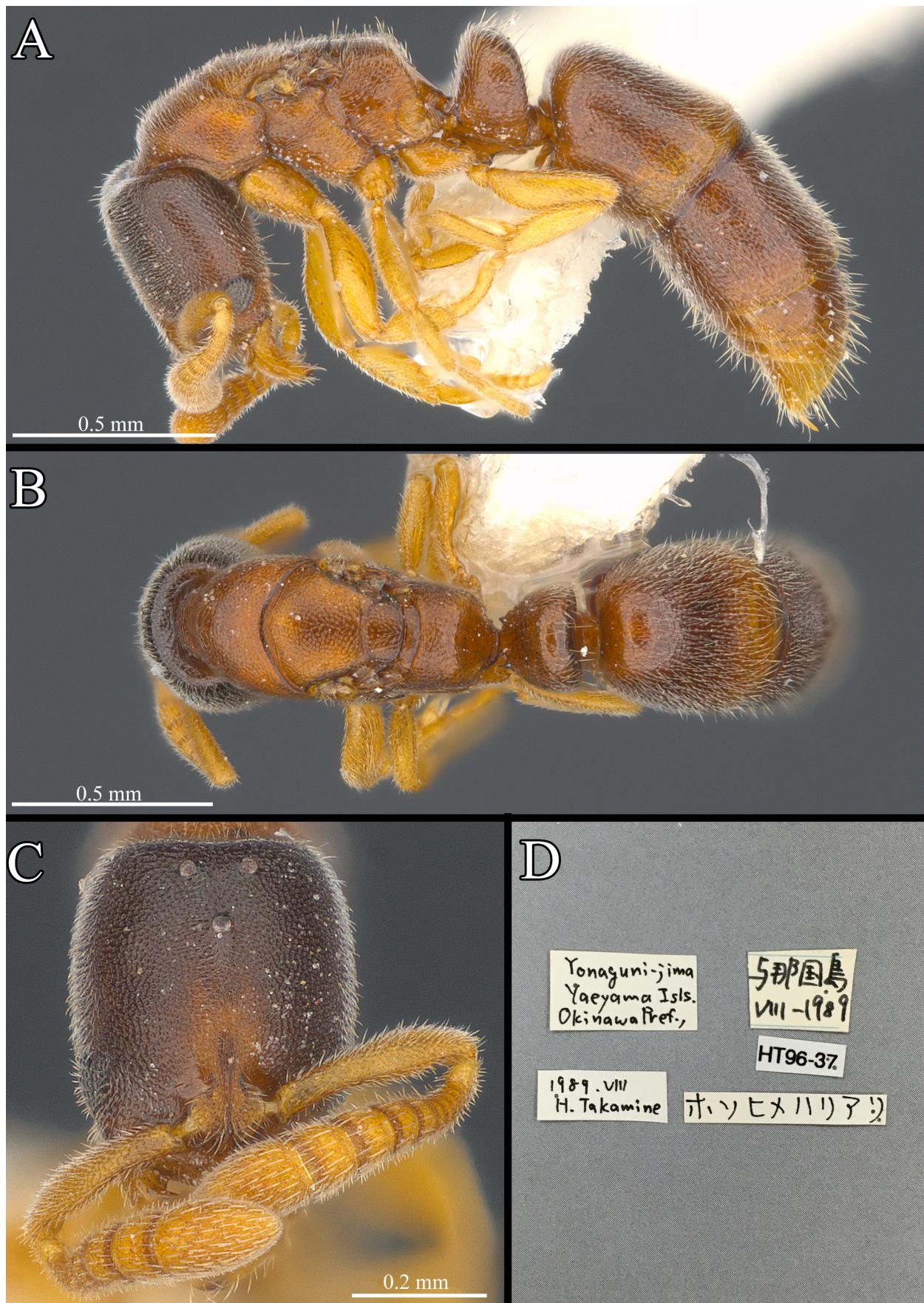
(Fig. 36: worker; Fig. 37: dealate queen)

*Ponera bishamon* Terayama, 1996: 13 (w.). Type locality: Japan, Okinawa Pref., Iriomote-Jima.

**Non-type material examined: JAPAN.** 3 workers and 1 dealate queen, Okinawa Pref., Yaeyama Is., Yonaguni-Jima, VIII 1989, H Takamine leg (MTC: LCM\_MT-Ponera-06), identified by Dr. Mamoru Terayama.



**FIGURE 36.** *P. bishamon* worker (LCM\_MT-Ponera-06c), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 37.** *P. bishamon* dealate queen (LCM\_MT-Ponera-06a), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.

Measurements (mm) and indices. Workers (n=3): HL 0.47–0.49; HW 0.38–0.39; SL 0.30–0.31; A06L 0.02; A07L 0.02; A08L 0.03; A09L 0.05; A10L 0.06; PrW 0.29–0.30; WL 0.64–0.65; PeH 0.30–0.32; PeNL 0.17–0.18; PeW 0.24–0.25; ATL 0.39–0.41; ATW 0.37–0.38; CI 77–84, SI 79, PeI 82–85, LPeI 54–58, DPeI 135–149, ATI 105–109.

Queen (n=1): HL 0.52; HW 0.42; SL 0.31; A06L 0.02; A07L 0.02; A08L 0.04; A09L 0.05; A10L 0.07; PrW 0.36; WL 0.73; PeH 0.34; PeNL 0.17; PeW 0.28; ATL 0.46; ATW 0.44; CI 82, SI 73, PeI 77, LPeI 50, DPeI 163, ATI 105.

**Diagnosis (worker).** This species is characterized by a short antennal scape; a clypeal margin with a blunt tooth; the third abdominal tergum longer than broad; and a petiolar node subtrapezoidal with slightly convex posterior margin. *Ponera bishamon* is similar to *P. yuhuang*, *P. taiyangshen*, *P. japonica*, *P. pianmana*, and *P. terayamai* sp. n., but can be distinguished from *P. yuhuang*, *P. taiyangshen*, *P. japonica*, and *P. pianmana* by its third abdominal tergum longer than broad. In dorsal view, the petiolar node is narrower in *P. bishamon* than in *P. terayamai* sp. n., and the medial tooth on the clypeal margin is blunt.

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 77–84), with slightly convex posterior margin, slightly convex lateral margins and broadly rounded posterolateral corners (Fig. 36C). Eye small; composed of a total of 3–4 indistinct facets. Anterior clypeal margin with blunt medial tooth. Masticatory margin of mandible with a series of about 13 indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 10% of the scape length to

the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.16 : 1.97 : 3.19 : 3.84$  (n=3).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 36A). Pronotum in dorsal view with acutely convex anterior margin and moderately convex lateral margins (Fig. 36B). Metanotal groove distinctly and finely incised. Lateral mesopleural suture superficially incised. Propodeal dorsum in dorsal view broad, with straight lateral margins. Propodeal corner in lateral view angular, propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view arched, with well convex anterior margin, slightly concave posterior margin, and convex lateral margins (Fig. 36B). Petiolar node in lateral view moderately thick and subtrapezoid, with straight anterior margin, slightly convex posterior margin, and convex dorsal margin; posterodorsal corner lower than anterodorsal corner (Fig. 36A). Subpetiolar process with medium and circular fenestra, anteroventral corner blunt, straight ventral margin, and posteroventral corner concave with a pair of small teeth. Third abdominal tergum slightly longer than broad (ATI: 105–109), with moderately convex anterior margin and well convex lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Pronotum and mesonotum evenly punctate. Mesopleuron evenly striate. Metapleuron with weakly striate lower portion and smooth upper portion. Propodeum with smooth lower portion and evenly punctate upper portion. Propodeal declivity smooth. Lateral face of petiole evenly punctate, posterior face smooth, dorsum sparsely punctate. The third and fourth abdominal segments densely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with scattered short hairs, but glabrous in the lower portion of propodeum. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node and gaster with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color dark brown. Mandible, clypeus, antennae, legs, and apex of gaster yellowish orange.

**Description of queen. Head.** (Fig. 37C) Similar to worker caste, but with large and oval Eye, maximum diameter of each eye about 0.09 mm with 7 ommatidia along the maximum diameter. Three ocelli present, and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.20 : 2.47 : 3.27 : 4.40$  (n=1).

**Mesosoma.** Mesosomal dorsum in lateral view broadly convex (Fig. 37A). Pronotum in dorsal view with acutely convex anterior margin, and broadly convex lateral margins (Fig. 37B). Scutum subtrapezoidal, narrow posteriad, with moderately convex anterior margin and straight posterior margin. Transcutal suture distinct and broad. Scutellum suboval. Anapleural sulcus weakly incised. Propodeal-metapleural suture indistinct. Propodeum

broad with straight lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 115 degree angle.

**Metasoma.** Petiolar node in dorsal view very thin, broader than long, with broadly convex anterior margin, slightly concave posterior margin (Fig. 37B). Petiolar node in lateral view subtrapezoidal and thin, with straight anterior margin, and slightly convex posterior margin (Fig. 37A). Subpetiolar process with small and circular fenestra, anteroventral corner blunt, straight ventral margin, and posteroventral corner concave with a pair of small teeth. The third abdominal segment similar to worker caste (ATI: 105).

**Sculpture.** Similar to worker caste; except metapleuron and lateral propodeum with increased puncture and striation.

**Pubescence.** Similar to worker caste; except metapleuron and lateral propodeum with increased short decumbent hairs.

**Color.** Similar to worker caste.

**Description of male.** Unknown.

**Distribution.** Japan (Iriomote-Jima and Yonaguni-Jima).

### ***Ponera chiponensis* Terayama, 1986**

(Fig. 38: worker; Fig. 39: dealate queen)

*Ponera chiponensis* Terayama, 1986: 593 (w. q.). Type locality: Taiwan, Taitung City, Chihpen.

**Type material examined: TAIWAN.** Paratypes, 2 workers, Taitung City, Chihpen, 22 VII 1982, M Terayama leg (MTC: LCM\_MT-Ponera-17). 1 worker, Taitung city, Chihpen, 24 VII 1982, M Terayama leg (MTC: LCM\_MT-Ponera-18). 1 dealate queen, Taitung city, Chihpen, 24 VII 1982, M Terayama leg (TARI).

**Non-type material examined: TAIWAN.** 1 worker, Taitung county, Chihpen, 8 IX 1988, CC Lin leg. 2 workers, 22.16°N; 120.73°E, ca. 700m alt., Pingtung county, Lilung, 31 I 2016, FC Hsu leg (CMPon061, CMPon062, CMPon063).

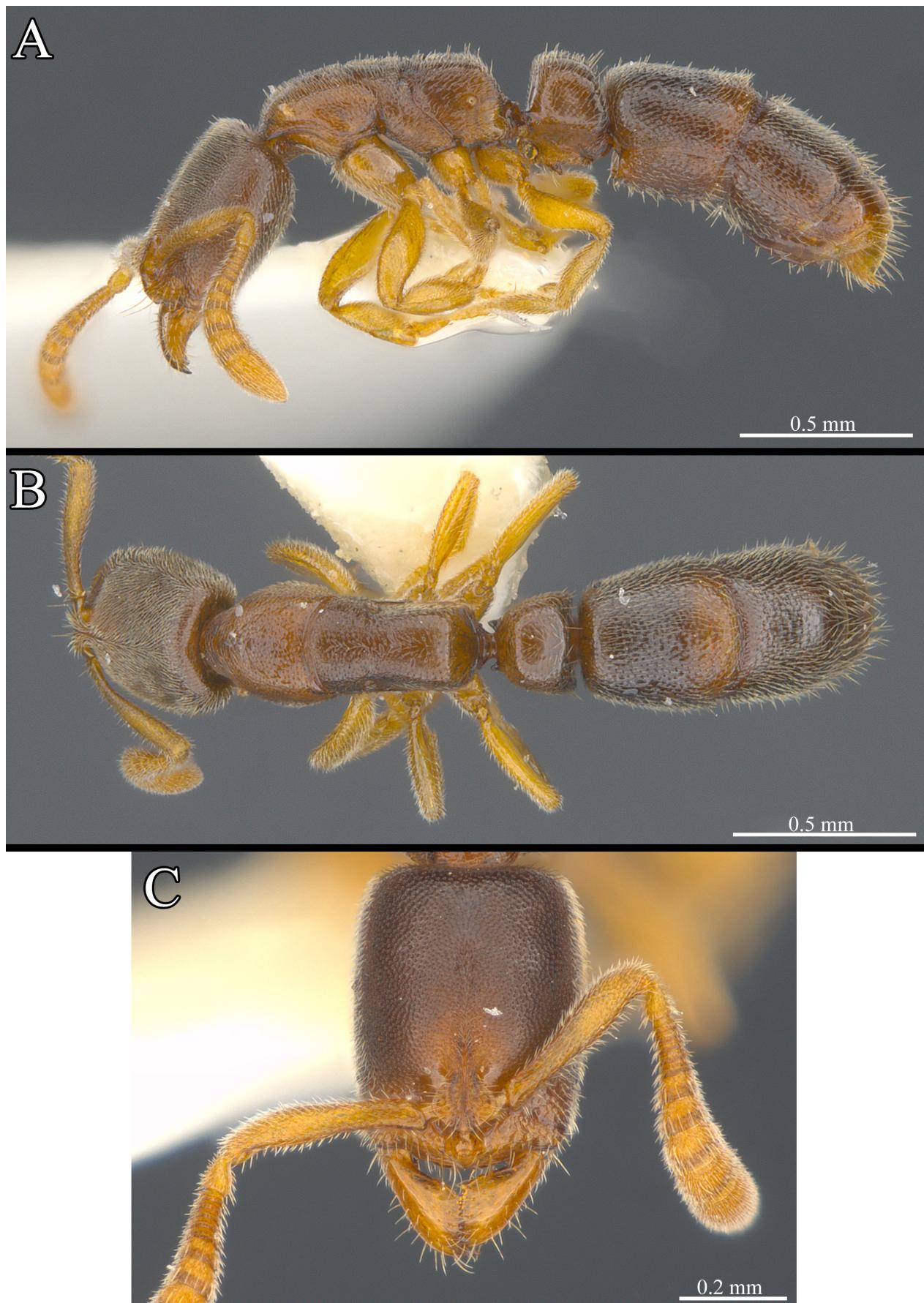
Measurements (mm) and indices. Workers (n=6): HL 0.50–0.56; HW 0.39–0.43; SL 0.32–0.37; A06L 0.02; A07L 0.02; A08L 0.04; A09L 0.06; A10L 0.07; PrW 0.32–0.33; WL 0.64–0.71; PeH 0.30–0.34; PeNL 0.18–0.22; PeW 0.26–0.29; ATL 0.39–0.40; ATW 0.40–0.41; CI 77–78, SI 81–86, PeI 81–86, LPeI 61–67, DPeI 128–148, ATI 93–98.

Queen (n=1): HL 0.53; HW 0.42; SL 0.36; A06L 0.02; A07L 0.02; A08L 0.04; A09L 0.06; A10L 0.08; PrW 0.37; WL 0.81; PeH 0.35; PeNL 0.21; PeW 0.29; ATL 0.41; ATW 0.43; CI 78, SI 86, PeI 86, LPeI 67, DPeI 148, ATI 98.

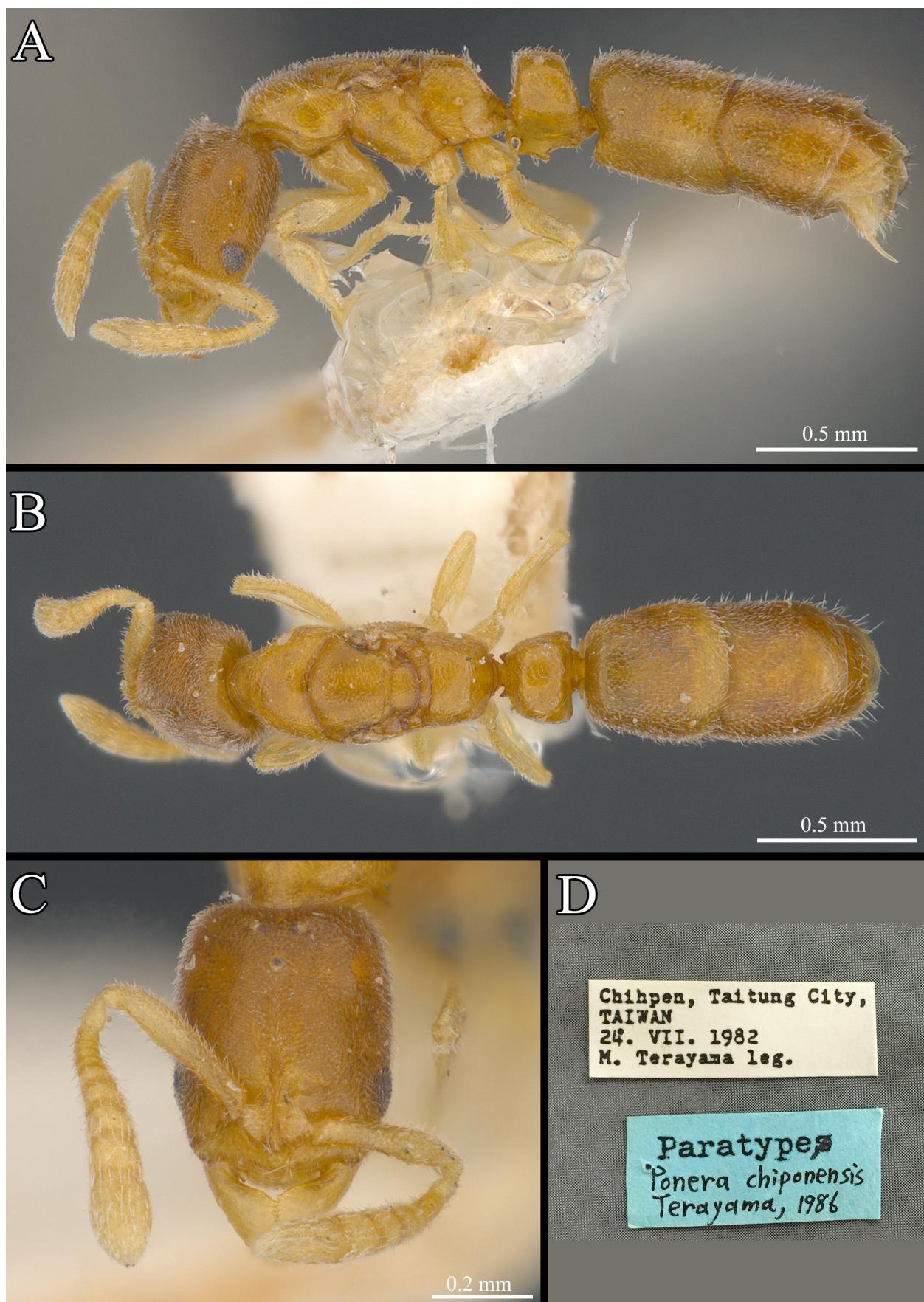
**Diagnosis (worker).** This species is characterized by a short antennal scape; a petiolar node in lateral view thick and trapezoid, with a slightly convex posterior margin; a subpetiolar process with large fenestra and large teeth; and its third abdominal tergum as long as broad. *Ponera chiponensis* presents similarities with *Ponera baka*, *P. xantha*, and *P. swazeyi*, but the body size of *P. chiponensis* (HW: 0.39–0.43 mm) is larger than *P. baka* (HW: ca. 0.33 mm), *P. xantha* (HW: ca. 0.35 mm), and *P. swazeyi* (HW: 0.32–0.34 mm). The posterior margin of the petiolar node is convex in *Ponera chiponensis*, but straight in *P. baka*, *P. xantha*, and *P. swazeyi*.

**Description of worker. Head.** In full-face view, head rectangular and distinctly longer than broad (CI: 77–78), with almost straight posterior margin, slightly convex lateral margins, and broadly rounded posterolateral corners (Fig. 38C). Eye small; composed of a total of 3–4 indistinct facets. Anterior clypeal margin with blunt medial tooth. Masticatory margin of mandible with a series of about seven indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 10% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.06 : 1.88 : 2.69 : 3.39$  (n=6).

**Mesosoma.** Mesosomal dorsum in lateral view almost straight (Fig. 38A). Pronotum in dorsal view with acutely convex anterior margin and moderately convex lateral margins (Fig. 38B). Metanotal groove distinctly and



**FIGURE 38.** *P. chiponensis* worker (CMPon062), A: body, lateral view, B: body, dorsal view, C: head, full-face view.



**FIGURE 39.** *P. chiponensis* paratype dealate queen, A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.

finely incised. Lateral mesopleural suture in lateral view weakly incised. Propodeal dorsum in dorsal view broad, with straight lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 125 degree angle.

**Metasoma.** Petiolar node in dorsal view trapezoidal and remarkably thick, with almost straight anterior margin, slightly convex posterior margin, and slightly convex lateral margins (Fig. 38B). Petiolar node in lateral view remarkably thick and trapezoid, with straight anterior margin, moderately convex posterior margin, and slightly convex dorsal margin; posterodorsal corner as high as anterodorsal corner (Fig. 38A). Subpetiolar process large with very big and circular fenestra, anteroventral corner blunt, ventral margin concave, and posteroventral corner concave with a pair of developed and acute teeth. Third abdominal tergum slightly broader than long (ATI: 93–98), with straight anterior margin and almost straight lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Pronotum and mesonotum evenly punctate. Mesopleuron, metapleuron evenly striate. Propodeal dorsum sparsely punctate. Propodeum in lateral view with evenly striate lower portion and evenly punctate upper portion. Propodeal declivity smooth and shining. Lateral face of petiole evenly punctate, posterior face smooth, dorsum sparsely punctate. The third and fourth abdominal segments densely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs; mesopleuron, metapleuron, propodeum and lateral face of petiole with scattered hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node and gaster with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color dark brown. Mandible, clypeus, antennae, legs, and apex of gaster yellowish orange.

**Description of queen.** See Terayama (1996); the morphology similar to worker caste as shown in Fig. 39, but the exoskeleton of the examined specimens cannot be examined in order to redescribe.

**Description of male.** Unknown.

**Distribution.** Taiwan (Taitung county: Chihpen and Lilung).

### *Ponera japonica* Wheeler, 1906

(Fig. 40: worker)

*Ponera japonica* Wheeler, 1906: 306 (w. q.). Type locality: Japan, Kanagawa Prefecture, Hakone Mountains.

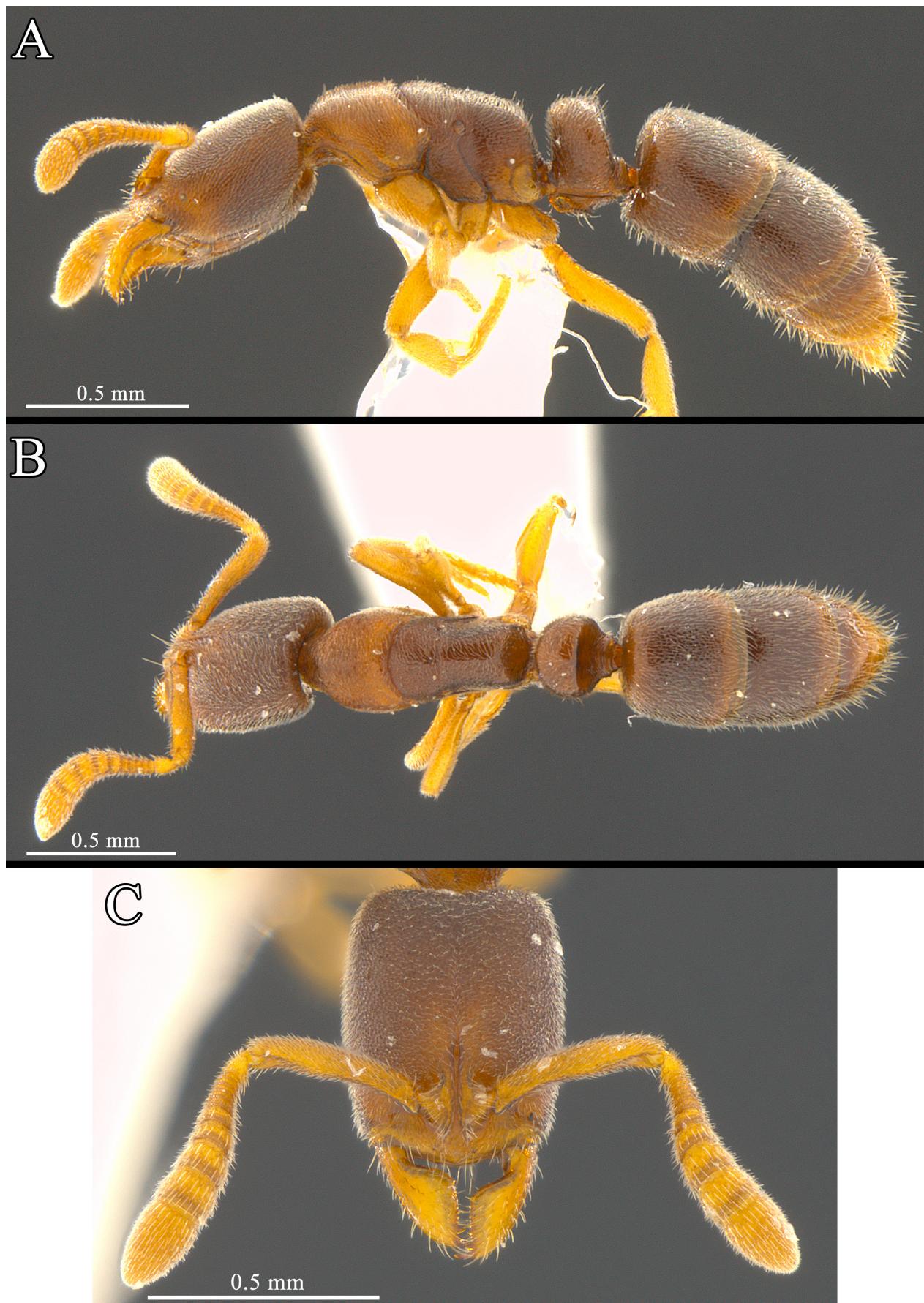
*Ponera japonica* var. *crocea* Santschi, 1941: 273 (w.). Synonym by Taylor, 1967: 67; Kupyanskaya 1990: 86.

**Non-type material examined: JAPAN.** 1 worker, Hakone, Kanagawa Pref., Ashigarashimo Dist., 23 V 1986, T. Tanabe leg (CMPon173). 1 worker, Kagoshima Pref Kirishima Mts., Ohnaminio-ike trl., 24 IX 2008, Sk Yamane leg (CMPon174). 1 worker, Tokyo, Itsukaichi, Ina, 6 X 1994, H Takamine leg (MTC: LCM\_MT-Ponera-07).

**TAIWAN.** 1 worker, 18 X 2016, Nantou county, Xitou, PC Hsu leg (CMPon086). 1 worker, Taipei city, Yangmingshan, 25.188°N; 121.567°E, 390 m alt., 15 V 2016, CM Leong leg (CMPon045).

Measurements (mm) and indices. Workers (n=5) HL 0.50–0.58; HW 0.41–0.47; SL 0.32–0.38; A06L 0.02; A07L 0.03; A08L 0.05; A09L 0.06; A10L 0.08; PrW 0.30–0.36; WL 0.69–0.76; PeH 0.31–0.35; PeNL 0.16–0.19; PeW 0.24–0.28; ATL 0.33–0.39; ATW 0.39–0.47; CI 79–83, SI 78–86, PeI 80–84, LPeI 51–56, DPeI 143–154, ATI 82–86.

**Diagnosis (worker).** This species is characterized by a short antennal scape; a posterior margin of head convex; a petiolar node in dorsal view arched with a straight posterior margin; and a petiolar node in lateral view with a straight and slightly sloping posterior margin. *Ponera japonica* presents similarities with *P. incerta*, *P. tenuis*, *P. pianmana*, *P. taiyangshen*, and *P. yuhuang*, however the following differences are noted. The median clypeal tooth is distinct and developed in *P. japonica*, but indistinct in *P. incerta*. *Ponera japonica* has a five segmented club, but four segmented club in *P. tenuis*. The posterior margin of the petiolar node in lateral view is straight in *P. japonica*, but slightly convex in *P. pianmana*. *Ponera japonica* presents a blunter posterodorsal corner of the petiolar node in lateral view than in *P. taiyangshen*; with also the posterior margin of the petiolar node straight in *P. japonica*, but slightly convex in *P. taiyangshen*. *Ponera japonica* also presents a subpetiolar teeth, which is absent in *P. yuhuang*.



**FIGURE 40.** *P. japonica* worker (CMPon173), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 79–83), with concave posterior margin, slightly convex lateral margins, and rounded posterolateral corners (Fig. 40C). Eye small; composed of a total of 4 to 6 indistinct facets. Anterior clypeal margin with blunt medial tooth. Masticatory margin of mandible with a series of about 11 indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 12–14% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.18 : 2.11 : 2.93 : 4.06$  (n=5).

**Mesosoma.** Mesosomal dorsum in lateral view convex. Pronotum in dorsal view with acutely convex anterior margin and slightly convex lateral margins (Fig. 40B). Metanotal groove thin and clearly incised. Lateral mesopleural suture distinctly incised. Propodeal dorsum in dorsal view broad with straight lateral margins. Propodeal dorsum and declivity forming approximatively a 125 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and arched, with well convex anterior margin, and straight posterior margin. Petiolar node in lateral view moderately thick and trapezoidal, with straight anterior and posterior margins, and convex dorsal margin. Subpetiolar process with medium-sized and oval fenestra, blunt anteroventral corner, slightly concave ventral margin, and posteroventral corner concave with small teeth. Third abdominal tergum distinctly broader than long (ATI: 82–86), with slightly convex anterior margin, and straight posterior margin.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Propodeum evenly punctate. Mesonotum and propodeal dorsum scatteredly punctate. Mesopleuron with weakly striate lower portion and scatteredly punctate upper portion. Metapleuron with weakly striate lower portion, but with smooth upper portion. Propodeal declivity smooth and shining. Petiolar node sparsely punctate, with smooth posterior face, dorsum with few superficial punctures. The third and fourth abdominal segments densely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head with dense short hairs. Mesosoma with evenly distributed short hairs; lower metapleuron with few short hairs, but glabrous in upper portion. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color brown. Mandible, clypeus, antennae, legs, and apex of gaster yellowish orange.

**Description of queen.** See Wheeler (1906).

**Description of male.** Unknown.

**Distribution.** South Korea, North Korea, Japan, and Taiwan (record confirmed with specimens collected from Nantou county: Xitou, Taipei city: Yangmingshan).

### *Ponera kohmoku* Terayama, 1996

(Fig. 41: worker; Fig. 42: dealate queen)

*Ponera kohmoku* Terayama, 1996: 9 (w. q.). Type locality: Japan, Kagoshima Pref., Yaku-shima, Kurio.

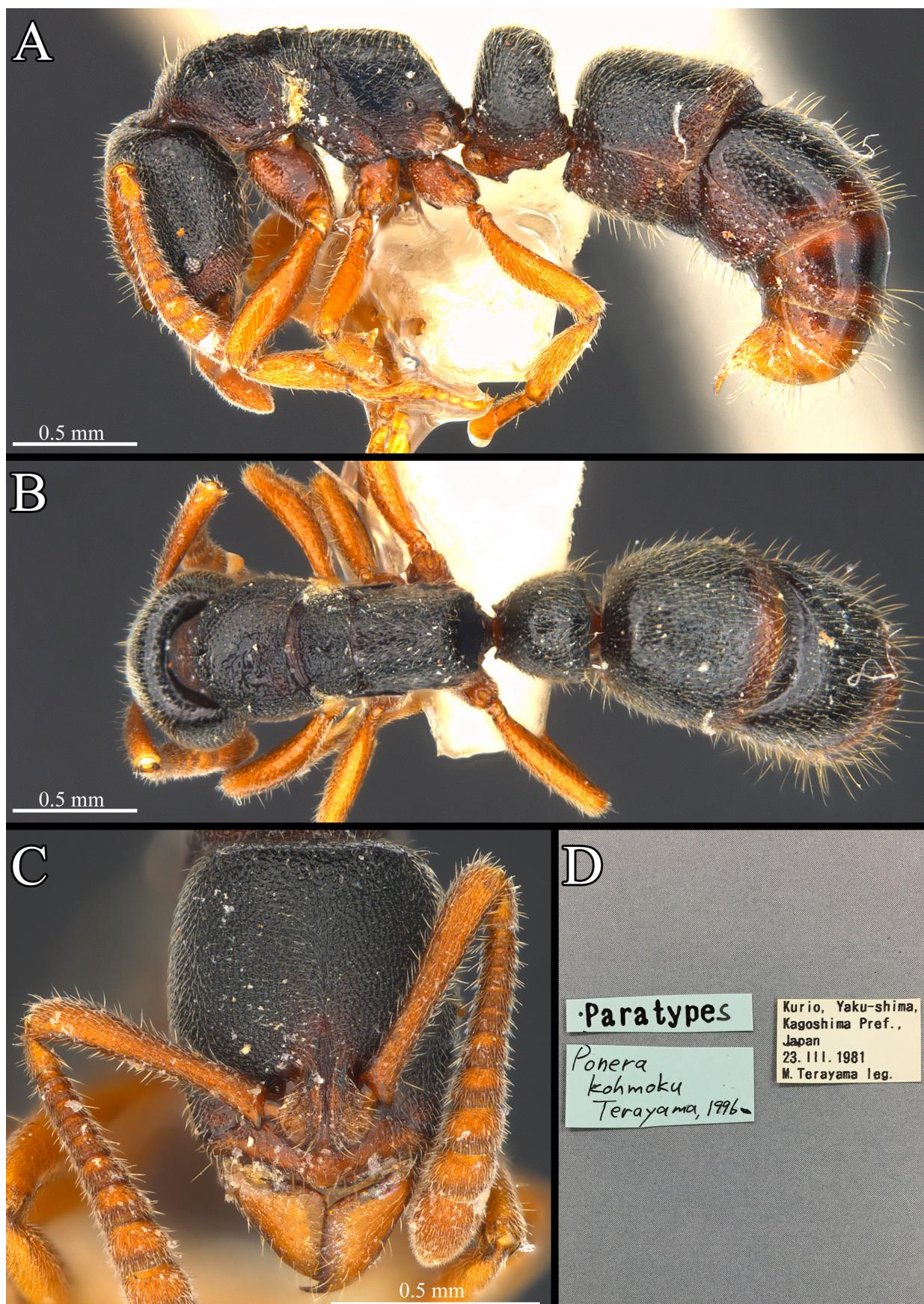
*Ponera scabra*: Santschi, 1937: 364 (**misidentification**).

**Type material examined: JAPAN.** Paratypes, 6 workers and 1 dealate queen, Kurio, Yaku-shima, Kagoshima Pref., 23 III 1981, M Terayama leg (MTC: LCM\_MT-Ponera-13, LCM\_MT-Ponera-14, LCM\_MT-Ponera-15). 1 worker, Sata-Misaki, Kagoshima Pref., 10 III 1981, M Terayama leg (LCM\_MT-Ponera-16).

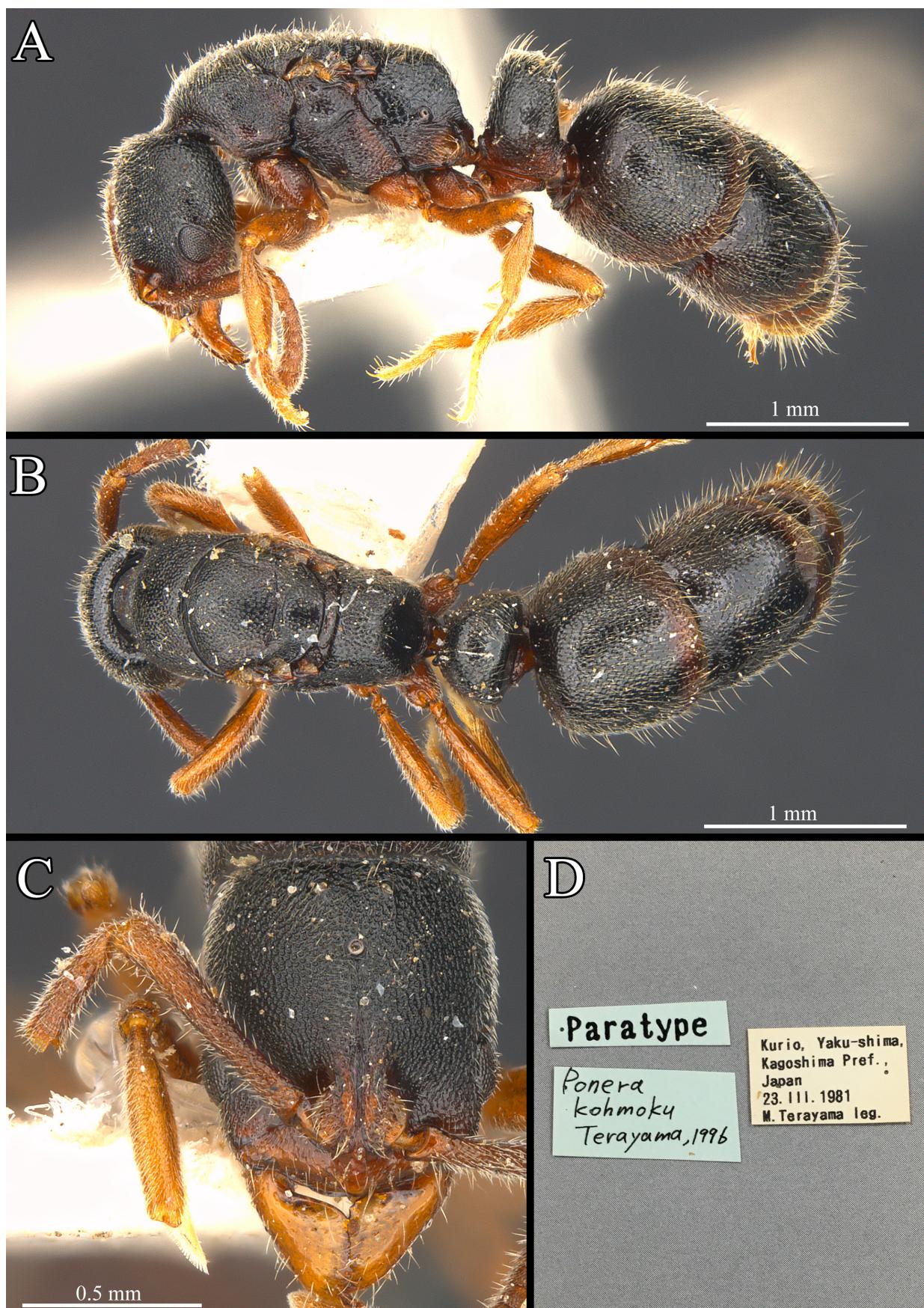
**Diagnosis (worker).** *Ponera kohmoku* can be easily distinguished by the large eye, consisting of about 20 indistinct facets.

Measurements (mm) and indices. Workers (n=6): HL 0.83–0.89; HW 0.70–0.77; SL 0.61–0.68; A06L 0.05; A07L 0.05; A08L 0.08; A09L 0.10; A10L 0.11; PrW 0.57–0.65; WL 1.06–1.29; PeH 0.62–0.65; PeNL 0.34–0.37; PeW 0.44–0.51; ATL 0.63–0.71; ATW 0.76–0.80; CI 80–87, SI 82–91, PeI 73–82, LPeI 54–58, DPeI 124–143, ATI 81–89.

Queen (n=1): HL 0.94; HW 0.81; SL 0.71; A06L 0.06; A07L 0.06; A08L 0.09; A09L 0.11; A10L 0.11; PrW 0.75; WL 1.52; PeH 0.74; PeNL 0.37; PeW 0.55; ATL 0.80; ATW 0.90; CI 86, SI 88, PeI 74, LPeI 50, DPeI 150, ATI 88.



**FIGURE 41.** *P. kohmoku* paratype worker (LCM\_MT-Ponera-13b), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 42.** *P. kohmoku* paratype dealate queen (LCM\_MT-Ponera-14c), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 80–87), with straight posterior margin, moderately convex lateral margins, and bluntly rounded posterolateral corners (Fig. 41C). Eye large; composed of a total of 18–22 indistinct facets. Anterior clypeal margin with strong and blunt medial tooth. Masticatory margin of mandible with a series of about ten indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, exactly reaching the posterolateral corner;

average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.16 : 1.68 : 1.98 : 2.24$  (n=6).

**Mesosoma.** Mesosomal dorsum in lateral view slightly convex (Fig. 41A). Pronotum in dorsal view with broadly convex anterior margin, and moderately convex lateral margins (Fig. 41B). Metanotal groove deeply and broadly incised. Lateral mesopleural suture clearly incised. Propodeal dorsum in dorsal view narrow, with straight lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 130 degree angle.

**Metasoma.** Petiolar node in dorsal view subcircular and thick, with well convex anterior margin, and moderately convex posterior margin (Fig. 41B). Petiolar node in dorsal view well thick and subtrapezoid, with straight anterior and posterior margins, and slightly convex dorsal margin (Fig. 41A). Subpetiolar process thick with medium-sized and oval fenestra, anteroventral corner blunt, straight ventral margin, and posteroventral corner concave with a pair of medium-sized teeth. Third abdominal tergum broader than long (ATI: 81–89) and narrow anteriad, with broadly convex anterior margin, and well convex lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosomal dorsum in dorsal view evenly punctate. Mesopleuron, metapleuron and propodeum evenly striate. Propodeal declivity smooth and shining. Lateral face of petiole evenly punctate, posterior face smooth, dorsum rough and evenly punctate. The third and fourth abdominal segments densely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with scattered short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node and gaster with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color dark. Mandible, clypeus, antennae, legs, and apex of gaster orange.

**Description of queen. Head.** (Fig. 42C) Similar to worker caste, but with large and oval Eye, maximum diameter of each eye about 0.21 mm with 15 ommatidia along the maximum diameter. Three ocelli present, and forming a subequilateral triangle. In full-face view, scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.07 : 1.53 : 1.80 : 1.85$  (n=1).

**Mesosoma.** Mesosomal dorsum in lateral view broadly convex (Fig. 42A). Pronotum in dorsal view with convex anterior margin, and broadly convex lateral margins (Fig. 42B). Scutum suboval and narrow posteriad, with moderately convex anterior margin, and slightly convex posterior margin. Transcutal suture distinct and broad. Scutellum suboval. Anapleural sulcus clearly incised. Propodeal-metapleural suture weakly incised. Propodeal dorsum in dorsal view broad, with straight lateral margins. Propodeal corner rounded; propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and arched, broader than long, with broadly convex anterior margin, and slightly convex posterior margin (Fig. 42B). Petiolar node in lateral view subrectangular and moderately thick, with straight anterior and posterior margins (Fig. 42A). Subpetiolar process with large and oval fenestra, anteroventral corner blunt, ventral margin straight, and posteroventral corner concave with a pair of small teeth. The third abdominal segment similar to worker caste (ATI: 88).

**Sculpture.** Similar to worker caste.

**Pubescence.** Similar to worker caste.

**Color.** Similar to worker caste.

**Description of male.** Unknown.

**Distribution.** Japan (Kagoshima Pref.).

**Remark.** A specimen collected from KiuShiu, Shiroyama, Japan, is mistakenly labeled as a type of *Ponera scabra* at NHMB (AntWeb images, specimen CASENT0915299). *Ponera scabra* was described from Mt. Maya, Hyogo Prefecture, Japan. Santschi (1937: 364) identified the KiuShiu specimen as a gynandromorph of *P. scabra*. However, this specimen can be easily identified as *P. kohmoku* Terayama, 1996 by the combination of the

following characters: large compound eye (ca. 30 facets), distinct metanotal groove and subcircular petiolar node in dorsal view; in contrast to *P. scabra*, which has small compound eye (ca. 5 facets), an indistinct metanotal groove and an arched petiolar node in dorsal view. Thus, there are no records of gynecoid workers in *Ponera* after the exclusion of Santschi's record.

### ***Ponera rishen* Terayama, 2009**

(Fig. 43: worker; Fig. 44: dealate queen)

*Ponera rishen* Terayama, 2009: 111 (w.). Type locality: Taiwan, Nantou Pref., Riyuetan.

**Type material examined:** TAIWAN. Holotype, 1 worker, Riyuetan, Nantou Pref., 28 VII to 2 VIII 1988 (NIAES). Paratypes, 2 workers, Riyuetan, Nantou Pref., 28 VII to 2 VIII 1988, M Terayama leg (MTC: LCM\_MT-Ponera-24).

**Non-type material examined:** TAIWAN. 4 workers and 1 dealate queen, 24.700°N; 121.589°E, Lun Bei, Yilan county, 1 IX 2016, FC Hsu leg (CMPon56, CMPon57, CMPon58, CMPon59, CMPon60).

Measurements (mm) and indices. Holotype. Worker: HL 0.66; HW 0.54; SL 0.46; A06L 0.04; A07L 0.04; A08L 0.05; A09L 0.08; A10L 0.09; PrW 0.49; WL 0.97; PeH 0.51; PeNL 0.28; PeW 0.46; ATL 0.54; ATW 0.63; CI 81, SI 86, PeI 94, LPeI 54, DPeI 167, ATI 84.

Workers (n=6): HL 0.65–0.73; HW 0.54–0.60; SL 0.45–0.51; A06L 0.03; A07L 0.04; A08L 0.05; A09L 0.07; A10L 0.09; PrW 0.46–0.49; WL 0.92–1.01; PeH 0.48–0.54; PeNL 0.25–0.27; PeW 0.44–0.48; ATL 0.50–0.54; ATW 0.61–0.65; CI 82–84, SI 82–85, PeI 94–100, LPeI 47–55, DPeI 166–188, ATI 79–84.

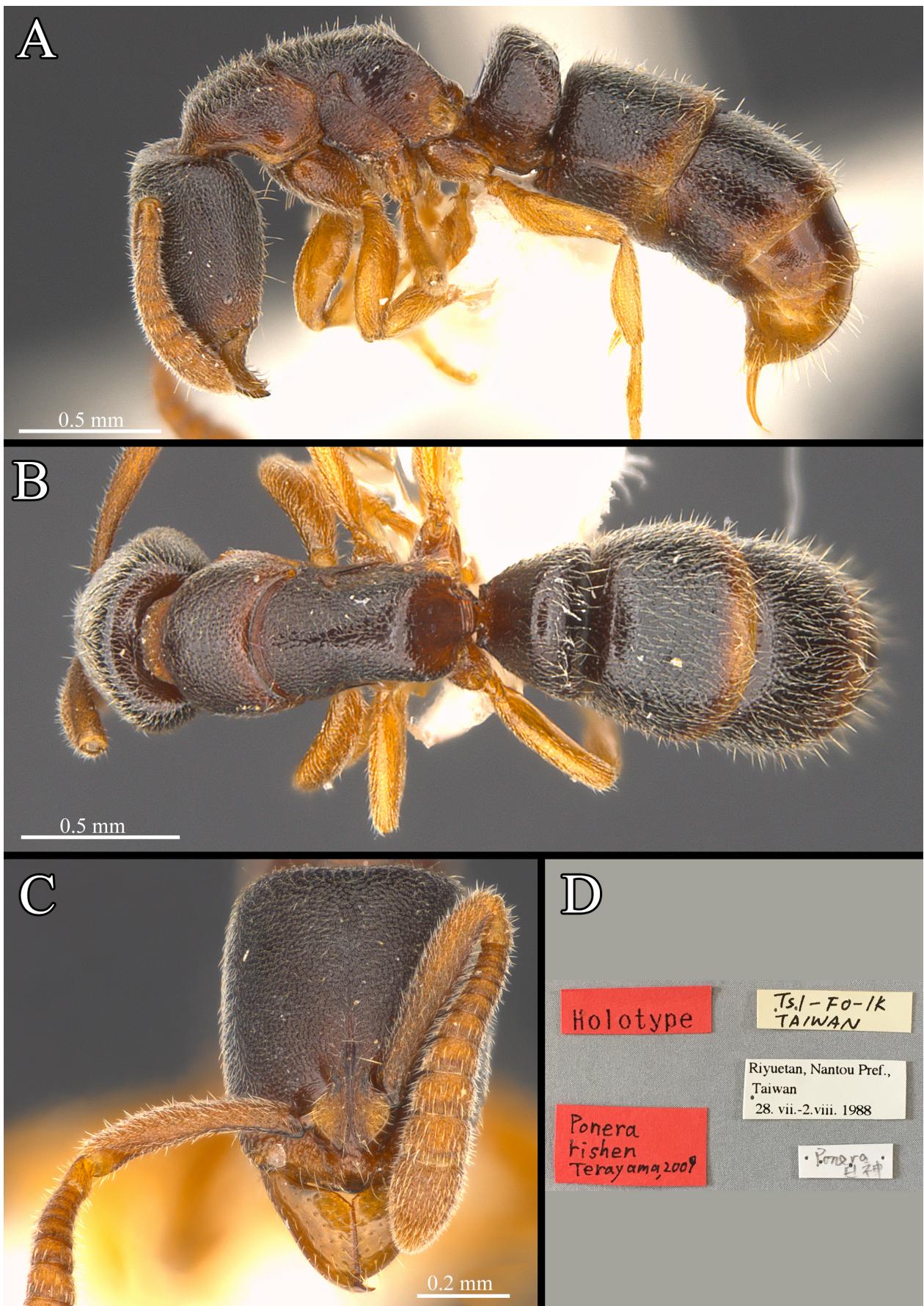
Queen (n=1): HL 0.74; HW 0.64; SL 0.54; A06L 0.05; A07L 0.06; A08L 0.07; A09L 0.09; A10L 0.10; PrW 0.56; WL 1.14; PeH 0.54; PeNL 0.27; PeW 0.51; ATL 0.61; ATW 0.75; CI 87, SI 83, PeI 91, LPeI 49, DPeI 193, ATI 82.

**Diagnosis (worker).** This large species (HW: 0.54–0.60 mm) is characterized by a long antennal scape; a metanotal groove indistinct; a thick petiolar node when observed in lateral view, the upper portion of the posterior margin protuding backward and convex; and a posterior margin of petiolar node in dorsal view slightly concave. *Ponera rishen* presents similarities with *P. scabra*, however the upper portion of the posterior margin of the petiolar node in lateral view is bulging in *P. rishen*, but not in *P. scabra*.

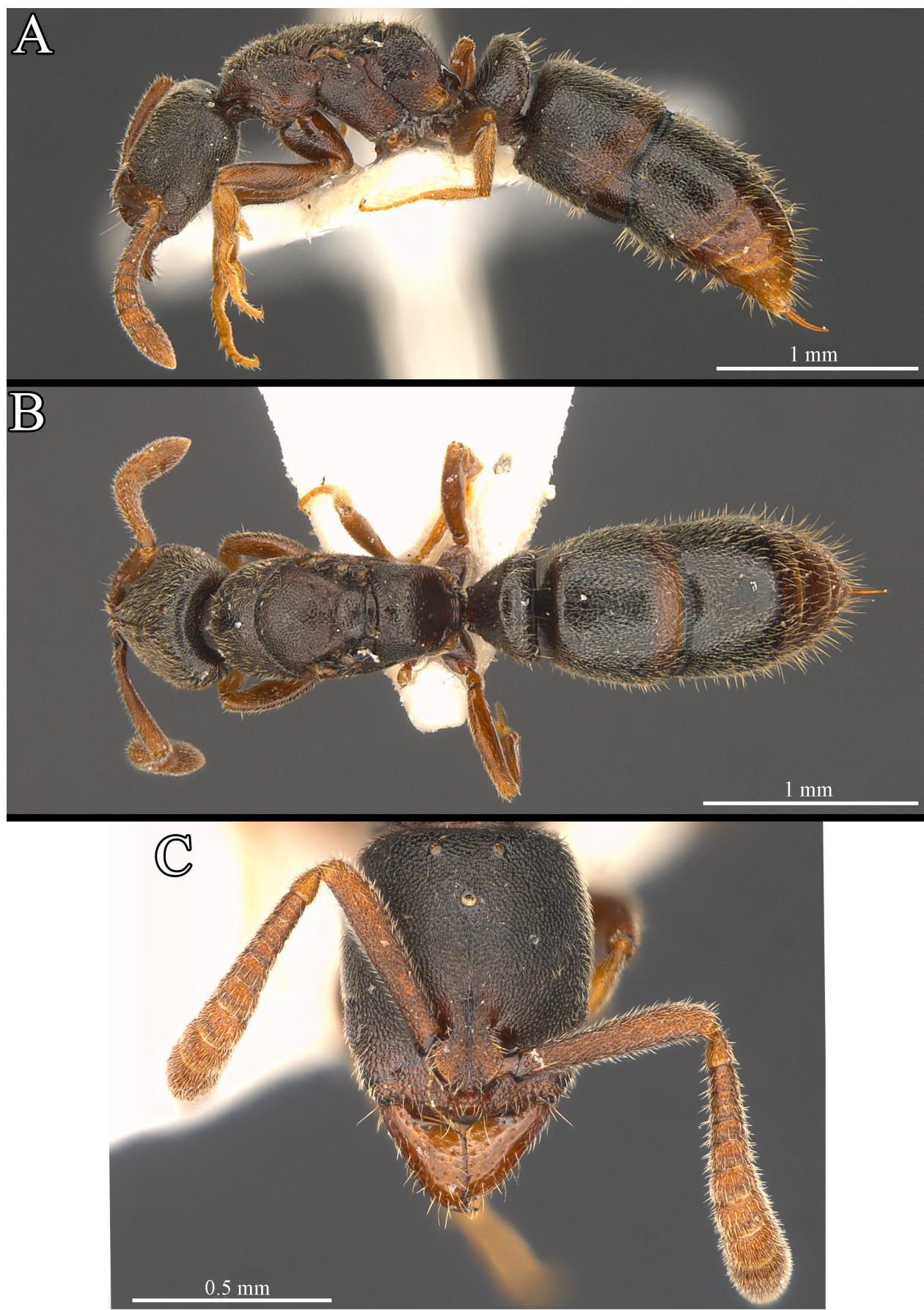
**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 82–84), with almost straight posterior margin, convex lateral margins, and broadly rounded posterolateral corners (Fig. 43C). Eye small; composed of a total of 3 to 4 indistinct facets. Anterior clypeal margin with strong and blunt medial tooth. Masticatory margin of mandible with a series of about ten indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 5% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.27 : 1.83 : 2.42 : 3.114$  (n=6).

**Mesosoma.** Mesosomal dorsum in lateral view almost straight (Fig. 43A). Pronotum in dorsal view with broadly convex anterior margin, and convex lateral margins (Fig. 43B). Metanotal groove very indistinct. Lateral mesopleural suture distinctly incised. Propodeal dorsum in dorsal view slightly narrow with concave lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively; a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and arched, with broadly convex anterior margin, and slightly concave posterior margin. Petiolar node in lateral view trapezoidal and thick, with straight anterior margin, and moderately convex posterior margin; with upper portion bulging, and anterodorsal corner distinctly higher than posterodorsal corner (Fig. 43A). Subpetiolar process large with large and suboval fenestra, anteroventral corner blunt, and slightly concave ventral margin with a pair of well developed teeth. Third abdominal tergum distinctly broader than long (ATI: 79–84), with straight anterior margin, and slightly convex lateral margins.



**FIGURE 43.** *P. rishen* holotype worker, A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 44.** *P. rishen dealata* queen (CMPon046), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosoma densely punctate. Mesopleuron with densely striate lower portion, evenly punctate upper portion. Metapleuron and propodeum striate, but particular decreasing in the portion between metapleuron and propodeum. Propodeal declivity smooth and shining. Lateral face of petiole evenly punctate, posterior face smooth, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with few short hairs, in particular glabrous in the upper portion of mesopleuron. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color black. Mandible, clypeus, antennae, legs, and apex of metasoma lightly brown.

**Description of queen. Head.** (Fig. 44C) Similar to worker caste, but with large and circular Eye, maximum diameter of each eye about 0.13 mm with 11 ommatidia along the maximum diameter. Three ocelli present and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres

$$\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.27 : 1.56 : 2.04 : 2.27 \text{ (n=1).}$$

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 44A), but with straight propodeal dorsum. Pronotum in dorsal view with broadly convex anterior margin, concave posterior margin and convex lateral margins (Fig. 44B). Scutum inverted-subtrapezoidal and narrow posteriad. Transcutal suture distinct. Scutellum subrectangular. Anapleural sulcus and propodeal-metapleural suture weakly incised. Propodeal dorsum in dorsal view moderately broad with straight lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 125 degree angle.

**Metasoma.** Petiolar node in dorsal view thick, with slightly convex anterior margin and almost straight posterior margin (Fig. 44B). Petiolar node in lateral view trapezoidal and moderately thick, with straight anterior margin, and convex posterior margin. Subpetiolar process with large and oval fenestra, anteroventral corner blunt, ventral margin slightly concave, and posteroventral corner concave with a pair of developed and acute teeth. The third abdominal segment similar to worker caste (ATI: 82).

**Sculpture.** Similar to worker caste.

**Pubescence.** Mostly like worker caste.

**Color.** Similar to worker caste.

**Description of male.** Unknown.

**Distribution.** Taiwan (Yilan county: Lun Bei, Nantou county: Sun Moon Lake).

### ***Ponera scabra* Wheeler, 1928b**

(Fig. 45: worker)

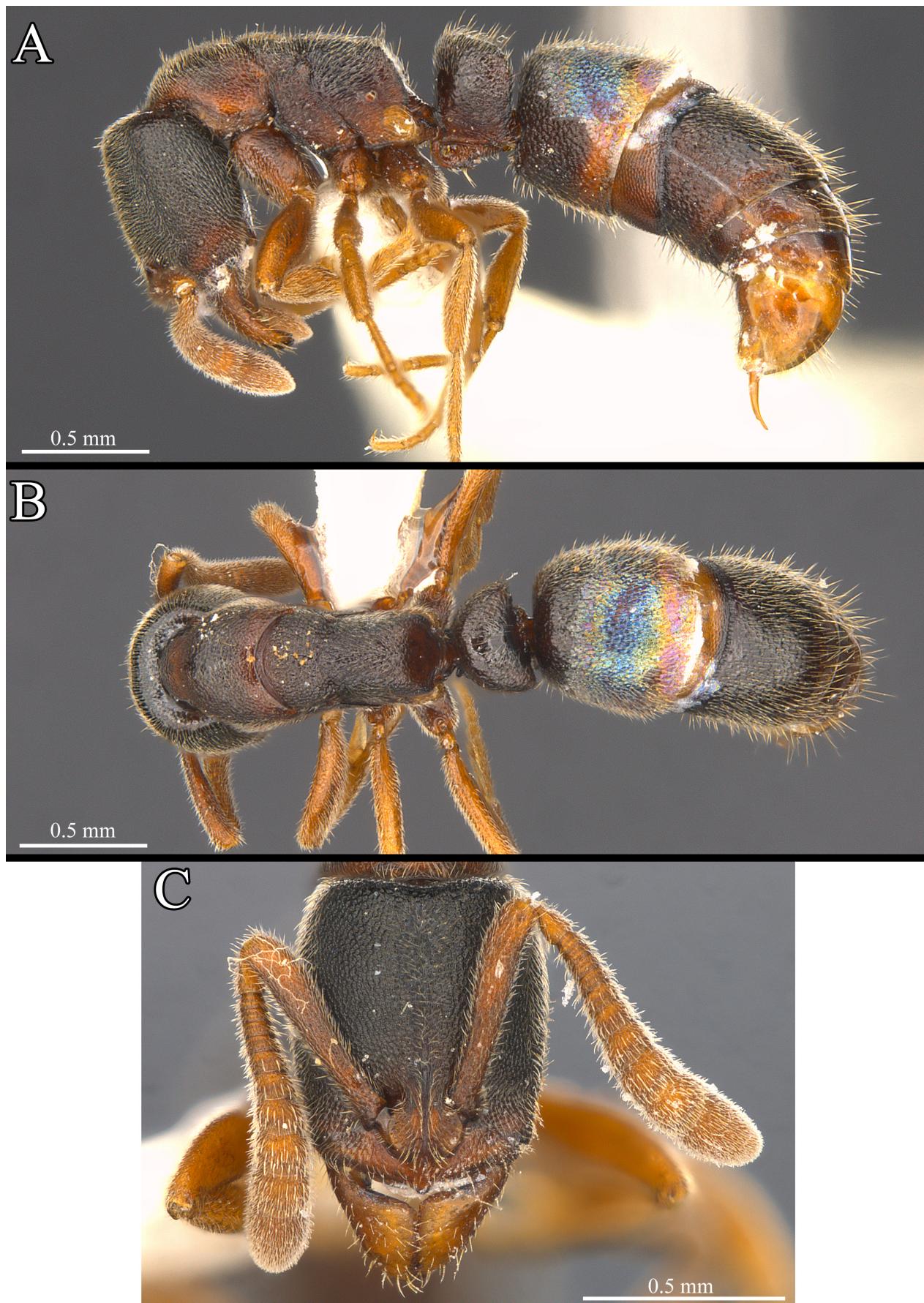
*Ponera scabra* Wheeler, 1928b: 99 (w. q.). Type locality: Japan, Hyogo Prefecture, Mt. Maya. Santschi, 1941: 273 (q.); Ogata, 1987: 121 (m.); Imai & Kubota, 1972: 194 (k.).

*Ponera yakushimensis* Tanaka, 1974: 32 (w. q.). Synonym by Yoshimura *et al.* 2009: 195.

**Type material examined: JAPAN.** 1 syntype, Hyogo Pref., Mte. Maya, “6.28.25”, Silvestri leg (MCZ: cotype 20482) [images examined].

**Non-type material examined: JAPAN.** 1 worker, Shiroyama, Kiu-Shiu, M Yano leg (NHMB: ANTC40459; Antweb.org: CASENT0915299) [images examined]. 2 workers, Kagoshima Pref., Kirishima Mts., Ohnamino-ike trl., 31 VIII 2008, Sk Yamane leg (CMPon170, CMPon171). 1 worker, Tochigi Pref., Utsunomiya city, Tsuruta-Numa, 10 VI 1991 (MTC: LCM\_MT-Ponera-11). 1 worker, Chiba Pref., Abiko, Konoyama, Katori Shrine, 4 IX 1991 (MTC: LCM\_MT-Ponera-12).

Measurements (mm) and indices. Workers (n=3): HL 0.74–78; HW 0.61–0.64; SL 0.53–0.54; A06L 0.04; A07L 0.05; A08L 0.07; A09L 0.08; A10L 0.10; PrW 0.48–0.52; WL 0.97–1.05; PeH 0.48–0.53; PeNL 0.27–0.29; PeW 0.42–0.47; ATL 0.57–0.60; ATW 0.64–0.68; CI 78–85, SI 84–92, PeI 87–92, LPeI 53–56, DPeI 151–166, ATI 88–93.



**FIGURE 45.** *P. scabra* worker (CMpon170), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

**Diagnosis (worker).** This species is characterized by a long antennal scape; a clypeus with an acute median tooth; a petiolar node in lateral view thick with straight anterior and posterior margins. *Ponera scabra* presents similarities with *P. rishen*, *P. kohmoku*, and *P. takaminei*. *Ponera scabra* can be distinguished from *P. takaminei* by its indistinct metanotal groove, while distinct in *P. takaminei*. *Ponera scabra* is distinct from *P. kohmoku* by its small eyes consisting of 5–7 facets, but about 20 facets in *P. kohmoku*. *Ponera scabra* is distinct from *P. takaminei* by the straight posterior margin of petiolar node in lateral view, while convex in *P. takaminei*.

**Description of worker.** In full-face view, head rectangular and distinctly longer than broad (CI: 78–85), with slightly convex posterior margin, convex lateral margins and angularly rounded posterolateral corners (Fig. 45C). Eye small; composed of a total of 5 to 7 indistinct facets. Anterior clypeal margin with strong and acute medial tooth. Masticatory margin of mandible with a series of about 15 indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, almost reaching posterolateral corner; average ratio of the length

of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.25 : 1.69 : 2.93 : 3.40$  (n=3).

**Mesosoma.** Mesosomal dorsum in lateral view slightly convex (Fig. 45A). Pronotum in dorsal view with broadly convex anterior margin, and well convex lateral margins (Fig. 45B). Metanotal groove indistinct. Lateral mesopleural suture distinctly incised. Propodeal dorsum in dorsal view slightly narrow with straight lateral margins. Propodeal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and arched, with broadly convex anterior margin, and concave posterior margin. Petiolar node in lateral view trapezoidal and thick, with straight anterior and posterior margins; anterodorsal corner convex and higher than posterodorsal corner (Fig. 45A). Subpetiolar process large with large and circular fenestra, anteroventral corner blunt, almost straight ventral margin with a pair of well developed teeth. Third abdominal tergum distinctly broader than long (ATI: 88–93), with straight anterior margin, and slightly convex lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosoma densely punctate. Mesopleuron with densely striate and punctate. Metapleuron and propodeum striate. Propodeal declivity shining, but sparsely punctate. Lateral face of petiole densely punctate, posterior face smooth. The third and fourth abdominal segments densely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with few short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color black. Mandible, clypeus, antennae, legs, and apex of metasoma brown.

**Description of queen.** See Wheeler (1928b).

**Description of male.** See Ogata (1987).

**Distribution.** China (Guizhou, Henan and Yunnan), North Korea, South Korea, Japan (except of Okinawa and Yaeyama Islands).

**Remarks.** First of all, we found that a specimen (ANTC40459 collected from KiuShiu, Shiroyama, Japan) which was mistakenly pinned with the type label of *Ponera scabra* (see: Antweb.org 2017), deposited in the Natural History Museum of Basel (NHMB), Switzerland. Regarding the type locality of *P. scabra* Wheeler, 1928, the species was described based on specimens collected from Mt. Maya, Hyogo Prefecture, Japan. Therefore, the specimen (ANTC40459) does not belong to type series. Secondly, this specimen was reported by Santschi in 1937, who identified it as a gynecoid worker of *P. scabra* (see: Santschi, 1937: 364). However, this specimen is not *P. scabra* and can be easily identified as *P. kohmoku* Terayama, 1996 by the combination of the following characters: large compound eye (ca. 30 facets), distinct metanotal groove and subcircular petiolar node in dorsal view; in contrast to *P. scabra*, which present small compound eye (ca. 5 facets), an indistinct metanotal groove and an arched petiolar node in dorsal view. In summary, we assume that the other specimens of *P. kohmoku* workers were also misidentified as *P. scabra* gynecoid by Santschi (1937). Thus, no valid record of gynecoid worker exist in the *Ponera* genus after the exclusion of Santschi's record (1937).

**Ponera shennong Terayama, 2009**

(Fig. 46: worker)

*Ponera shennong* Terayama, 2009: 112 (w.). Type locality: Taiwan, Pingtung Pref., Kending.

**Type material examined:** TAIWAN. Holotype. 1 worker, Kending, Pingtung Pref., Taiwan, 28 VII to 2 VIII 1988 (NIAES).

**Non-type material examined:** TAIWAN. 2 workers, ca. 25.02°N; 121.75°E, Pingxi, New Taipei city, 3 XII 1989, YC Shiao leg (CMPon043, CMPon044).

Measurements (mm) and indices. Holotype. Worker: HL 0.34; HW 0.27; SL 0.19; A06L 0.01; A07L 0.01; A08L 0.02; A09L 0.03; A10L 0.05; PrW 0.20; WL 0.45; PeH 0.19; PeNL 0.13; PeW 0.15; ATL 0.27; ATW 0.28; CI 79, SI 72, PeI 77, LPeI 68, DPeI 116, ATI 96.

Worker (n=1): HL 0.36; HW 0.28; SL 0.23; A06L 0.01; A07L 0.01; A08L 0.02; A09L 0.03; A10L 0.04; PrW 0.22; WL 0.44; PeH 0.22; PeNL 0.14; PeW 0.0.17; ATL 0.27; ATW 0.28; CI 78, SI 81, PeI 77, LPeI 64, DPeI 119, ATI 96.

**Diagnosis (worker).** *Ponera shennong* can be easily distinguished by its short antennal scape, a posterior margin of the petiolar node convex when observed in lateral view, a posterior margin of the petiolar node straight in dorsal view, a subpetiolar teeth indistinct, its abdominal tergum III as long as broad, and its small body size (HW: 0.27–0.28 mm).

**Description of worker. Head.** In full-face view, head subrectangular and longer than broad (CI: 78), with concave posterior margin, slightly convex lateral margins and angularly rounded posterolateral corners (Fig. 46C). Eye absent or with a small facet. Anterior clypeal margin without developed medial tooth. Masticatory margin of mandible with series of numerous indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 35% of the scape length to the posterolateral corner;

average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.27 : 1.74 : 3.23 : 4.61$  (n=2).

**Mesosoma.** Mesosomal dorsum in lateral view moderately convex (Fig. 46A). Pronotum in dorsal view with acutely convex anterior margin and convex lateral margins (Fig. 46B). Metanotal groove distinct. Lateral mesopleural suture indistinct. Propodeal dorsum in dorsal view very broad, with straight and subparallel lateral margins. Propodeal corner in lateral rounded; propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view very thick and subsquare, with slightly convex anterior margin, and straight posterior margin (Fig. 46B). Petiolar node in lateral view trapezoidal and remarkably thick, with straight and slightly sloping anterior and posterior margins, long and straight dorsal margin, and anterodorsal corner as high as posterodorsal corner (Fig. 46A). Subpetiolar process with small and oval fenestra, anteroventral corner blunt, almost straight ventral margin, and posteroventral corner concave with teeth extremely reduced. Third abdominal tergum almost as long as large (ATI: 96) with straight anterior margin, and almost straight lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosomal dorsum evenly punctate. Mesopleuron, metapleuron, and lateral face of propodeum with superficial striae. Lateral and dorsal faces of petiolar node with few punctures, smooth posterior face. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.

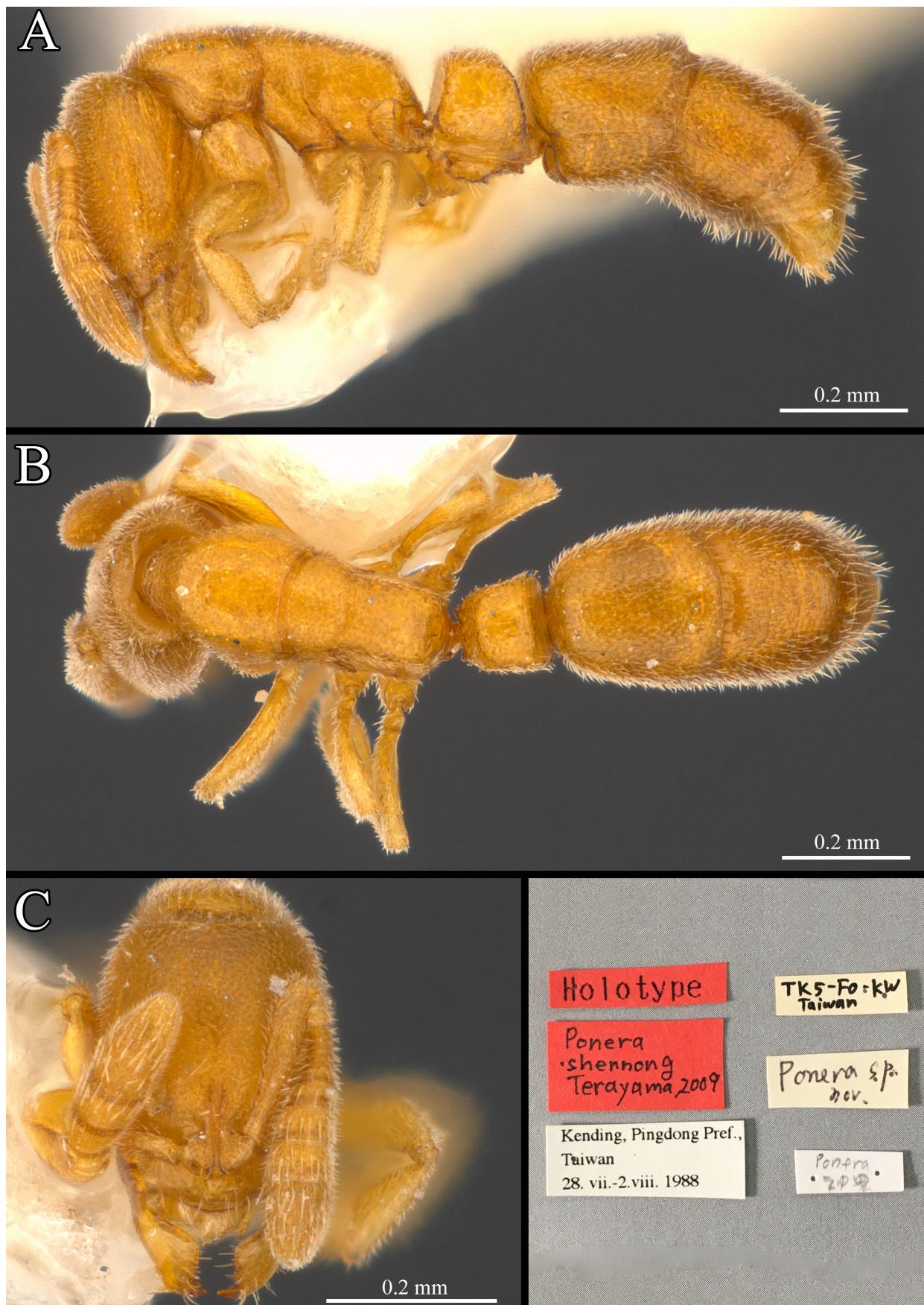
**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs, but scattered on the lateral portion of mesosoma. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long and erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color yellowish brown.

**Description of queen.** Unknown.

**Description of male.** Unknown.

**Distribution.** Taiwan (Pingtung county: Kending, New Taipei city: Pingxi).



**FIGURE 46.** *P. shennong* holotype worker, A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.

***Ponera sinensis* Wheeler, 1928**

(Figs. 47, 48: worker; Fig. 49: dealate queen)

*Ponera sinensis* Wheeler, 1928a: 6 (w.). Type locality: Hong Kong. Taylor, 1967: 53.

**Type material examined: HONG KONG.** Holotype, worker, "X 11 24" (MCZ: ENT20483) [images examined].

**Non-type material examined: TAIWAN.** 1 worker, Kenting Bot. G., Pingtung county, 12VIII1969, M Kubota leg (MCZ: ENT000594458). 3 workers, 24.0803°N; 121.0209°E, 762 m alt., Huisun, Nantoung county, 21 V 2016, CM Leong leg (CMPon074, CMPon075, CMPon076). 2 workers, Huisun, Nantoung county, 21 VI 1994, CC Lin leg (CMPon077; CMPon078). 4 workers, 24.9888°N; 121.6790°E, 300 m alt., Huangdidian, New Taipei city, 23 VI 2016, CM Leong (CMPon088, CMPon091; CMPon092, CMPon093). 4 workers and 1 dealate queen, 24.9673°N; 121.6185°E, 626 m alt., Ergeshan, New Taipei city, 23 VII 2016, via Winkler extractor, CM Leong leg (CMPon112, CMPon113, CMPon114, CMPon115, CMPon119). 3 workers, 25.0162°N; 121.5521°E, 34 m alt., Fujhoushan, Taipei city, 09 IX 2016, CM Leong (CMPon117, CMPon118, CMPon119).

Measurements (mm) and indices. Holotype. Worker: HL 0.61; HW 0.55; SL 0.43; A06L 0.02; A07L 0.03; A08L 0.05; A09L 0.07; A10L 0.08; PrW 0.38; WL 0.82; PeH 0.39; PeNL 0.19; PeW 0.34; ATL N.A.; ATW N.A.; CI 90, SI 78, PeI 90, LPeI 50, DPeI 178, ATI N.A. [measured from images]

Non-type specimens. Workers (n=16): HL 0.57–0.61; HW 0.49–0.56; SL 0.40–0.44; PrW 0.36–0.43; A06L 0.03; A07L 0.03; A08L 0.05; A09L 0.06; A10L 0.08; WL 0.73–0.88; PeH 0.38–0.45; PeNL 0.18–0.22; PeW 0.31–0.38; ATL 0.41–0.48; ATW 0.46–0.53; CI 86–94, SI 77–85, PeI 81–94, LPeI 46–54, DPeI 159–181, ATI 80–92.

Non-type specimens. Queen (n=1): HL 0.64; HW 0.59; SL 0.47; A06L 0.03; A07L 0.04; A08L 0.05; A09L 0.07; A10L 0.09; PrW 0.54; WL 1.07; PeH 0.48; PeNL 0.24; PeW 0.44; ATL 0.56; ATW 0.66; CI 91, SI 80, PeI 83, LPeI 49, DPeI 188, ATI 85.

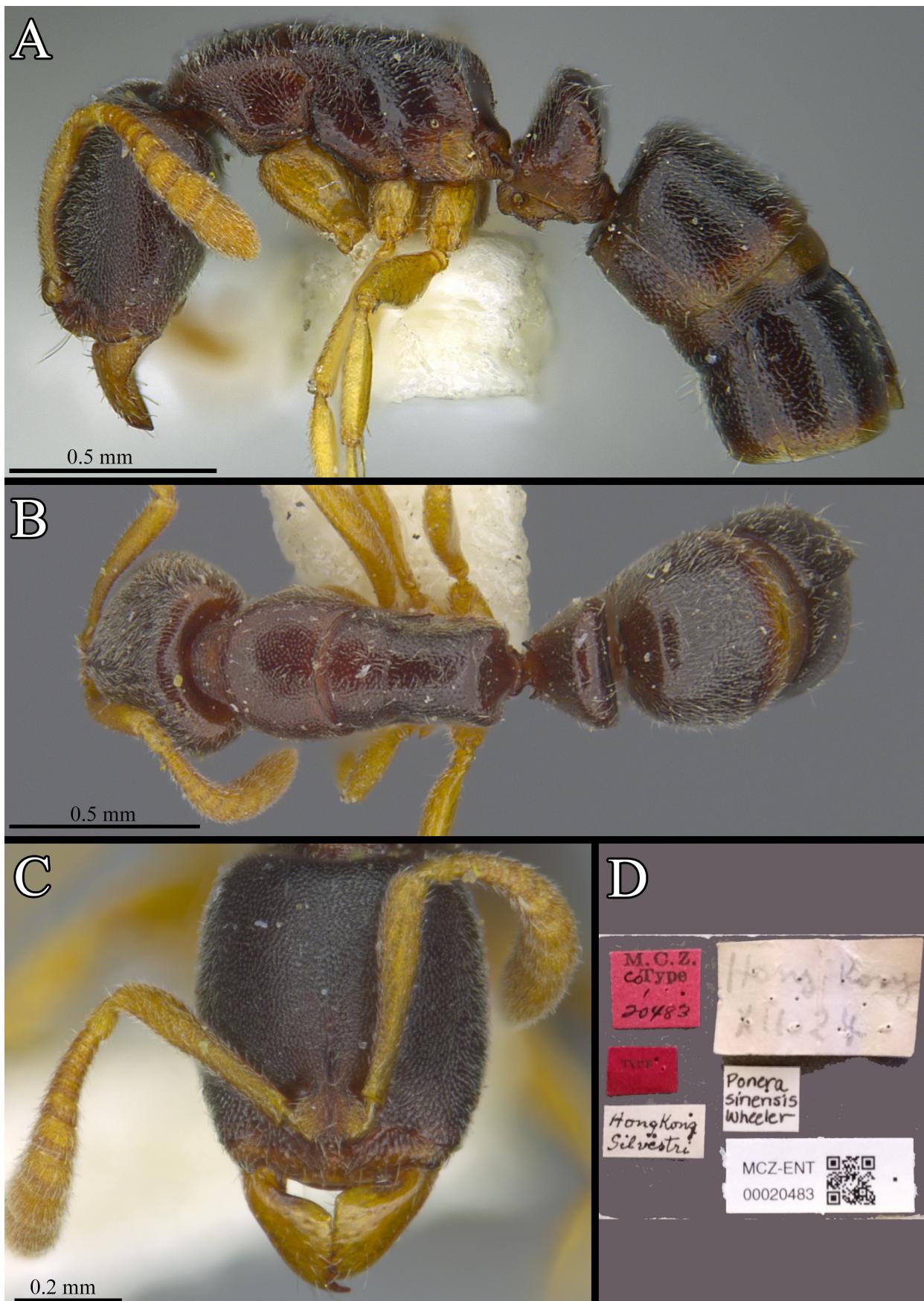
**Diagnosis (worker).** *Ponera sinensis* is characterized by its antennal scape almost reaching the posterior corner of the head, a triangular petiolar node with a broadly convex posterior margin when observed in lateral view; and in dorsal view a petiolar node remarkably thin and arched. *Ponera sinensis* presents similarities with *P. tamon*, *P. oreas* and *P. guangxiensis*, but *P. sinensis* can be distinguished by its remarkable thin petiolar node in dorsal view and triangular petiolar node in lateral view; with its dorsum forming an acute corner.

**Description of worker. Head.** In full-face view, head subrectangular and longer than broad (CI: 86–94), with slightly concave posterior margin, moderately convex lateral margins, and broadly rounded posterolateral corners (Fig. 47C). Eye small; composed of a total of 4 to 7 indistinct facets. Anterior clypeal margin with distinct and blunt medial tooth. Masticatory margin of mandible edentate (Fig. 48D), but with three large teeth on the apical part (Fig. 48D). Antennal scape, when laid backward, with a remaining distance of about 5% of the scape length to the posterolateral corner; average ratio of the length of antenniferes  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.16 : 1.81 : 2.55 : 3.14$  (n=17).

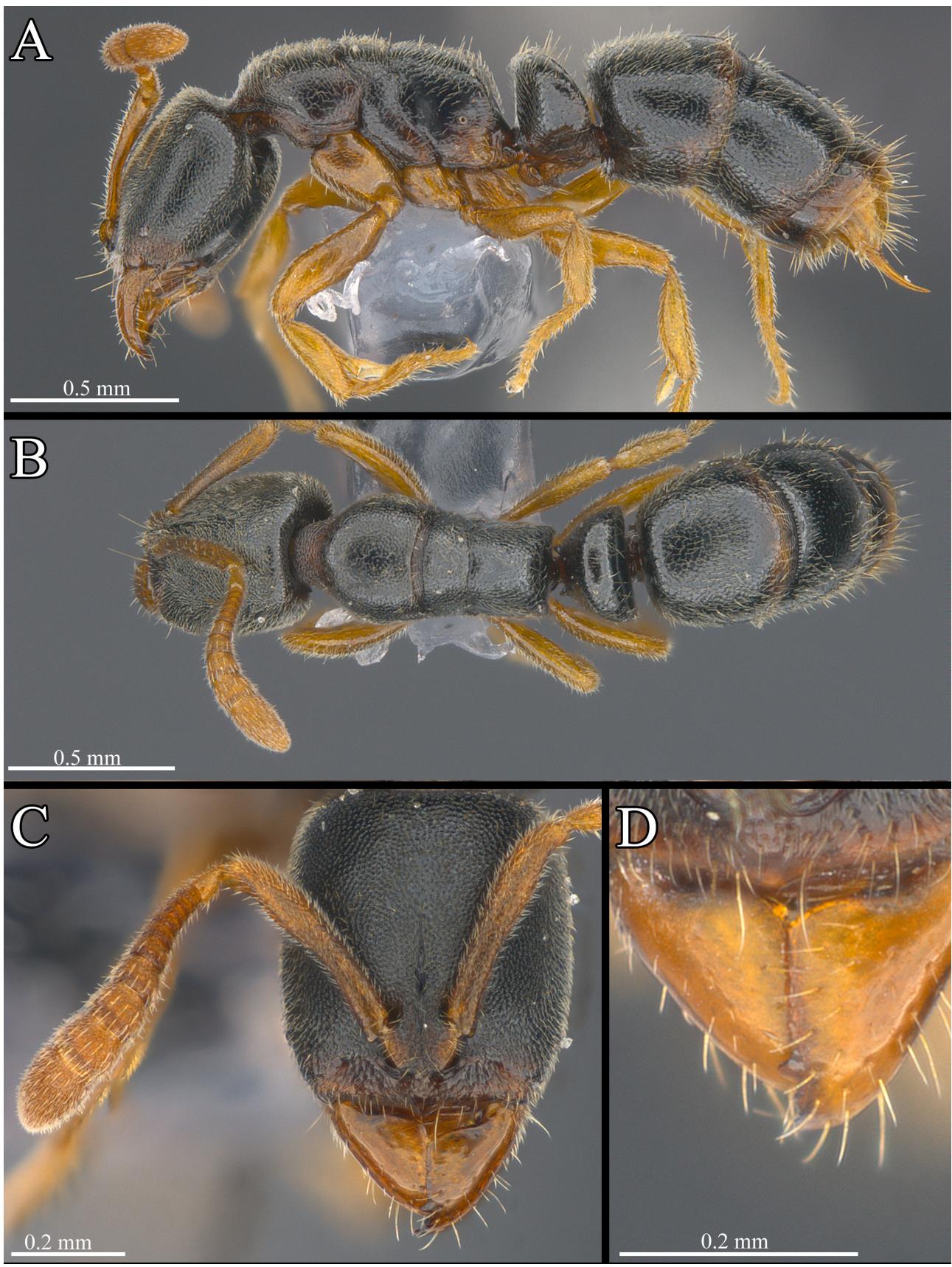
**Mesosoma.** Mesosomal dorsum in lateral view slightly convex (Fig. 48A). Pronotum in dorsal view with well convex anterior margin and moderately convex lateral margins (Fig. 48B). Metanotal groove in dorsal view distinctly incised. Propodeal dorsum in dorsal view moderately broad, with straight lateral margins. Posteroventral corner of propodeum in lateral view angular, propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view remarkably thin and arched, with broadly convex anterior margin, and moderately concave posterior margin. Petiolar node in lateral view (Fig. 48A), moderately thick and triangular, with straight anterior margin, broadly convex posterior margin, and dorsum forming an acute corner. Subpetiolar process with small and suboval/circular fenestra, anteroventral corner blunt, slightly concave ventral margin, and posteroventral corner concave with a pair of developed teeth. Third abdominal tergum distinctly broader than long (ATI: 80–92), with almost straight anterior and posterior margins.

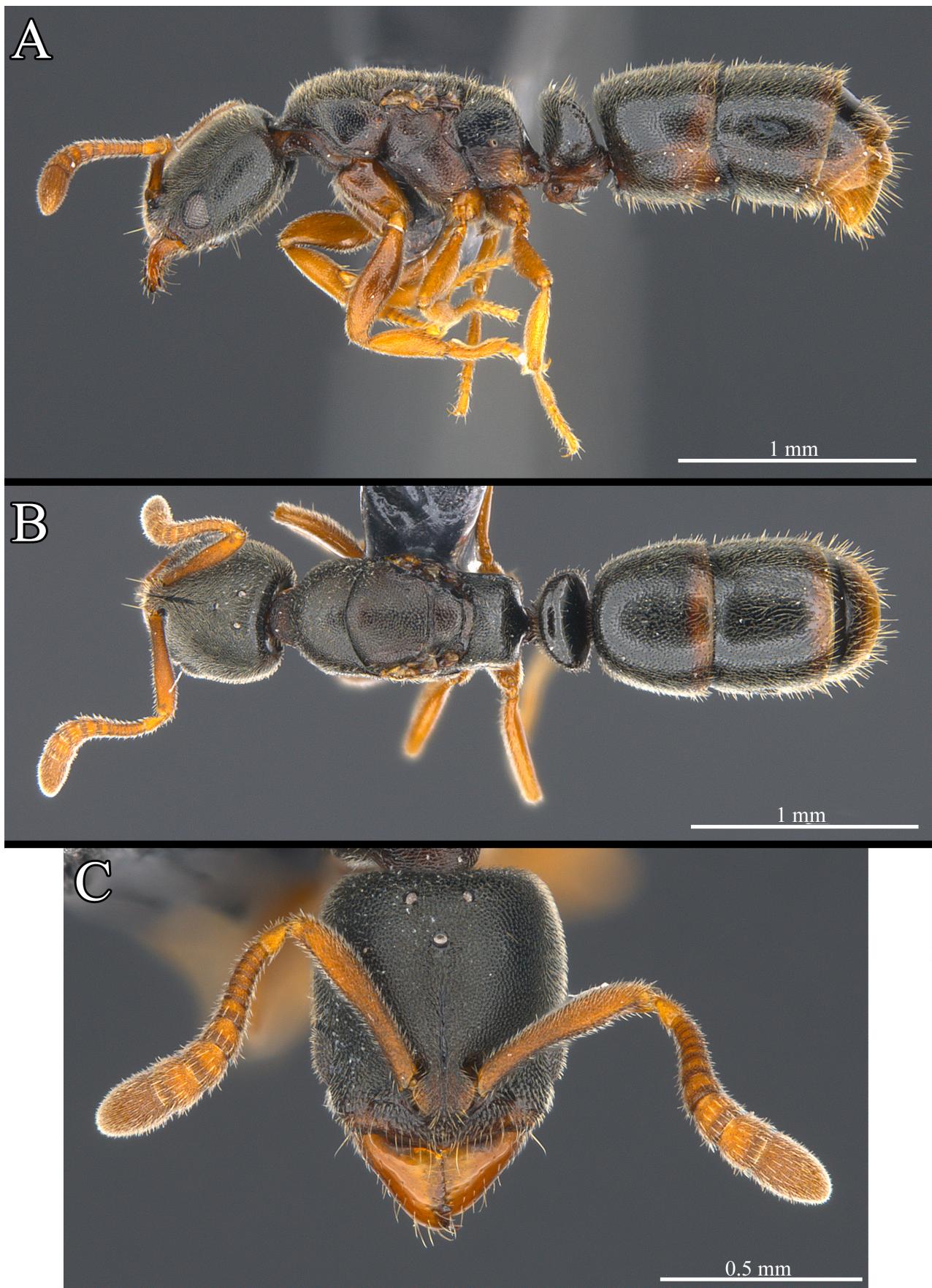
**Sculpture.** Head densely punctate. Mandible sparsely punctate. Pronotum and mesonotum evenly punctate. Mesopleuron with weakly striate lower portion and sparsely punctate upper portion. The portion contained between metapleuron and propodeum very smooth. Propodeal declivity smooth. Lateral face of petiole sparsely punctate, with smooth posterior face, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.



**FIGURE 47.** *P. sinensis* holotype worker, A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 48.** *P. sinensis* worker (CMPPon117), A: body, lateral view, B: body, dorsal view, C: head, full-face view, d: mandible.



**FIGURE 49.** *P. sinensis* dealate queen (CMPon111), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

**Pubescence.** Head with dense and short hairs. Mesosoma with evenly distributed short hairs; mesopleuron, metapleuron and propodeum with scattered short hairs. Petiolar node with scattered short hairs in lateral and anterior faces, posterior and dorsal faces with few short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color dark to dark brown. Mandible, clypeus, antennae, legs, and apex of gaster orange brown.

**Description of queen. Head.** (Fig. 49C) Similar to worker caste, but with large and oval Eye, maximum diameter of each eye about 0.18 mm with 12 ommatidia along the maximum diameter. Three ocelli present and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.21 : 1.59 : 1.82 : 2.31$  (n=1).

**Mesosoma.** Mesosomal dorsum in lateral view convex. Pronotum in dorsal view with broadly convex anterior margin, moderately convex lateral margins (Fig. 49B). Scutum subtrapezoidal and narrow posteriad, with moderately convex anterior margin and slightly convex posterior margin. Transcutal suture distinct. Scutellum subtrapezoidal. Anapleural sulcus superficially incised (Fig. 49A). Propodeal-metapleural suture very weakly incised. Propodeal dorsum in dorsal view broad with slightly concave lateral margins. Propodeal corner angular; propodeal dorsum and declivity forming approximatively a 115 degree angle.

**Metasoma.** Petiolar node in dorsal view remarkably thin, with broadly convex anterior margin, moderately concave posterior margin. Petiolar node in lateral view thin and triangular, with straight anterior margin, well convex posterior margin, and dorsum forming an acute corner (Fig. 49A). Subpetiolar process with small and suboval fenestra, with anteroventral corner blunt, straight ventral margin, and posteroventral corner concave with small teeth. The third abdominal segment similar to worker caste (ATI: 85).

**Sculpture.** Similar to worker caste; except metapleuron and lateral propodeum with increased puncture and striation.

**Pubescence.** Similar to worker caste; except metapleuron and lateral propodeum with increased short decumbent hairs.

**Color.** Similar to worker caste.

**Distribution.** Guangxi, Hong Kong, Taiwan (new records from Nantou county: Huisun, Pingtung county: Kenting, New Taipei city: Huangdidian, Ergeshan, Taipei city: Fujhoushan), and Yunnan.

### *Ponera swazeyi* Wheeler, 1933

(Fig. 50: worker)

*Pseudocryptopone swazeyi* Wheeler, 1933: 16 (w. q.). Type locality: Hawaii.

*Ponera swazeyi*: Wilson, 1957: 370; Taylor, 1967: 85; Terayama, 1996: 14.

**Non-type material examined: JAPAN.** 2 workers, Okiminato, Hahajima, Ogasawara Is., 19 III 1977, M Shindo leg (MTC: LCM\_MT-Ponera-05).

Measurements (mm) and indices. Worker (n=1): HL 0.41; HW 0.34; SL 0.26; A06L 0.02; A07L 0.02; A08L 0.03; A09L 0.04; A10L 0.05; PrW 0.25; WL 0.51; PeH 0.26; PeNL 0.14; PeW 0.19; ATL 0.28; ATW 0.32; CI 82, SI 76, PeI 77, LPeI 53, DPeI 142, ATI 90.

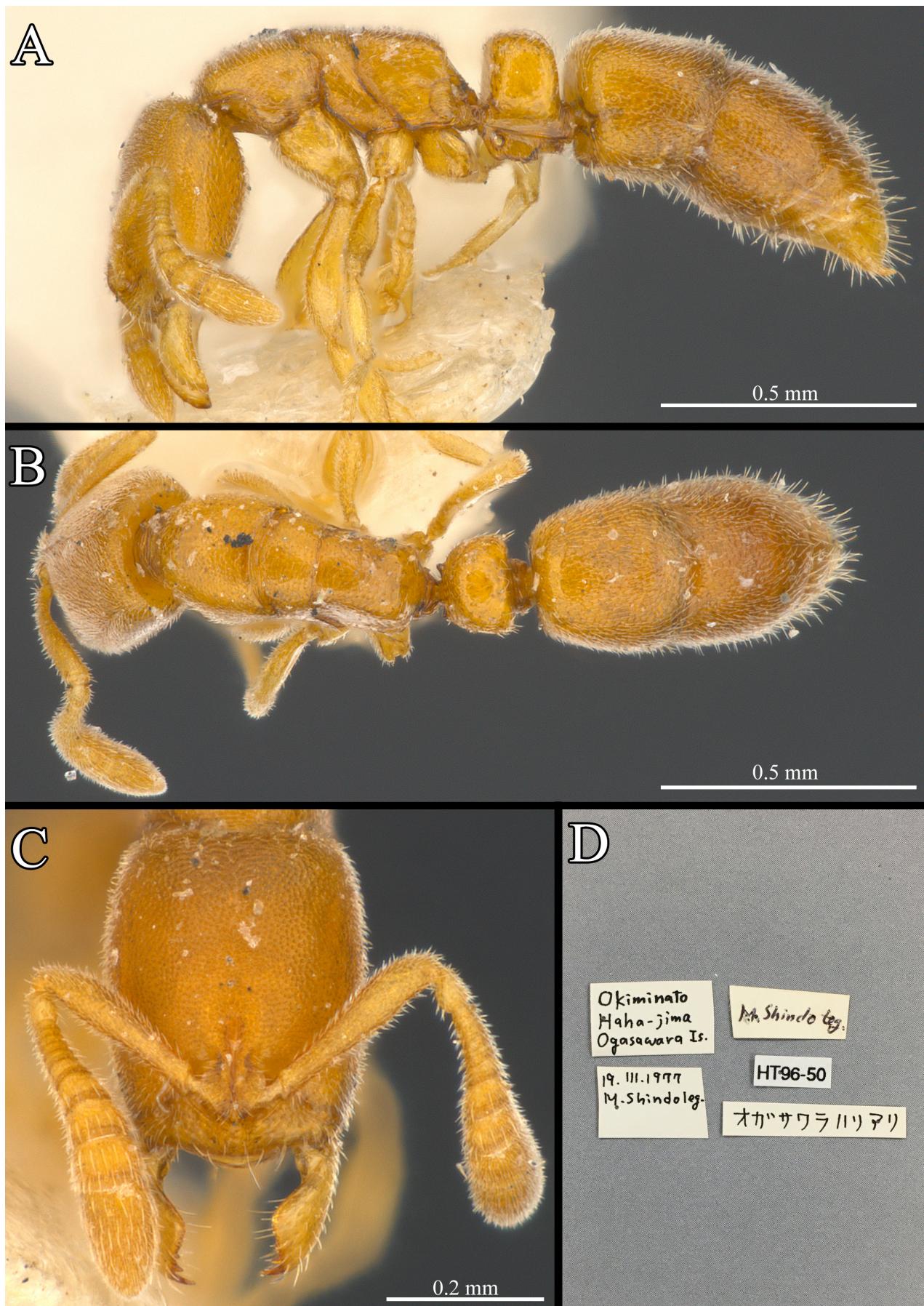
**Diagnosis (worker).** *Ponera swazeyi* can be easily distinguished by a short antennal scape and the presence of a five segmented club, a metanotal groove distinct, a petiolar node in lateral view thick and trapezoidal with straight anterior and posterior margins, its small body size (HW: 0.32–0.34 mm), and the yellowish brown body color.

**Description of worker.** See Wheeler (1933).

**Description of queen.** See Wheeler (1933).

**Description of male.** Unknown.

**Distribution.** Australian: Tanzania, Sino-Japanese: Ogasawara Islands; Oriental: Christmas Island; Oceanai: Fiji, Hawaii, Solomon Islands; Madagascan: Madagascar.



**FIGURE 50.** *P. swazeyi* worker (LCM\_MT-Ponera-05a), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

**Remarks.** *Ponera swezeyi* belongs to the *P. japonica* species group defined by Taylor (1967), which includes *P. japonica*, *P. incerta* and *P. swezeyi*. These three species have a five segmented antennal club, yellow to brown body color and are widely distributed within the Sino-Japanese, Oriental and Oceanian regions. Recently, three Oriental species, *P. baka* Xu, 2001 and *P. xatha* Xu, 2001 from Yunnan; *P. shennong* Terayama, 2009 from Taiwan were discovered, and show important similarities with *P. swezeyi* (yellowish brown body color, five segmented antennal club, small body size and thick petiolar node). Here, our morphological comparison suggests that *P. swezeyi* is similar to *P. baka*, *P. shennong* and *P. xatha*, instead of *P. japonica* and *P. incerta* for the following reasons:

- (1) Head width in *P. baka* (HW: 0.33 mm), *P. xatha* (HW: 0.35 mm), *P. shennong* (HW: 0.28 mm) and *P. swezeyi* (HW: 0.32–0.33 mm) is distinctly smaller than *P. incerta* (HW: 0.36–0.40 mm) and *P. japonica* (HW: 0.41–0.50 mm) (see the references in Table 1);
- (2) Petiolar node in lateral view very thick in *P. baka*, *P. shennong*, *P. swezeyi* and *P. xatha*, but moderately thick in *P. incerta* and *P. japonica*;
- (3) Antennal scape short in *P. baka*, *P. shennong*, *P. swezeyi* and *P. xatha* (when laid backward, with a remaining distance of more than 30% of the scape length to the posterolateral corner), but relatively long in *P. incerta* and *P. japonica* (when laid backward, with a remaining distance of less than 15% of the scape length to the posterolateral corner);
- (4) Body color yellowish in *P. baka*, *P. shennong*, *P. swezeyi* and *P. xatha*, but brown in *P. incerta* and *P. japonica*.

These morphological similarities suggest that *P. swezeyi* might be closer to the Oriental species than to *P. japonica* and *P. incerta*. Although the reported distribution of *P. swezeyi* is wide (antmaps.org 2017), this species may be native to the Oriental region.

### *Ponera taiyangshen* Terayama, 2009

(Fig. 51: worker; Fig. 52: dealate queen)

*Ponera taiyangshen* Terayama, 2009: 112 (w.). Type locality: Taiwan, Yilan Pref., Taipingshan.

**Type material examined:** TAIWAN. Holotype. Worker, Taipingshan, Yilan Pref., 28 VII to 2 VIII 1988 (NIAES). Paratypes. 5 workers, Taipingshan, Yilan Pref., 28 VII to 2 VIII 1988 (MTC: LCM\_MT-Ponera-22, LCM\_MT-Ponera-23).

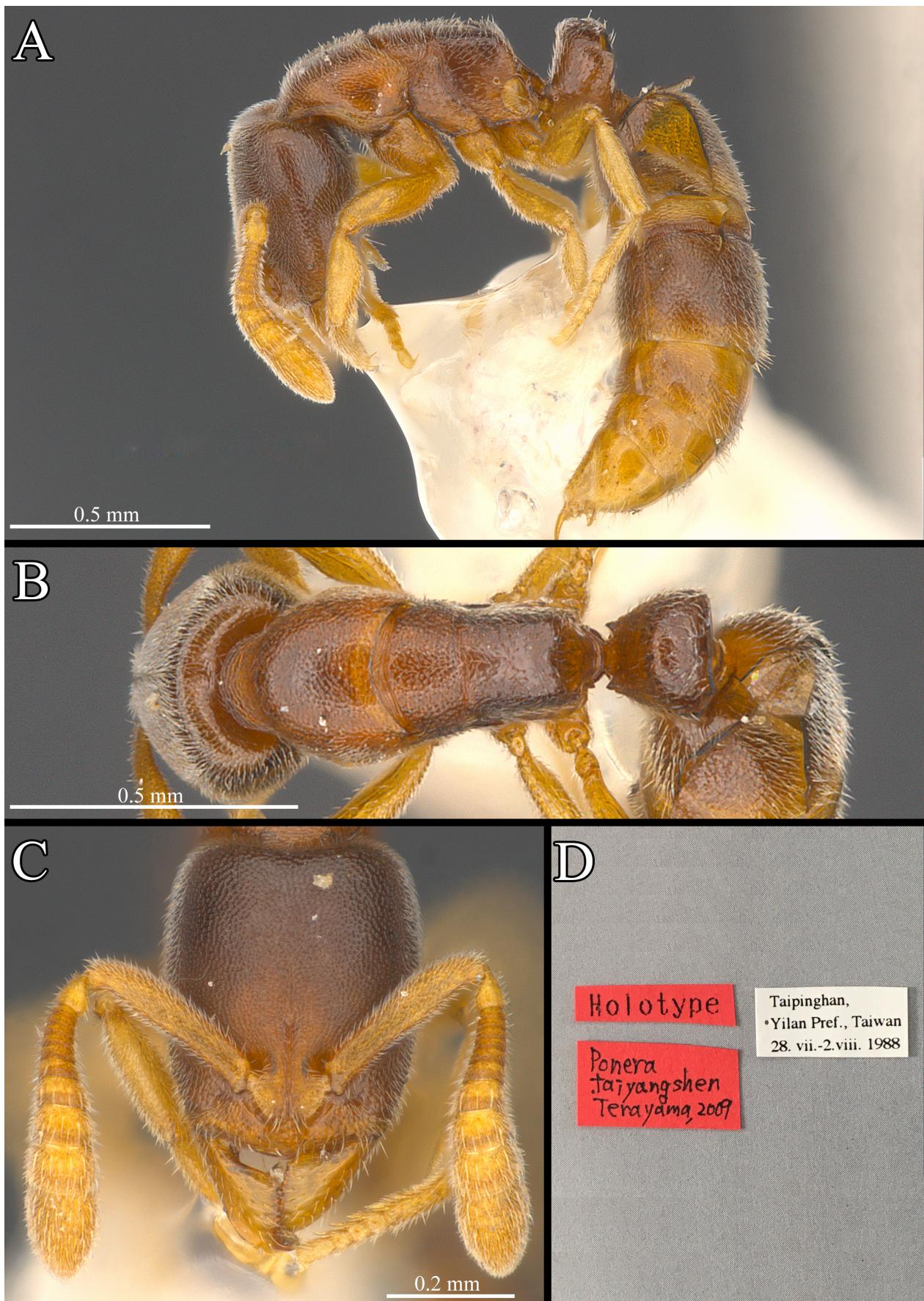
**Non-type material examined:** TAIWAN. 4 workers and 1 dealate queen, 24.51°N, 121.60°E, Cufenghu, Yilan county, 6 IX 1989, YC Shiao leg (CMPon037, CMPon039, CMPon166, CMPon167, CMPon168). 4 workers, ca. 24.49°N; 121.53°E, Taipingshan, Yilan county, 6 IV 2016, via. Winkler extractor, JJ Liu leg (CMPon033, CMPon036, CMPon038, CMPon040). 1 worker and 1 dealate queen, Cufenghu trail 14.5k, Yilan county, 3 XI 2016, via. Winkler extractor, JJ Liu leg (LCM00027, LCM00028).

Measurements (mm) and indices. Holotype. Workers: HL 0.44; HW 0.37; SL 0.29; A06L 0.02; A07L 0.02; A08L 0.03; A09L 0.05; A10L 0.06; PrW 0.30; WL 0.60; PeH 0.29; PeNL 0.15; PeW 0.22; ATL N.A.; ATW N.A.; CI 83, SI 79, PeI 72, LPeI 53, DPeI 143, ATI N.A.

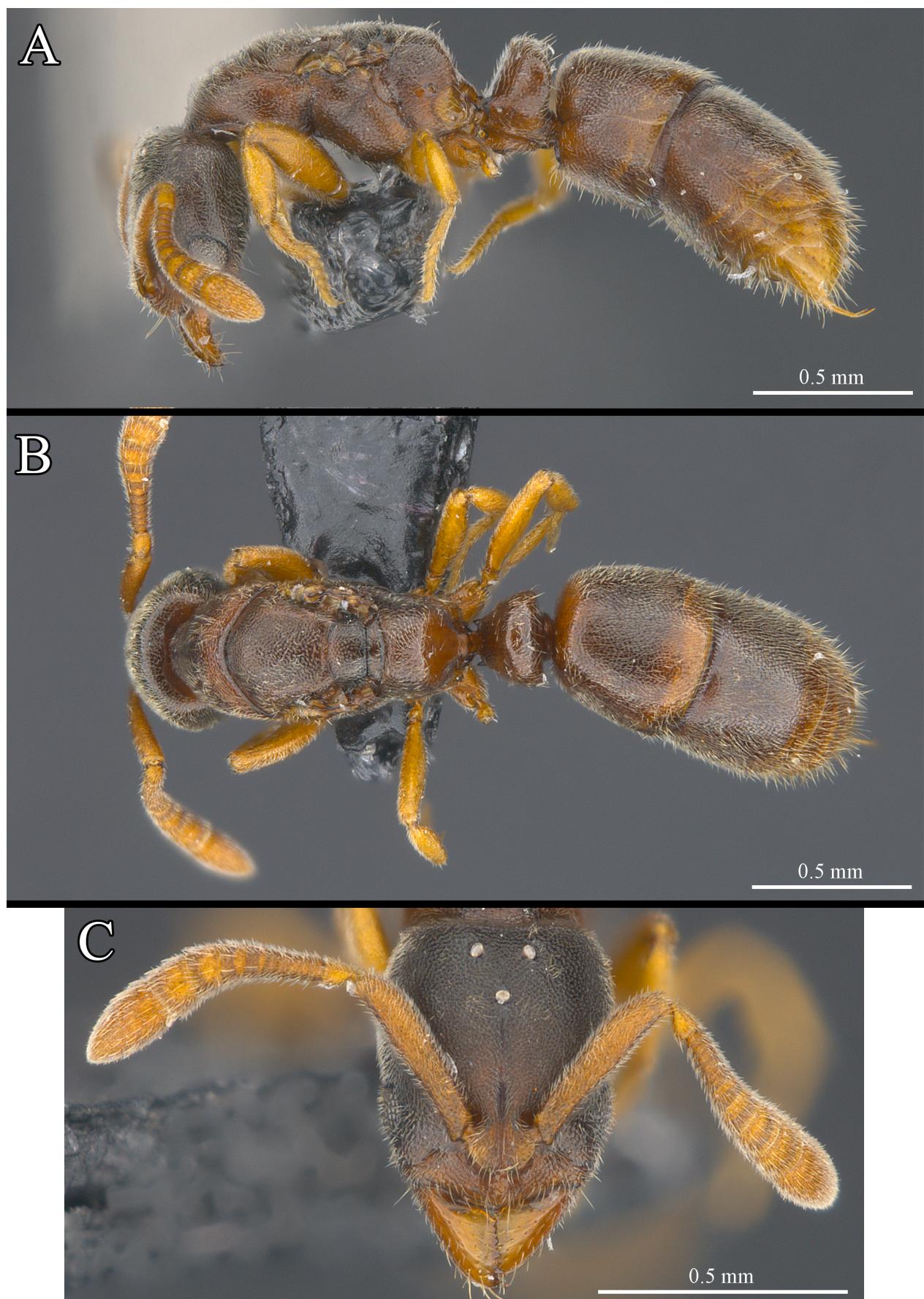
Workers (n=14): HL 0.49–0.55; HW 0.39–0.46; SL 0.30–0.36; A06L 0.02; A07L 0.02; A08L 0.03; A09L 0.05; A10L 0.07; PrW 0.31–0.36; WL 0.62–0.73; PeH 0.30–0.35; PeNL 0.15–0.18; PeW 0.23–0.26; ATL 0.34–0.40; ATW 0.38–0.44; CI 81–87, SI 73–82, PeI 70–81, LPeI 47–56, DPeI 135–162, ATI 85–96.

Queens (n=2): HL 0.56; HW 0.48–0.49; SL 0.36; A06L 0.02; A07L 0.03; A08L 0.04; A09L 0.05; A10L 0.07; PrW 0.42; WL 0.89–0.90; PeH 0.37–0.38; PeNL 0.17–0.18; PeW 0.29; ATL 0.47–0.48; ATW 0.50–0.51; CI 85–87, SI 73–76, PeI 68, LPeI 46, DPeI 164–168, ATI 91–96.

**Diagnosis (worker).** This species is characterized by a short antennal scape; a posterior margin of head moderately concave; a petiolar node in lateral view moderately thick and rectangular, the anterodorsal corner slightly higher than the posterodorsal corner; and a subpetiolar teeth distinctly visible. *Ponera taiyangshen* can be distinguished from *P. yuhuang* by the presence of a five segmented club, versus four-segmented club in *P. yuhuang*.



**FIGURE 51.** *P. taiyangshen* holotype worker, A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 52.** *P. taiyangshen* dealate queen (CMPon028), A: body, lateral view, B: body, dorsal view, C: head, full-face view.

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 81–87), moderately concave posterior margin, convex lateral margins, and rounded posterolateral corners, (Fig. 51C). Eye small; composed of a total of 4–5 indistinct facets. Anterior clypeal margin with blunt medial tooth. Masticatory margin of mandible with a series of about ten indistinct denticles, and three large on the apical part. Antennal scape, when laid backward, with a remaining distance of about 15% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.17 : 1.77 : 2.60 : 3.58$  (n=15).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 51A). Pronotum in dorsal view arched, with acutely convex anterior margin and moderately convex lateral margins (Fig. 51B). Metanotal groove distinct with a fine suture. Lateral mesopleural suture distinct and fine. Propodeal dorsum in dorsal view broad, with straight lateral margins. Posterodorsal corner of propodeum angular, propodeal dorsum and declivity forming approximatively a 125 degree angle.

**Metasoma.** Petiolar node in dorsal view arched, with broadly convex anterior margin and slightly concave posterior margin. Petiolar node in lateral view moderately thick and rectangular, with straight anterior margin and slightly convex posterior margin, anterodorsal corner forming a right angle, posterodorsal corner moderately convex with a projection, anterodorsal corner slightly higher than posterodorsal corner (Fig. 51A). Subpetiolar process with small and suboval fenestra, anteroventral corner blunt, almost straight ventral margin, posteroventral corner concave with small teeth. Third abdominal tergum broader than long (ATI: 85–96) with slightly convex anterior and posterior margins, and slightly convex lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosomal dorsum evenly punctate. Mesopleuron with weakly striate lower portion and sparsely punctate upper portion. Metapleuron and lateral face of propodeum striate, but especially smooth in the portion contained between metapleuron and propodeum. Propodeal declivity smooth and shining. Lateral face of petiole evenly punctate, posterior face smooth, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with few short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color black brown. Mandible, clypeus, antennae, legs, and apex of metasoma lighter.

**Description of queen. Head.** (Fig. 52C) Similar to worker caste, but with large and circular Eye, maximum diameter of each eye about 0.13 mm with about 10 ommatidia along the maximum diameter. Three ocelli present and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.20 : 1.60 : 2.31 : 2.96$  (n=2).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 52A). Pronotum in dorsal view pentagonal, with bluntly convex anterior margin, acutely convex posterior margin, slightly convex lateral margins (Fig. 52B). Scutum subpentagonal. Transcutal suture distinct and fine. Scutellum subrectangular with moderately convex anterior margin and straight posterior margin. Anapleural sulcus indistinct and weakly incised. Propodeal-metapleural suture indistinct. Propodeal dorsum broad, with straight lateral margins. Propodeal corner angular; propodeal dorsum and declivity forming approximatively a 125 degree angle.

**Metasoma.** Petiolar node in dorsal view very thin and subrectangular, with slightly convex anterior margin and almost straight posterior margin (Fig. 52B). Petiolar node in lateral view moderately thick and subtrapezoidal, with straight anterior margin and convex posterior margin (Fig. 52A). Subpetiolar process with small and circular fenestra, anteroventral corner blunt, almost straight ventral margin, and posteroventral corner concave with a pair of small teeth. The third abdominal segment similar to worker caste (ATI: 91–96).

**Sculpture.** Mostly like worker caste, but the sculpture more increase especially in the lateral view of mesosoma.

**Pubescence.** Similar to worker caste.

**Color.** Similar to worker caste.

**Description of male.** Unknown.

**Distribution.** Taiwan (Yilan county: Cuifenghu and Taipingshan).

***Ponera takaminei* Terayama, 1996**

(Fig. 53: worker; Fig. 53: dealate queen)

*Ponera takaminei* Terayama, 1996: 11 (w.). Type locality: Japan, Okinawa Pref., Miyako-jima.

**Type material examined:** JAPAN. Paratype. 1 worker, Miyako-jima, Okinawa Pref., 10 XI 1985, Y Hashimoto leg (MTC: LCM\_MT-Ponera-04).

**Non-type material examined:** JAPAN. 6 workers and 1 dealate queen, Kume Island, Okinawa Pref., 10 VII 1983, H Takamine leg (MTC: LCM\_MT-Ponera-01, LCM\_MT-Ponera-02, LCM\_MT-Ponera-03).

Measurements (mm) and indices. Worker (n=7): HL 0.68–0.75; HW 0.57–0.64; SL 0.47–0.52; A06L 0.04; A07L 0.04; A08L 0.06; A09L 0.08; A10L 0.09; PrW 0.44–0.50; WL 0.90–1.05; PeH 0.48–0.49; PeNL 0.27–0.30; PeW 0.41–0.60; ATL 0.55–0.60; ATW 0.55–0.62; CI 81–86, SI 77–82, PeI 93–95, LPeI 55–62, DPeI 145–171, ATI 94–101.

Queen (n=1): HL 0.79; HW 0.67; SL 0.46; A06L 0.04; A07L 0.05; A08L 0.09; A09L 0.10; A10L 0.12; PrW 0.56; WL 1.22; PeH 0.50; PeNL 0.28; PeW 0.49; ATL 0.70; ATW 0.67; CI 85, SI 69, PeI 88, LPeI 57, DPeI 173, ATI 105.

**Diagnosis (worker).** *Ponera takaminei* is a large species (HW: 0.57–0.64 mm) that can be distinguished by its long antennal scape, a distinct metanotal groove, a petiolar node thick when observed in lateral view with upper portion of the posterior margin bulging, and with a convex posterior margin of the petiolar node in dorsal view.

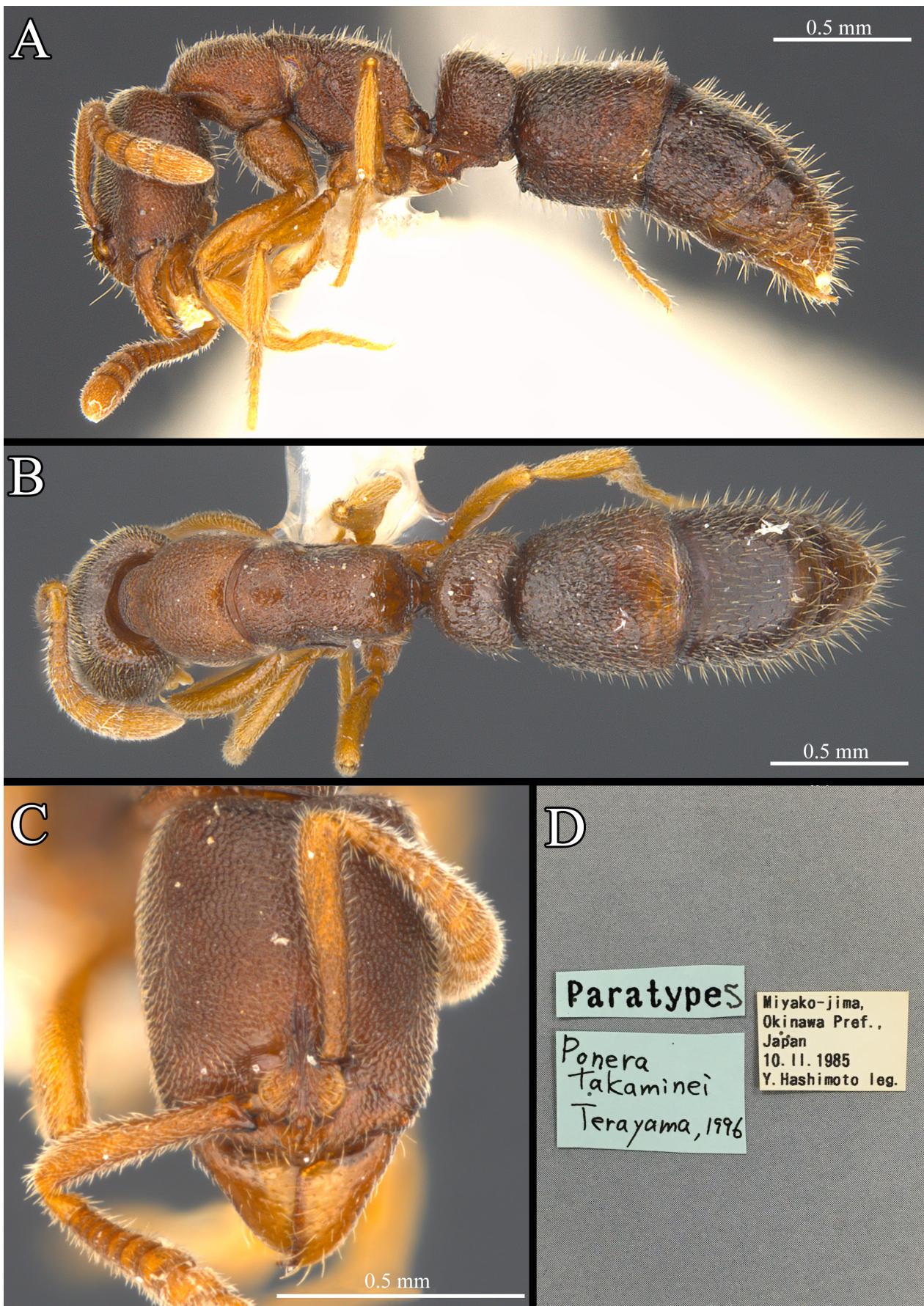
**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 81–86), with convex posterior margin, slightly convex lateral margins and broadly rounded posterolateral corners (Fig. 53C). Eye small; composed of a total of 3–5 indistinct facets. Anterior clypeal margin with very strong and blunt medial tooth. Masticatory margin of mandible with a series of about 12 indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 8% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.19 : 1.61 : 2.16 : 2.68$  (n=7).

**Mesosoma.** Mesosomal dorsum in lateral view slightly convex (Fig. 53A). Pronotum in dorsal view with well convex anterior margin, moderately convex lateral margins (Fig. 53B). Metanotal groove distinctly and clearly incised. Lateral mesopleural suture in lateral view deeply incised. Propodeal dorsum broad, with straight lateral margins. Posterodorsal corner of propodeum rounded, propodeal dorsum and declivity forming approximatively a 130 degree angle.

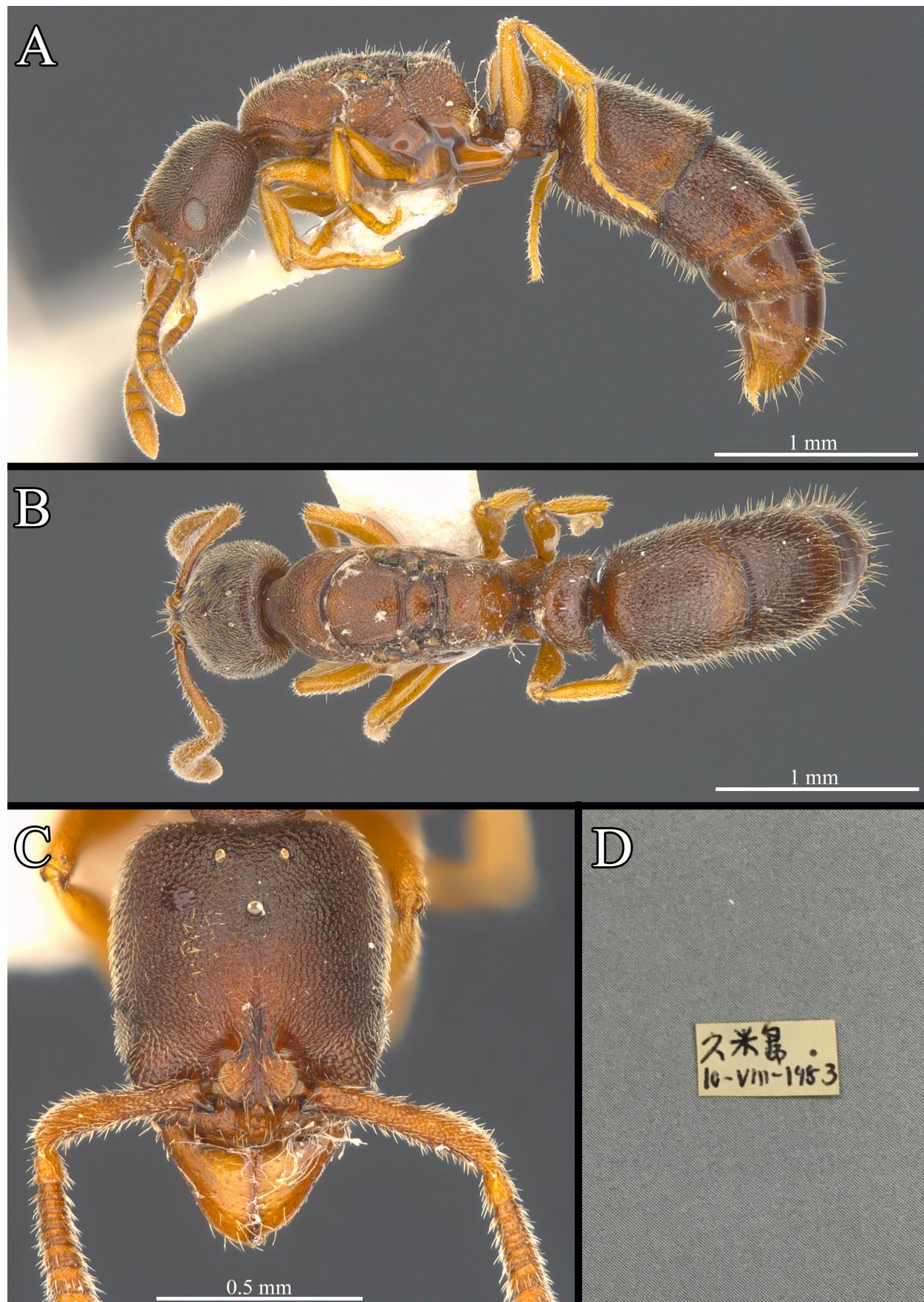
**Metasoma.** Petiolar node in dorsal view thick and arched, with slightly convex anterior margin, moderately concave posterior margin, and slightly convex lateral margins (Fig. 53B). Petiolar node in lateral view very remarkably and trapezoid, with straight anterior margin and moderately convex posterior margin; with upper portion bulging, anterodorsal corner higher than posterodorsal corner (Fig. 53A). Subpetiolar process thick with large and circular fenestra, anteroventral corner blunt, slightly concave ventral margin, and posteroventral corner concave with a pair of developed teeth. Third abdominal tergum as long as large (ATI: 94–101), with broadly convex anterior margin, slightly convex lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosomal dorsum evenly punctate, particular rough in propodeal dorsum. Mesopleuron, metapleuron and propodeum evenly striate. Propodeal declivity smooth. Lateral face of petiole evenly punctate, posterior face shining, dorsum rough and evenly punctate. The third and fourth abdominal segments densely punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with scattered short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node and gastral with many long erect hairs. Subpetiolar process with a few long erect hairs.



**FIGURE 53.** *P. takaminei* paratype worker (LCM\_MT-Ponera-02b), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 54.** *P. takaminei* dealate queen (LCM\_MT-Ponera-01), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.

**Color.** Body color reddish brown. Mandible, clypeus, antennae, legs, and apex of gaster orange.

**Description of queen** (dealate queen). **Head.** (Fig. 54C) Similar to worker caste, but with large and oval Eye, maximum diameter of each eye about 0.17 mm with 13 ommatidia along the maximum diameter. Three ocelli present, and forming a subequilateral triangle; median eye larger than lateral eye. Antennal scape similar to worker;

average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.07 : 1.53 : 1.80 : 1.85$  (n=1).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 54A). Pronotum in dorsal view with moderately convex anterior margin and broadly convex lateral margins (Fig. 54B). Scutum subpentagonal, with moderately convex anterior margin, almost straight posterior margin. Transcutal suture distinct and broad. Scutellum oval. Anapleural sulcus weakly incised. Propodeal-metapleural suture indistinct. Propodeal dorsum in dorsal view broad with straight lateral margins. Propodeal corner in lateral view rounded; propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and arched, broader than long, with broadly convex anterior margin, moderately concave posterior margin (Fig. 54B). Petiolar node in lateral view trapezoidal and moderately thick, with straight anterior and posterior margins (Fig. 54A). Subpetiolar process with large and circular fenestra, anteroventral corner blunt, slightly concave ventral margin, and posteroventral corner concave with a pair of medium-sized teeth. The ratio of third abdominal segment slightly longer than worker caste (ATI: 105).

**Sculpture.** Similar to worker caste.

**Pubescence.** Similar to worker caste.

**Color.** Similar to worker caste.

**Description of male.** Unknown.

**Distribution.** Japan (Okinawa Pref.).

### ***Ponera tamon* Terayama, 1996**

(Fig. 55: worker; Fig. 56: dealate queen)

*Ponera tamon* Terayama, 1996: 11 (w. q.). Type locality: Japan, Kagoshima Pref., Anami-oshima, Uken-son.

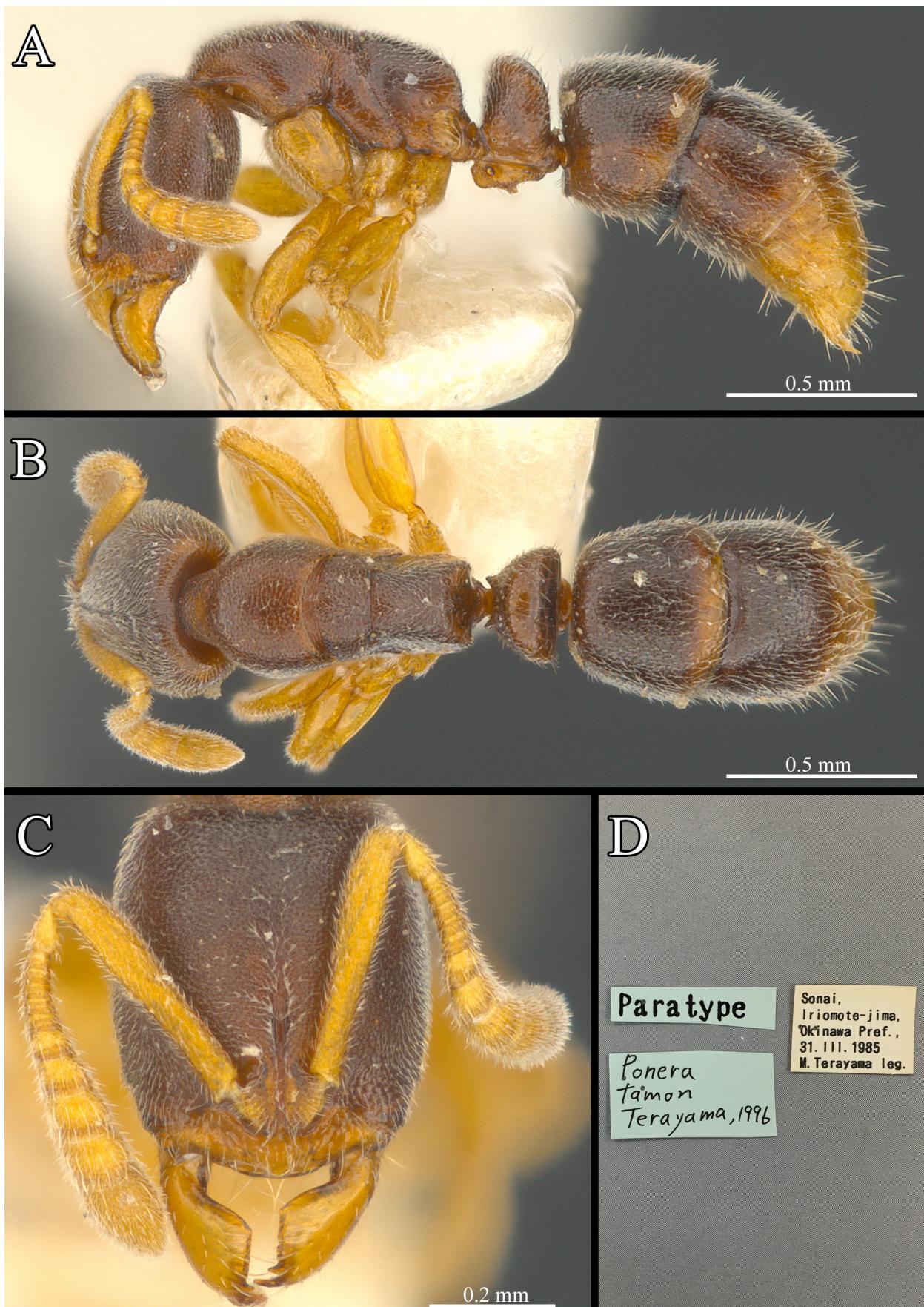
**Type material examined:** JAPAN. Paratypes, 2 workers, Okinoerabu-jima, Kagoshima Pref., 17 III 1989, M Terayama leg (MTC). 1 worker, Sonai, Iriomote-jima, Okinawa Pref., 31 III 1985, M Terayama leg (MTC: LCM\_MT-Ponera-25). 1 dealate queen and 2 workers, Uken-son, Amami-oshima, Kagoshima Pref., 1 VII 1983, M Terayama leg (MTC: LCM\_MT-Ponera-26, LCM\_MT-Ponera-28). 3 workers, Nago, Okinawai Is., 3 X 1984, M Terayama leg (MTC: LCM\_MT-Ponera-27). 9 workers, Sumiyo-son, Amami-oshima, Kagoshima Pref., VII 1983, M Terayama (MTC: LCM\_MT-Ponera-29, LCM\_MT-Ponera-30, LCM\_MT-Ponera-31, LCM\_MT-Ponera-32).

**Non-type material examined:** JAPAN. 4 workers and 1 dealate queen, Okuyona forest road, Okinawa Pref., 20IV2001, CC Lin leg (CMPon175, CMPon176, CMPon177, CMPon178, CMPon179). 2 workers, Naha, Okinawa Pref., 18 IV 2001, CC Lin leg (CMPon180, CMPon181). 1 worker, Aminoko-toge, Setouchi-cho, Amami-Oshima Island, Kagoshima Pref., 26 I 2008, Sk Yamane leg (CMPon169). TAIWAN. 2 workers, Taroko Nat. Par. (Wenshan), Hualien county, 23 I 1989, CC Lin leg (CMPon68; CMPon69). 1 worker and 1 dealate queen, 23.3549°N; 121.1867°E, Maravi, Hualien county, 31 X 2016, WH Lin leg (CMPon161, CMPon162).

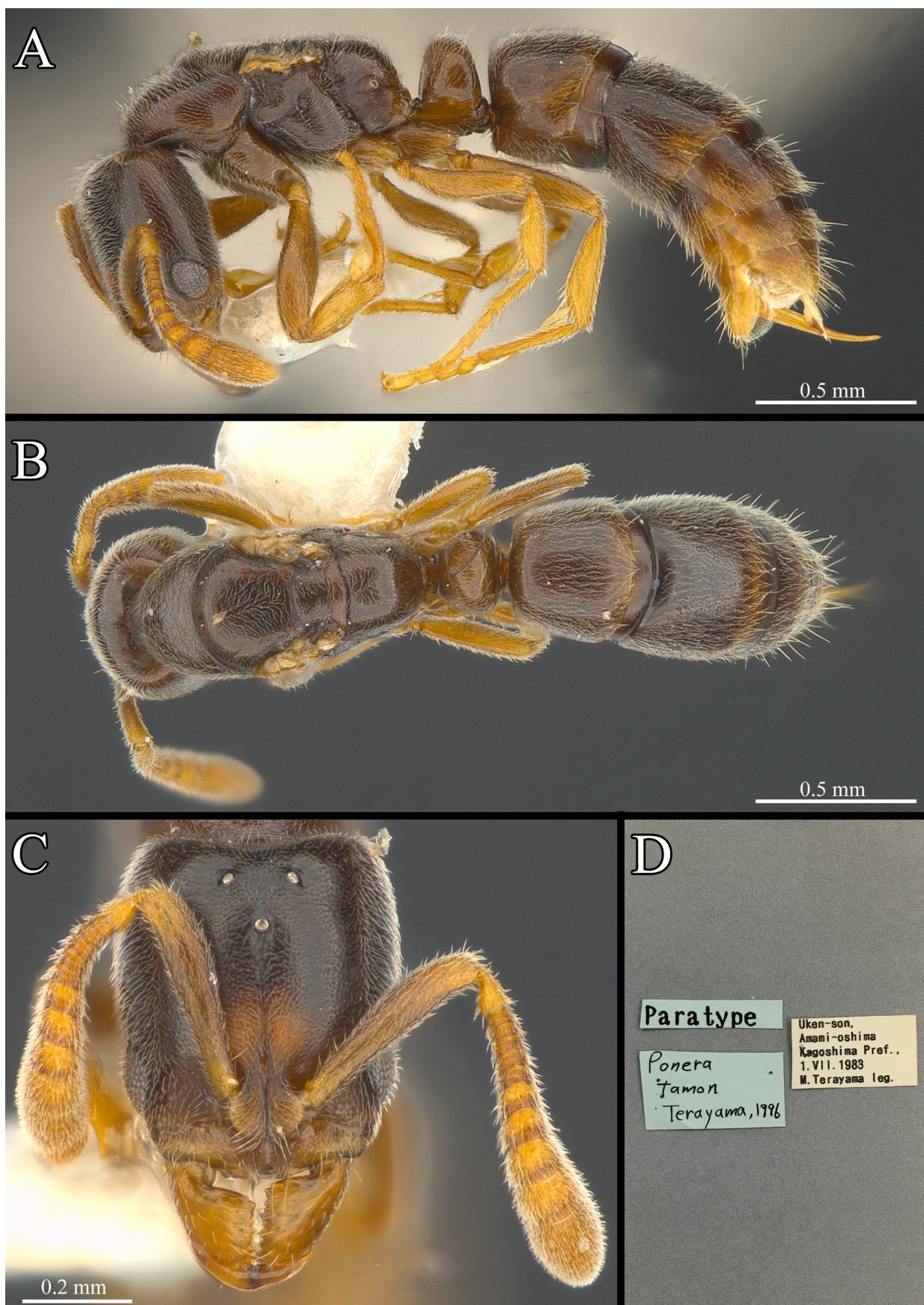
Measurements (mm) and indices. Workers (n=22): HL 0.51–0.59; HW 0.44–0.52; SL 0.32–0.41; A06L 0.02; A07L 0.03; A08L 0.04; A09L 0.06; A10L 0.07; PrW 0.33–0.40; WL 0.66–0.84; PeH 0.30–0.42; PeNL 0.16–0.21; PeW 0.26–0.33; ATL 0.37–0.45; ATW 0.41–0.52; CI 83–91, SI 71–86, PeI 74–87, LPeI 46–55, DPeI 152–184, ATI 76–93.

Queens (n=3): HL 0.59–0.61; HW 0.52–0.55; SL 0.40–0.45; A06L 0.03; A07L 0.03; A08L 0.05; A09L 0.06; A10L 0.08; PrW 0.44–0.50; WL 0.88–1.11; PeH 0.33–0.47; PeNL 0.19–0.21; PeW 0.27–0.39; ATL 0.40–0.54; ATW 0.46–0.65; CI 89–92, SI 77–81, PeI 65–80, LPeI 45–57, DPeI 150–185, ATI 84–90.

**Diagnosis (worker).** *Ponera tamon* can be easily by its short antennal scape not reaching the posterior margin of the head, a clypeus with blunt medial tooth, a metanotal groove distinctly visible, a subtriangular petiolar node when observed in lateral view with a moderately convex posterior margin, and its brown body color.



**FIGURE 55.** *P. tamon* paratype worker (LCM\_MT-Ponera-25), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 56.** *P. tamon* paratype dealate queen (LCM\_MT-Ponera-26), A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.

**Description of worker. Head.** In full-face view, head structure subrectangular and slightly longer than broad (CI: 84–91), with slightly convex posterior margin, moderately convex lateral margins and broadly rounded posterolateral corners (Fig. 55C). Eye small; composed of a total of 4 to 5 indistinct facets. Anterior clypeal margin with blunt medial tooth. Masticatory margin of mandible with a series of about ten indistinct denticles, and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 5% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.17 : 1.89 : 2.41 : 3.08$  (n=22).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 55A). Pronotum in dorsal view with acutely convex anterior margin, and convex lateral margins (Fig. 55B). Metanotal groove distinctly incised with fine suture. Lateral mesopleural suture weakly incised. Propodeal dorsum in dorsal view broad, with straight lateral margins. Propodeal corner in lateral view rounded; propodeal dorsum and declivity forming approximatively a 115 degree angle.

**Metasoma.** Petiolar node in dorsal view arched and moderately thin, with broadly convex anterior margin, and slightly convex posterior margin (Fig. 55B). Petiolar node in lateral view subtriangular and moderately thick, with straight anterior margin, and moderately convex posterior margin; with distinct projection on posterodorsal corner, dorsum forming a blunt angle (Fig. 55A). Subpetiolar process with small and circular fenestra, anteroventral corner blunt, concave ventral margin with small teeth. Third abdominal tergum generally broader than long (ATI: 76–93), with slightly convex anterior margin, almost straight lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosoma evenly punctate. Mesopleuron with weakly striate lower portion and sparsely punctate upper portion. Metapleuron with weakly striate lower portion and smooth upper portion. Propodeal declivity smooth and shining. Lateral face of petiole evenly punctate, posterior face smooth, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with few short hairs, and with glabrous upper portion of mesopleuron. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color brown. Mandible, clypeus, antennae, legs, and apex of metasoma lighter.

**Description of queen. Head.** (Fig. 56C) Similar to worker caste, but with large and oval Eye, maximum diameter of each eye about 0.13 mm with 10 ommatidia along the maximum diameter. Three ocelli present, and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.22 : 1.74 : 2.16 : 2.75$  (n=3).

**Mesosoma.** Mesosomal dorsum in lateral view broadly convex (Fig. 56A). Pronotum in dorsal view with convex anterior margin, and broadly convex lateral margins (Fig. 56B). Scutum subtrapezoidal, narrow posteriad, with broadly convex anterior margin, and concave posterior margin. Transcutal suture distinct and broad. Scutellum subrectangular. Anapleural sulcus clearly incised. Propodeal-metapleural suture indistinct. Propodeal dorsum in dorsal view broad, with straight lateral margins. Propodeal corner rounded and almost forming approximatively 115 degree angle.

**Metasoma.** Petiolar node in dorsal view oval and moderately thin, broader than long, with broadly convex anterior margin, and slightly convex posterior margin (Fig. 56B). Petiolar node in lateral view subconical and moderately thick, moderately convex anterior and posterior margins, dorsum well convex (Fig. 56A). Subpetiolar process with small and circular fenestra, anteroventral corner blunt, concave ventral margin, and posteroventral corner concave with a pair of small teeth. The third abdominal segment similar to worker caste (ATI: 105).

**Sculpture.** Similar to worker caste.

**Pubescence.** Similar to worker caste.

**Color.** Similar to worker caste.

**Description of male.** Unknown.

**Distribution.** Japan (Kyushu, Okinawa Is., Satsunan Is., and Yaeyama Is.) and Taiwan (Taitung county: Maravi and Wenshan).

**Ponera terayamai sp. n.**

<http://zoobank.org/3D911AD9-18BB-4287-9820-514DD7F673E3>

(Figs. 59, 61: holotype worker; Figs. 60, 62: paratype worker; Figs. 63, 64: paratype dealate queen)

**Type material:** Holotype. Worker: **TAIWAN**. 1777 to 1787 m alt., Fenghuang Shan, Xitou, Nantou county, 18 X 2016, via Winkler extractor, PC Hsu leg (NMNS: CMPon163).

Paratypes (12 workers and 2 dealate queens). **TAIWAN**. 3 workers, same collection data as holotype (NTU: CMPon159, CAS: CMPon160, TARI: CMPon164). 1 worker, 23.6592°N; 120.8074°E, 1786 m alt., Fenghuang Shan, Xitou, Nantou county, 12 I 2016, via Winkler extractor, PC Hsu leg (HKUBM: CMPon019). 1 worker, 23.6595°N; 120.8074°E, 1787 m alt., Fenghuang Shan, Xitou, Nantou county, 12 I 2016, via Winkler extractor, PC Hsu leg (NMNS: CMPon021). 1 worker, 23.6592°N; 120.8074°E, 1786 m alt., Fenghuang Shan, Xitou, Nantou county, 15 II 2016, via Winkler extractor, PC Hsu leg (NMNS: CMPon022). 1 dealate queen, 23.6598°N; 120.8057°E, 1777 m alt., Fenghuang Shan, Xitou, Nantou county, 22 III 2016, via Winkler extractor, PC Hsu leg (NMNS: CMPon018). 5 workers and 1 dealate queen, ca. 1400 m alt., Fenchiuh, Chiayi county, 8 X 1994, WH Tsai leg (NTU: CMPon006; NMNS: CMPon007, CAS: CMPon008; TARI: CMPon009; HKUBM: CMPon011; TARI: CMPon014).

**Non-type material:** **TAIWAN**. 1 worker, 24.5054°N; 121.1140°E, 2085 m alt., Xuejian Recreation area, Miaoli county, VIII 2016, via pit-fall trap, JY Tsai leg (NIAES: CMPon026).

Measurements (mm) and indices. Holotype. Worker: HL 0.56; HW 0.44; SL 0.36; A06L 0.02; A07L 0.02; A08L 0.04; A09L 0.06; A10L 0.07; PrW 0.33; WL 0.73; PeH 0.33; PeNL 0.20; PeW 0.25; ATL 0.45; ATW 0.39; CI 78, SI 83, PeI 76, LPeI 61, DPeI 162, ATI 116.

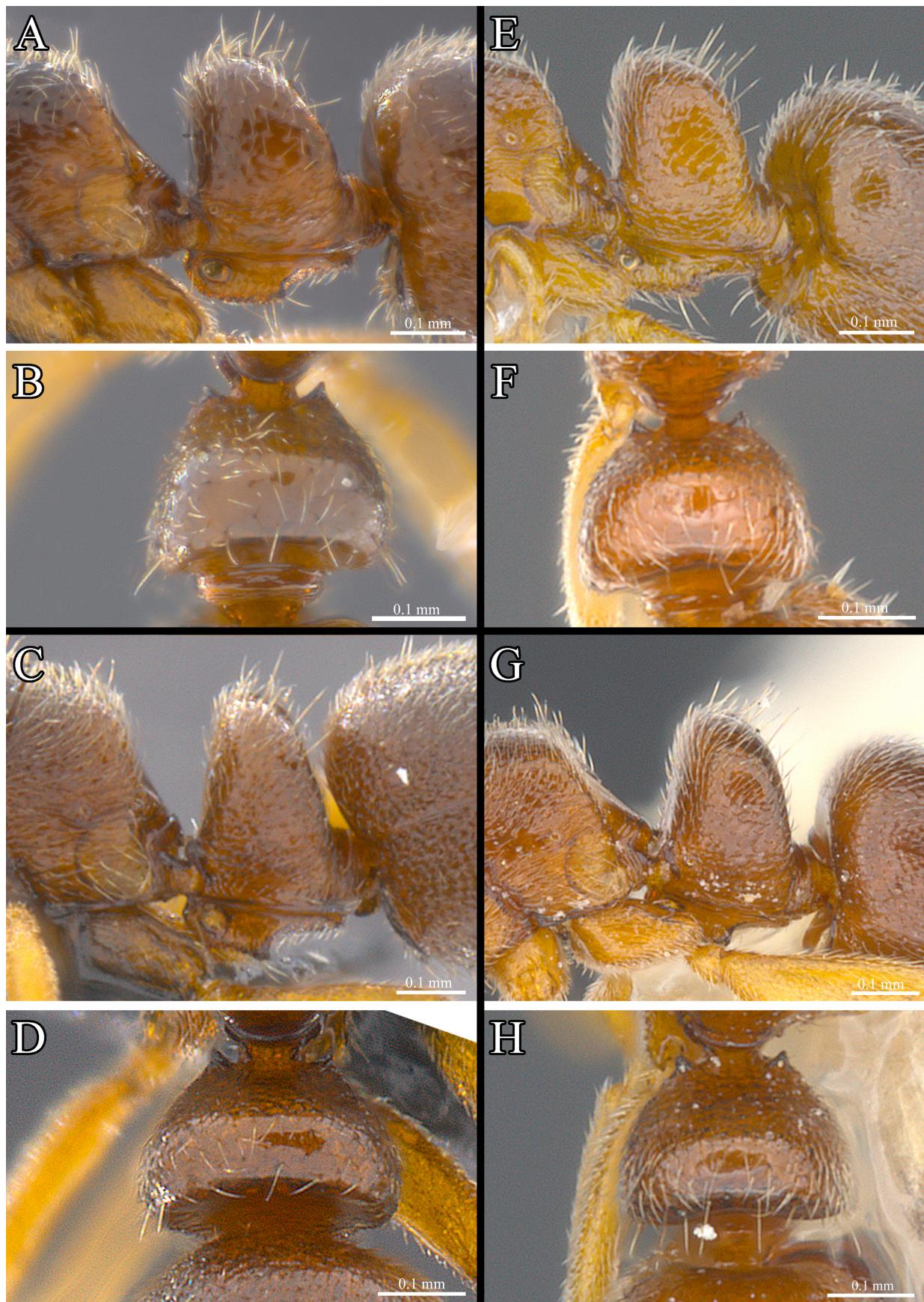
Paratype workers (n=11): HL 0.53–0.57; HW 0.43–0.47; SL 0.32–0.38; A06L 0.02; A07L 0.02; A08L 0.04; A09L 0.06; A10L 0.08; PrW 0.32–0.35; WL 0.68–0.76; PeH 0.33–0.36; PeNL 0.18–0.21; PeW 0.24–0.27; ATL 0.44–0.48; ATW 0.38–0.44; CI 76–82, SI 73–86, PeI 72–83, LPeI 53–58, DPeI 143–178, ATI 106–117.

Paratype gynes (n=2): HL 0.58–0.61; HW 0.47–0.50; SL 0.40–0.41; A06L 0.02; A07L 0.02; A08L 0.05; A09L 0.06; A10L 0.08; PrW 0.42–0.43; WL 0.88–0.92; PeH 0.39; PeNL 0.21–0.22; PeW 0.30; ATL 0.54–0.56; ATW 0.49–0.50; CI 81–83, SI 82–85, PeI 70–71, LPeI 54–57, DPeI 133–142, ATI 110–112.

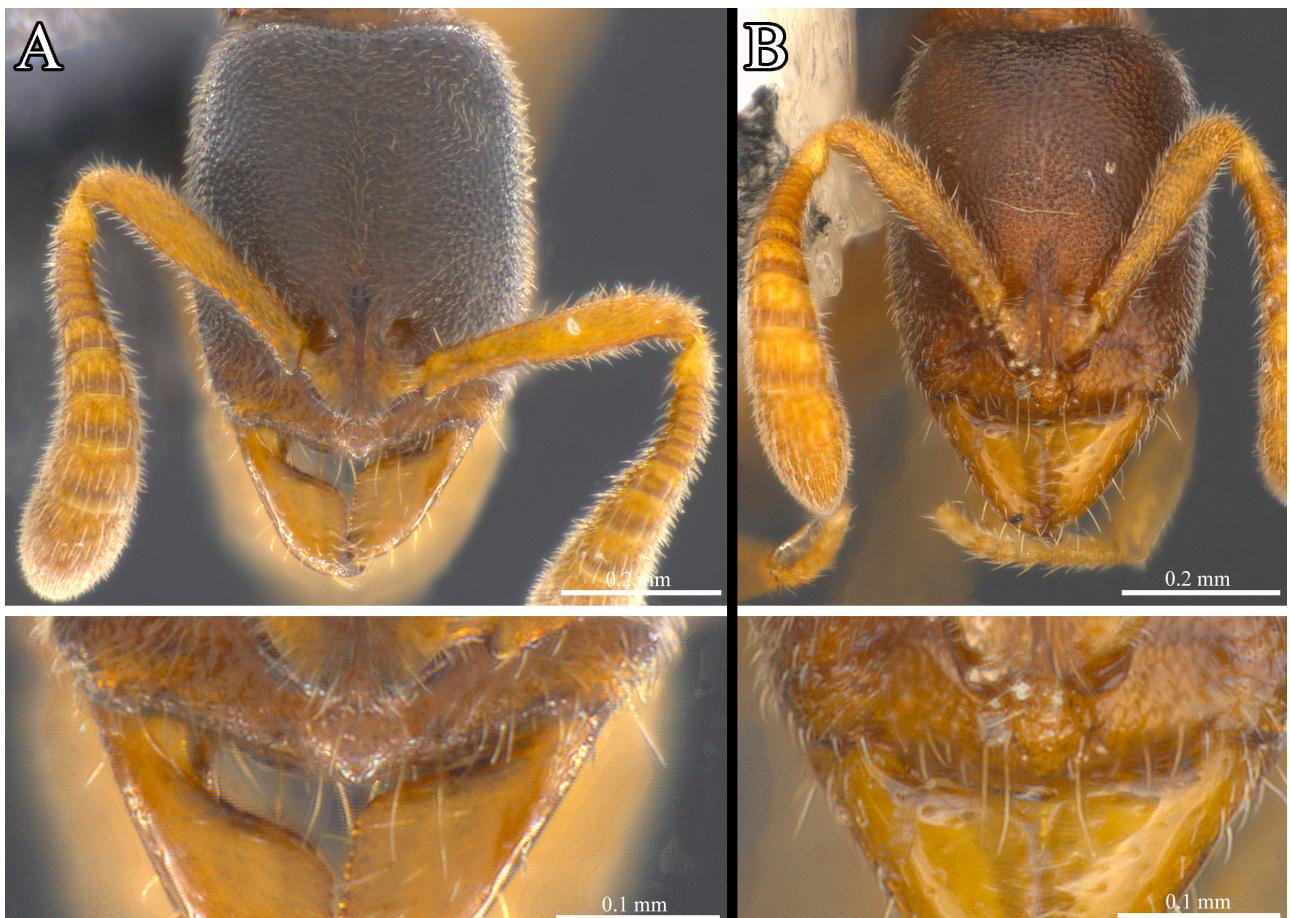
**Diagnosis (worker).** *Ponera terayamai* can be easily distinguished by the combination of the following characters: in *P. terayamai*, (1) the clypeus presents an acute anterior margin, (2) in dorsal view, the petiolar node is not forming an arch and has an anterior margin almost straight, (3) the dorsum of the petiolar node forms an arch in lateral view and has a posterior margin broadly convex, (4) the antennal scape is short; far to reach the posterior margin of head, and (5) the third abdominal tergum distinctly longer than broad. Although *P. terayamai* presents similarities with *P. bishamon*, both species can be distinguished by the shape of their petiolar node and body size; when observed in lateral view, the petiolar node of *P. terayamai* is subtrapezoidal with a clearly convex posterior margin (Fig. 57A), while *P. bishamon* has a rectangular petiolar node with a slightly convex posterior margin (Fig. 57B). In dorsal view, the petiolar node of *P. terayamai* is relatively broader than *P. bishamon*. *Ponera terayamai* is also larger (HW: 0.43–0.47 mm; n=12) than *P. bishamon* (HW: 0.38–0.39 mm; n=4 with single type worker included). Moreover, *P. terayamai* presents a relatively acute tooth on its clypeus which is less developed in *P. bishamon* (Fig. 58).

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 76–82), with slightly convex posterior margin and lateral margins, rounded posterolateral corner (Fig. 59). Eye small; composed of a total of 4 to 5 indistinct facets (Fig. 60C). Anterior clypeal margin with acute medial tooth (Fig. 60A). Masticatory margin of mandible with a series of about 11 to 12 indistinct denticles (Fig. 60B) and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 10% of the

scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.08 : 1.96 : 2.74 : 3.56$  (n=12).



**FIGURE 57.** Petiole, *P. terayamai* sp. n. holotype worker, A: lateral view, B: dorsal view; paratype dealate queen, C: lateral view, D: dorsal view. Petiole, *P. bishamon* worker, E: lateral view, F: dorsal view; dealate queen, G: lateral view, H: dorsal view.



**FIGURE 58.** Clypeus, A: *P. terayamai* sp. n. holotype worker, B: *P. bishamon* worker.

**Mesosoma.** Mesosomal dorsum in lateral view straight (Fig. 61A). Pronotum in dorsal view arched, with slightly convex lateral margins of pronotum (Fig. 62B). Metanotal groove weakly incised, with fine suture (Fig. 62B). Lateral mesopleural suture weakly incised (Fig. 62B). Propodeal dorsum broad, with straight lateral margins. Posterodorsal corner of propodeum rounded, propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view trapezoidal and distinctly broader than long (Fig. 61B), with almost straight anterior margin, slightly concave posterior margin, and slightly convex lateral margins. Petiolar node in lateral view (Fig. 61A) moderately thick and subtrapezoid, with straight anterior margin, broadly convex posterior margin, and dorsum forming an arch. Subpetiolar process with median-sized and oval fenestra, anteroventral corner blunt, ventral margin straight, with a series of indistinct denticles (Fig. 60D), and posteroventral corner concave with a pair of small teeth. Third abdominal tergum distinctly longer than broad (ATI: 106–117), with slightly convex anterior margin and straight lateral margins (Fig. 61C).

**Sculpture.** Head densely punctate (Fig. 60AC). Mandible sparsely punctate (Fig. 60B). Mesosomal dorsum evenly punctate, but scattered on propodeum. Mesopleuron striate; more densely striate in its lower portion. Metapleuron and lateral face of propodeum striate (Fig. 62A); with denser striae present on the lower portion. Propodeal declivity smooth. Lateral face of petiole sparsely punctate, smooth posterior face, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma and gaster with dense short hairs. Mesopleuron, metapleuron and propodeum with few short hairs (Fig. 62A). Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color dark brown. Mandible, clypeus, antennae, legs, and apex of gaster yellowish orange.



**FIGURE 59.** *P. terayamai* sp. n. holotype worker (CMPon163), head, full-face view.

**Description of queen. Head.** (Fig. 63) Similar to worker caste, but with large and rounded Eye; maximum diameter of each eye about 0.10 mm with 8 ommatidia along the maximum diameter. Three ocelli present and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.11 : 2.20 : 2.92 : 3.89$  (n=2).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 64A). Pronotum in dorsal view arched, with distinctly convex anterior margin, and convex lateral margins (Fig. 64B). Scutum subtrapezoidal and strongly narrow posteriad, with convex anterior margin, and slightly convex posterior margin. Transcutal suture distinct. Scutellum oval. Anapleural sulcus weakly incised. Propodeal-metapleural suture incised. Propodeal dorsum in dorsal view broad, with right posterolateral corner, and straight posterior margin. Propodeal corner almost forming a sub-right angle.

**Metasoma.** Petiolar node in dorsal view thin and subrectangular; strongly broader than long, with almost straight anterior and posterior margins, and convex lateral margins (Fig. 64B). Petiolar node in lateral view thin and subtriangular, with straight anterior margin, and moderately convex posterior margin (Fig. 64A). Subpetiolar process with middle and circular fenestra, anteroventral corner blunt, ventral margin slightly concave, and

posteroventral corner concave with strong and acute teeth. The third abdominal segment similar to worker caste (Fig. 64B) (ATI: 110–112).

**Sculpture.** Similar to worker caste.

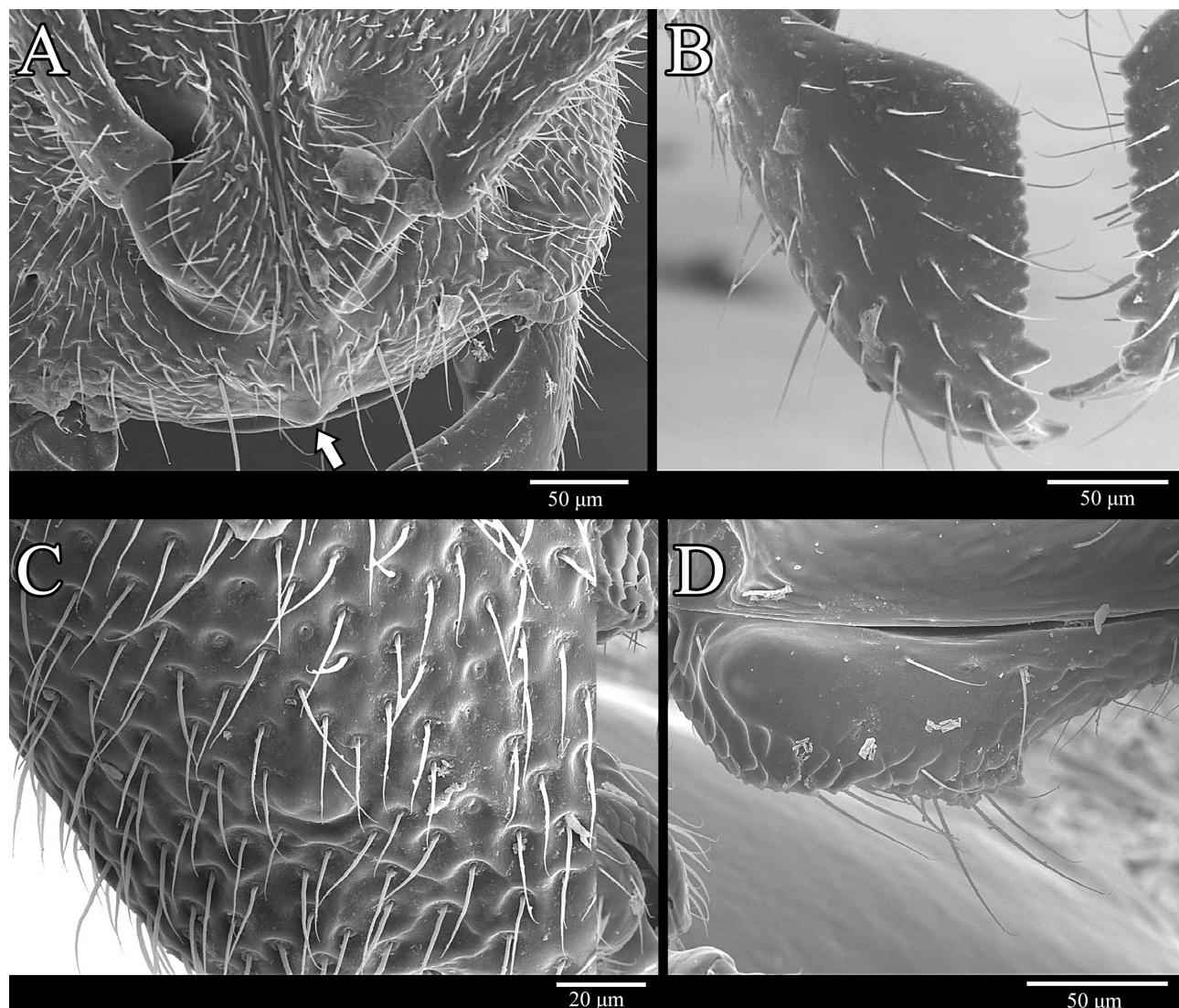
**Pubescence.** Mostly like worker caste, except for metapleuron and propodeum with scattered short decumbent hairs.

**Color.** Similar to worker caste.

**Remarks.** The type specimens of *P. terayamai* were collected in five separate Winkler samples from leaf litter in primary forest. In Xuejian Recreation area, additional specimens were collected with pitfall traps. Other paratypes are from Fenchihu (ca. 1400 m; primary forest) but without further information on habitat type. While this species was collected with both Winkler extractors and pitfall traps, Winkler extractors seem most useful to collect this cryptobiotic ant. *P. terayamai* prefers mature forests at middle to high elevation habitats based on current knowledge of collecting information (1777 to 2085 m elevation).

**Etymology.** The specific name is given in honor of the Japanese entomologist, Dr. Mamoru Terayama for his contribution to the myrmecological research in Taiwan and the taxonomic study of *Ponera*.

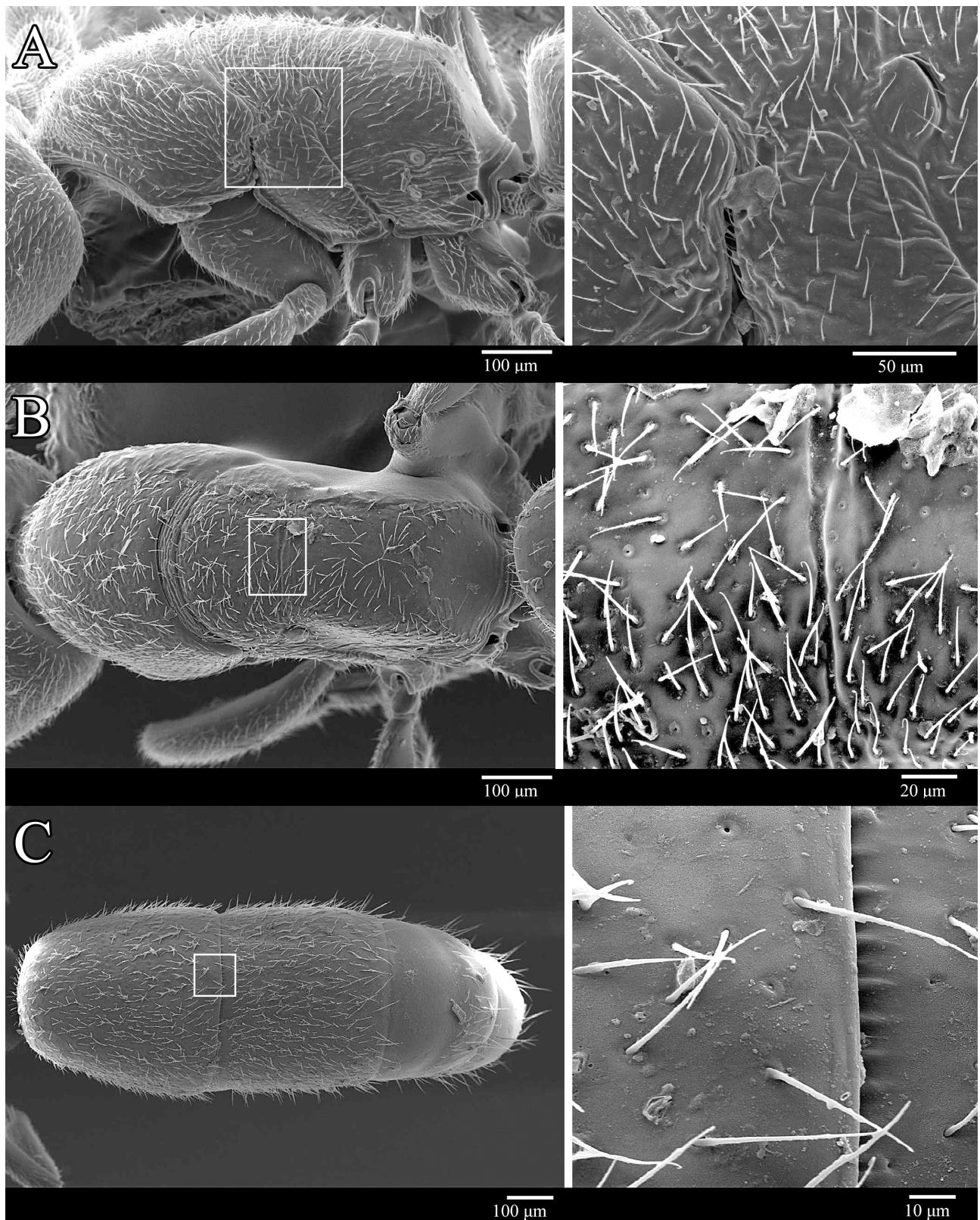
**Distribution.** Taiwan (Miaoli county: Xuejian Recreation area, Nantou county: Xitou- and Chiayi county: Fenchihu).



**FIGURE 60.** *P. terayamai* sp. n. paratype worker (CMPPon021), SEM photo, A: clypeus (the arrow indicates clypeal tooth), B: mandible, C: eye, D: subpetiolar process.



**FIGURE 61.** *P. terayamai* sp. n. holotype worker (CMPon163), A: mesosoma, lateral view, B: mesosoma and petiole, dorsal view, C: third abdominal tergum, dorsal view.



**FIGURE 62.** *P. terayamai* sp. n. paratype worker (CMPPon021), SEM photo, A: lateral mesopleural suture, B: metanotal groove, C: helcium.



**FIGURE 63.** *P. terayamai* sp. n. paratype dealate queen (CMPon018), head, full-face view.

***Ponera wui* sp. n.**

<http://zoobank.org/325D05C9-0F30-4151-8AEA-F0BC098BDEA3>

(Figs. 65, 67: holotype worker; Figs. 66, 68: paratype worker; Figs. 69, 70: paratype dealate queen)

**Holotype.** Worker. **TAIWAN.** Orchid Island, Taitung county, 11 IX 1997, WH Tsai leg (NMNS: CMPon029).

**Paratypes.** **TAIWAN.** 2 alate queens, (NMNS: CMPon004; NIAES: CMPon030) and 3 workers, same collection data as holotype, NTU: CMPon002; NIAES: CMPon031; CAS: CMPon032). 1 worker, Orchid Island, Taitung county, 17 V 1997, WH Tsai leg (HKUBM: CMPon005).

Measurements (mm) and indices. Holotype. Worker: HL 0.61; HW 0.51; SL 0.42; A06L 0.03; A07L 0.03; A08L 0.05; A09L 0.06; A10L 0.08; PrW 0.38; WL 0.85; PeH 0.38; PeNL 0.20; PeW 0.31; ATL 0.42; ATW 0.49; CI 83, SI 84, PeI 82, LPeI 51, DPeI 159, ATI 85.

Paratype workers (n=4): HL 0.60–0.62; HW 0.49–0.52; SL 0.40–0.45; A06L 0.03; A07L 0.03; A08L 0.05; A09L 0.06; A10L 0.08; PrW 0.38–0.40; WL 0.80–0.86; PeH 0.39–0.41; PeNL 0.21–0.22; PeW 0.31–0.34; ATL 0.39–0.41; ATW 0.48–0.51; CI 81–84, SI 78–88, PeI 81–86, LPeI 52–57, DPeI 147–159, ATI 77–85.

Paratype alate queens (n=2): HL 0.65–0.67; HW 0.54–0.56; SL 0.42–0.46; A06L 0.04; A07L 0.04; A08L 0.05; A09L 0.07; A10L 0.09; PrW 0.49–0.50; WL 0.95–0.99; PeH 0.46; PeNL 0.23–0.24; PeW 0.39–0.40; ATL 0.48–0.51; ATW 0.59–0.60; CI 82–83, SI 75–86, PeI 77–81, LPeI 50–52, DPeI 160–174, ATI 79–86.

**Diagnosis (worker).** *Ponera wui* can be distinguished from other Asian *Ponera* species by the combination of the following characters: in *P. wui*, (1) the subpetiolar process has an acute and well-developed subpetiolar teeth, (2) the petiolar node is moderately thick and trapezoid, (3) the clypeal margin presents an acute median tooth, (4) the antennal scapes almost reach the posterior margin of head, and (5) in lateral view the propodeum is shining and smooth. Based on its morphology, *Ponera wui* is most similar to *P. alisana*, *P. japonica*, *P. scabra*, *P. diodonta*, *P. chapmani* and *P. oreas*. However, *P. wui* is distinct by the absence of a metanotal groove (strongly distinct in *P. alisana*, *P. japonica*, *P. chapmani* and *P. oreas*) and its thick petiolar node when observed in dorsal view (thin in *P. diodonta*). Also *Ponera wui* can be distinguished from *P. scabra* by its indistinctly incised mesopleural suture (Fig. 65B) and relatively thin petiolar node in lateral view (Fig. 65B), contrasting with the distinctly incised lateral mesopleural suture (Fig. 65A) and well thick petiolar node (Fig. 65A) of *P. scabra*.



**FIGURE 64.** *P. terayamai* sp. n. paratype dealate queen (CMPPon018), A: mesosoma, lateral view, B: mesosoma, dorsal view.

**Description of worker. Head.** In full-face view, head subrectangular and distinctly longer than broad (CI: 81–84), with almost straight posterior margin, convex lateral margins and bluntly rounded posterolateral corners (Fig. 66). Eye small; composed of a total of 4–5 indistinct facets (Fig. 67C). Anterior clypeal margin with distinctly acute medial tooth (Fig. 67A). Masticatory margin of mandibles with a series of about eight indistinct teeth (Fig. 67B) and three large teeth on the apical part. Antennal scape, when laid backward, with a remaining distance of about 5% of the scape length to the posterolateral corner; average ratio of the length of antennomeres

$$\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.42 : 2.23 : 2.74 : 3.59 \text{ (n=5).}$$



**FIGURE 65.** A comparison of lateral view focusing mesosoma (the arrow indicates the contained portion between metapleuron and propodeum); A: *P. scabra*, B: holotype of *P. wui* sp. n.

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 68A). Pronotum in dorsal view arched, with convex lateral margins (Fig. 68B). Metanotal groove indistinct and almost obliterated (Fig. 69B). Propodeal dorsum in dorsal view moderately broad, with straight lateral margins. Lateral mesopleural suture indistinctly incised and almost obliterated (Fig. 69B). Posterodorsal corner in lateral view angular; propodeal dorsum and declivity forming approximatively a 130 degree angle.

**Metasoma.** Petiolar node in dorsal view broader than long, with convex anterior margin, straight posterior margin, and broadly convex lateral margins (Fig. 68B). Petiolar node in lateral view moderately thick and trapezoidal, with straight anterior margin, slightly convex posterior margin, and broadly convex dorsum (Fig. 68A). Subpetiolar process with medium and oval fenestra, anteroventral corner blunt, and posteroventral corner concave with a pair of developed and acute teeth (Fig. 67D). The third abdominal tergum distinctly broader than long (ATI: 77–85) and moderately narrow anteriad, with slightly convex anterior and posterior margins, and slightly convex lateral margins.

**Sculpture.** Head densely punctate (Fig. 67A). Mandible sparsely punctate (Fig. 67B). Mesosomal dorsum densely punctate. Mesopleuron with moderately striate lower portion, weakly striate and evenly punctate upper portion. Metapleuron with weakly striate lower portion and smooth upper portion (Fig. 69A). Lateral face of

propodeum sparsely punctate. Propodeal declivity smooth. Lateral face of petiole with sparsely punctate, posterior face smooth, dorsum with few punctures. The third and fourth abdominal segments with evenly punctate, others segments smooth and shining with sparsely punctate.

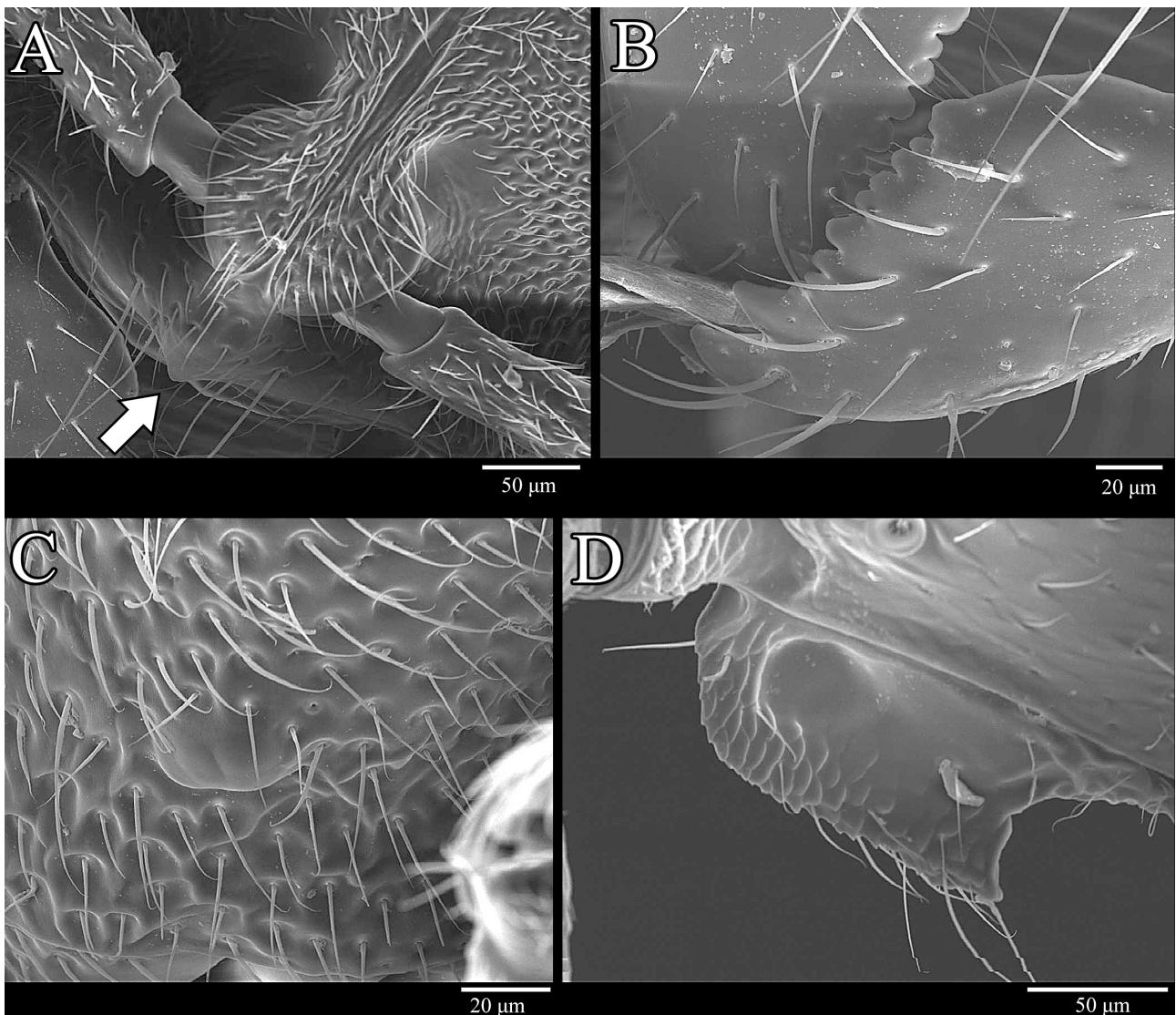


**FIGURE 66.** *P. wui* sp. n. holotype worker (CMPon029), head, full-face view.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs; but upper portion of metapleuron smooth and glabrous (Fig. 69A). Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with numerous long erected hairs. Subpetiolar process with a few long erect hairs.

**Color.** Color dark brown. Mandible, clypeus, antennae, legs, and apex of metasoma yellowish brown.

**Description of queen. Head.** (Fig. 70A) Similar to worker caste, but with large and oval Eye, maximum diameter of eye about 0.18 mm with 8 ommatidia along the maximum diameter. Three ocelli present, and forming an equilateral triangle. Antennal scape similar to worker; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.26 : 2.09 : 2.96 : 4.15$  (n=2).



**FIGURE 67.** *P. wui* sp. n. paratype worker (CMPon002), SEM photo, A: clypeus (the arrow indicates clypeal tooth), B: mandible, C: eye, D: subpetiolar process.

**Mesosoma.** Mesosomal dorsum in lateral view broadly convex (Fig. 71A). Pronotum in dorsal view arched, with broadly convex lateral margins. Scutum subtrapezoidal and narrow posteriad, with broadly convex anterior margin, and straight posterior margin (Fig. 71B). Transcutal suture distinct. Scutellum oval. Anapleural sulcus distinctly incised. Propodeal-metapleural suture indistinct. Propodeal dorsum broad, with straight lateral margins. Propodeal corner in lateral view round; propodeal dorsum and declivity forming approximatively a 120 degree angle.

**Metasoma.** Petiolar node in dorsal view thick and subrectangular, distinctly broader than long, with slightly convex anterior margin, straight posterior margin, slightly convex lateral margins. Petiolar node in lateral view moderately thick and subtrapezoidal, with straight anterior and posterior margins (Fig. 71A). Subpetiolar process with middle and oval fenestra, anteroventral corner blunt, straight ventral margin, and posteroventral corner concave with big teeth. The third abdominal segment similar to worker caste (ATI: 79–86).

**Sculpture.** Similar to worker caste; except lateral propodeum with increased puncture and striation.

**Pubescence.** Similar to worker caste; except lateral propodeum with increased short decumbent hairs.

**Wing.** Forewing (Fig. 70B): Rsf1 and Mf1 forming a blunt angle; Rsf short, Mf1 distinctly straight. Mf2 very short; almost absent, Rs+M with second abscissa distad 1m-cu, cell dc1 rectangular. 2rs-m juncture with Rsf4 distad 2r-rs. Mf1 diverging from M+Cu distad cu-a. Cell smc2 distinctly shorter than cell mc1. Hindwing (Fig. 70C): A vein reaching wing outer margin, but Rsf, Cuf, Mf almost reaching outer margin.



**FIGURE 68.** *P. wui* sp. n. holotype worker (CMPon029), A: body, lateral view, B: body, dorsal view.

**Color.** Similar to worker caste.

**Etymology.** The specific name is given in honor of the Taiwanese entomologist, Dr. Wen-Jer Wu for his contribution to the entomological research in Taiwan.

**Distribution.** Taiwan (Taitung county: Orchid Island).

#### *Ponera yuhuang* Terayama, 2009

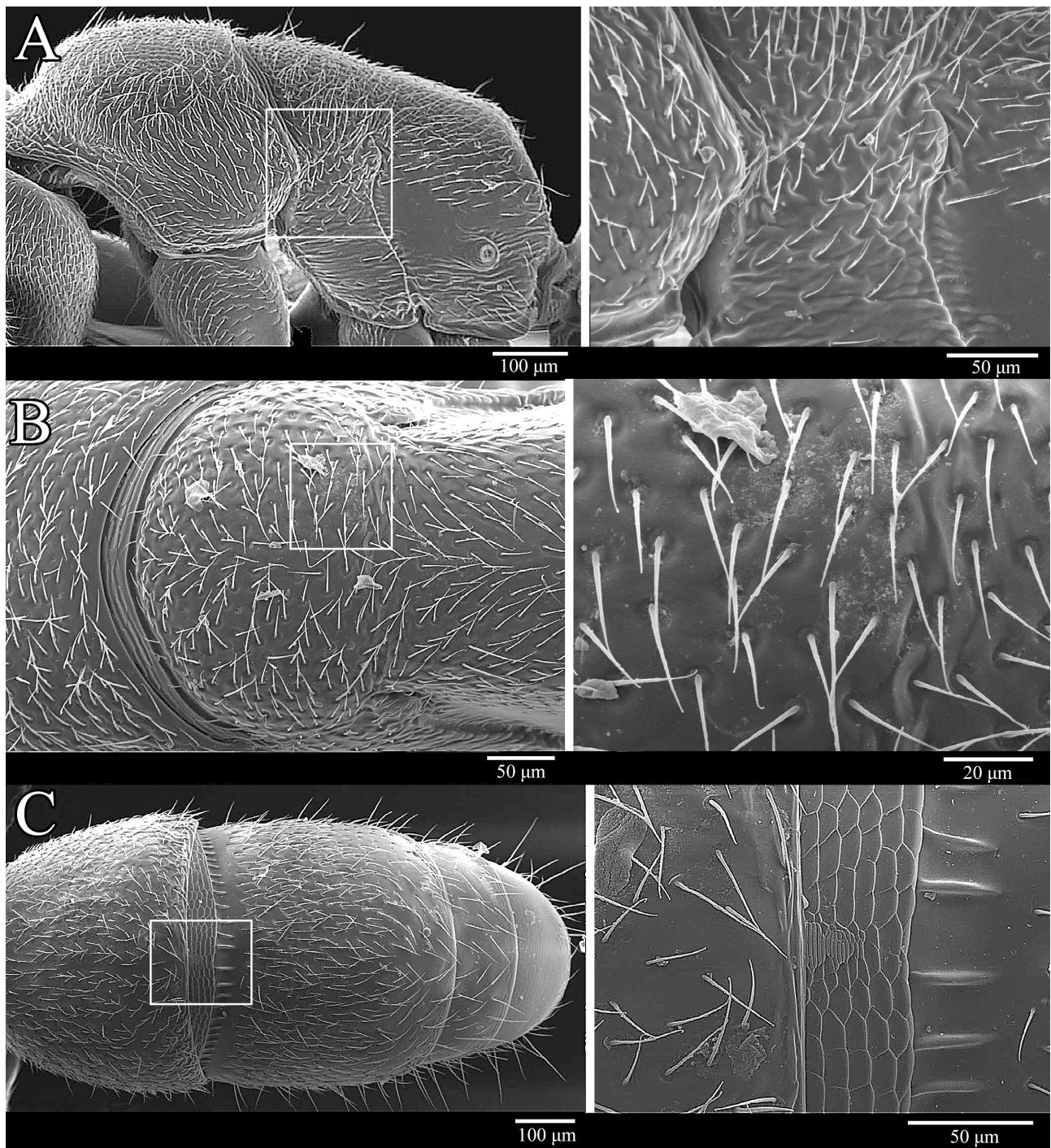
(Fig. 72: worker)

*Ponera yuhuang* Terayama, 2009: 110 (w.). Type locality: Yilan Pref.: Nanshan-Anleng.

**Type material examined:** TAIWAN. Holotype. Worker, Nanshan-Anleng, Yilan Pref., 28 VII to 2 VIII 1988 (NIAES). Note that “Nanshan-Aleng” mean Nanshan to Anleng, Taiwan, holotype specimen was collected by the members of the Japanese Society of Soil Zoology using Berlese funnel (per. comm. Dr. Maromu Terayama).

**Non-type material examined:** TAIWAN. 2 workers, 24.39°N; 121.67°E, 1300 m alt., Mysterious Lake, Yilan county, 6 V 1995, CC Lin leg (CMPon027, CMPon028).

Measurements (mm) and indices. Holotype. worker: HL 0.45; HW 0.37; SL 0.29; A06L 0.02; A07L 0.02; A08L 0.03; A09L 0.05; A10L 0.06; PrW 0.29; WL 0.62; PeH 0.28; PeNL 0.14; PeW 0.21; ATL 0.34; ATW 0.41; CI 83, SI 78, PeI 71, LPeI 51, DPeI 148, ATI 83.

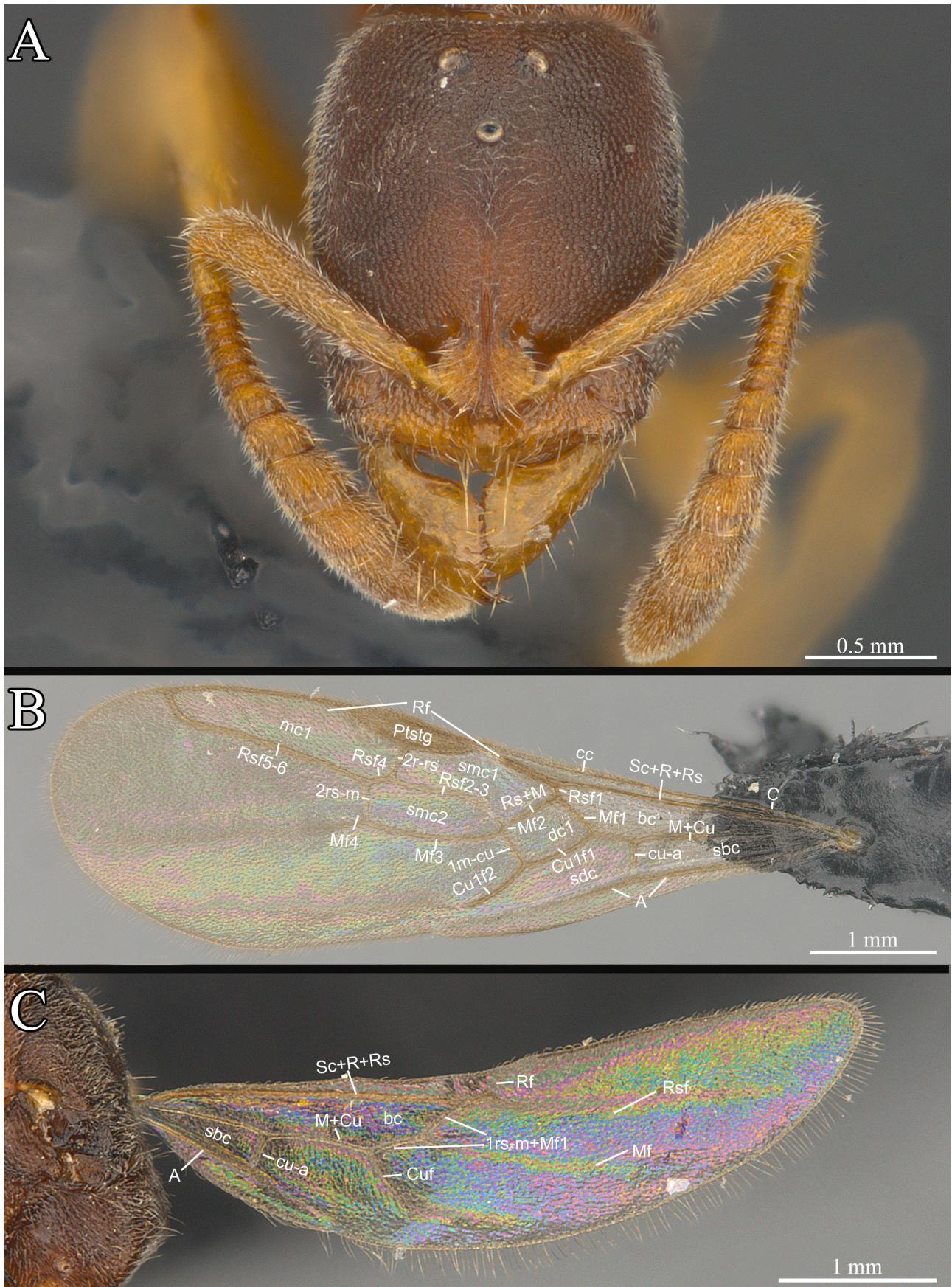


**FIGURE 69.** *P. wui* sp. n. paratype worker (CMPon002), SEM photo, A: lateral mesopleural suture, B: metanotal groove, C: helcium.

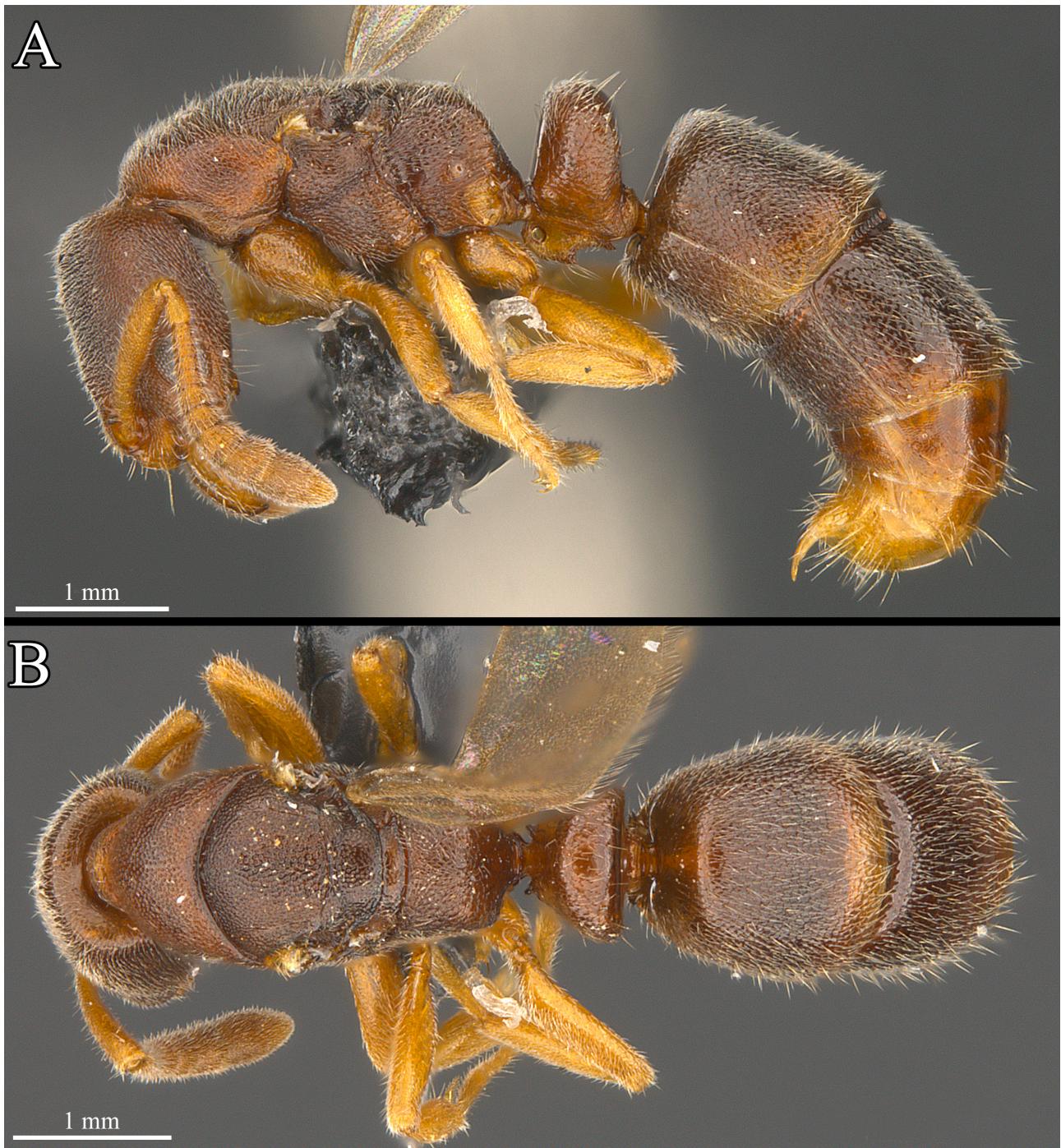
Worker (n=1): HL 0.46; HW 0.37; SL 0.27; A06L 0.02; A07L 0.02; A08L 0.03; A09L 0.04; A10L 0.06; PrW 0.30; WL 0.62; PeH 0.31; PeNL 0.15; PeW 0.25; ATL 0.33; ATW 0.39; CI 81, SI 73, PeI 82, LPeI 49, DPeI 159, ATI 85.

**Diagnosis (worker).** Although *Ponera yuhuang* presents similarities with *P. bishamon*, *P. japonica*, and *P. taiyanghen*, it can be distinguished by its four segmented club and its subpetiolar process without distinct teeth.

**Description of worker. Head.** In full-face view, head rectangular and distinctly longer than broad (CI: 81–83), with slightly concave posterior margin, slightly convex lateral margins and rounded posterolateral corners (Fig. 72C). Eye small; composed of a total of 2–3 indistinct facets. Anterior clypeal margin with very blunt medial tooth. Masticatory margin of mandible with a series of about seven indistinct denticles, and three large on the apical part.



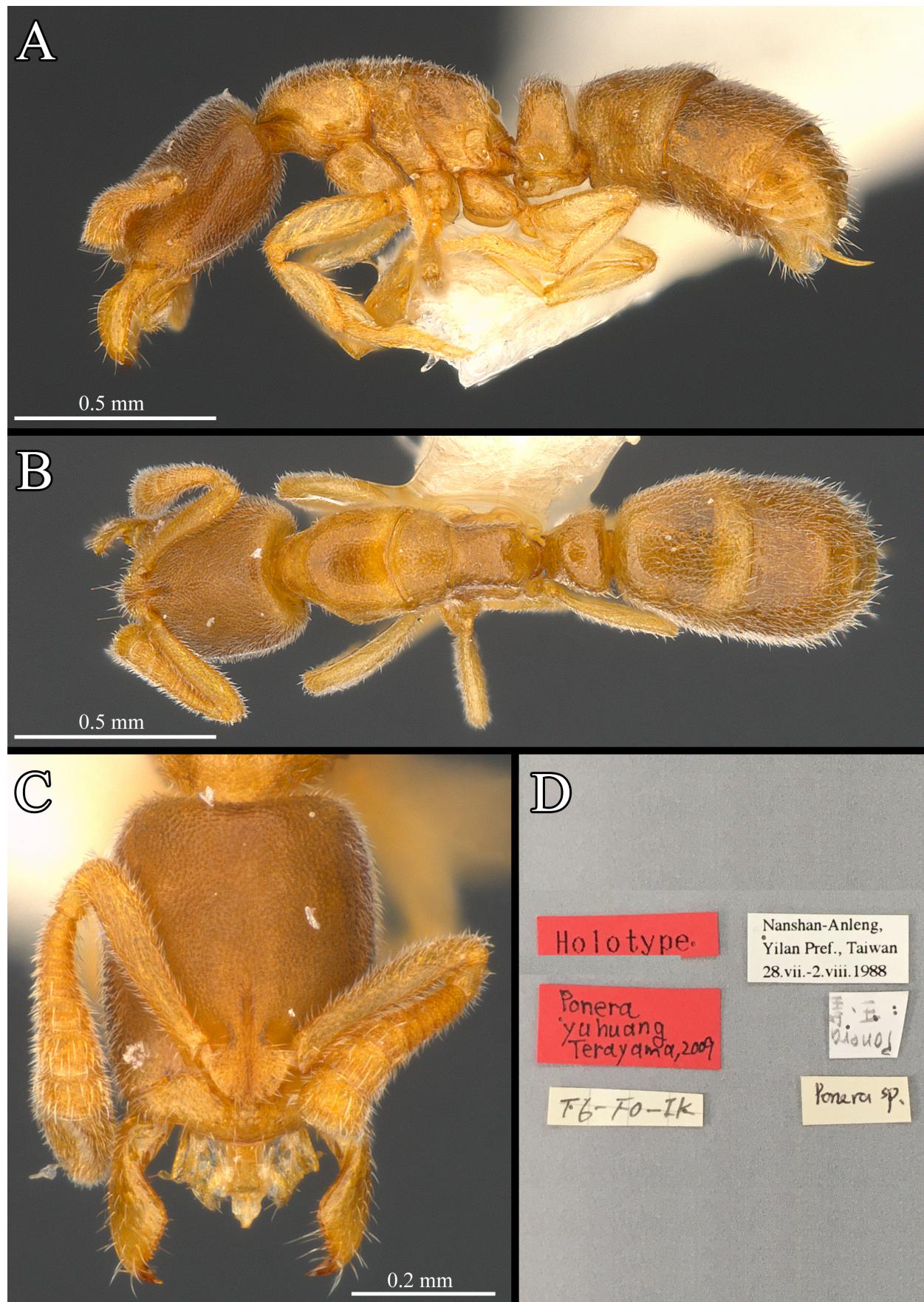
**FIGURE 70.** *P. wui* sp. n. paratype alate queen (CMPon004), A: head, full-face view, B: left of forewing, C: right of hindwing.



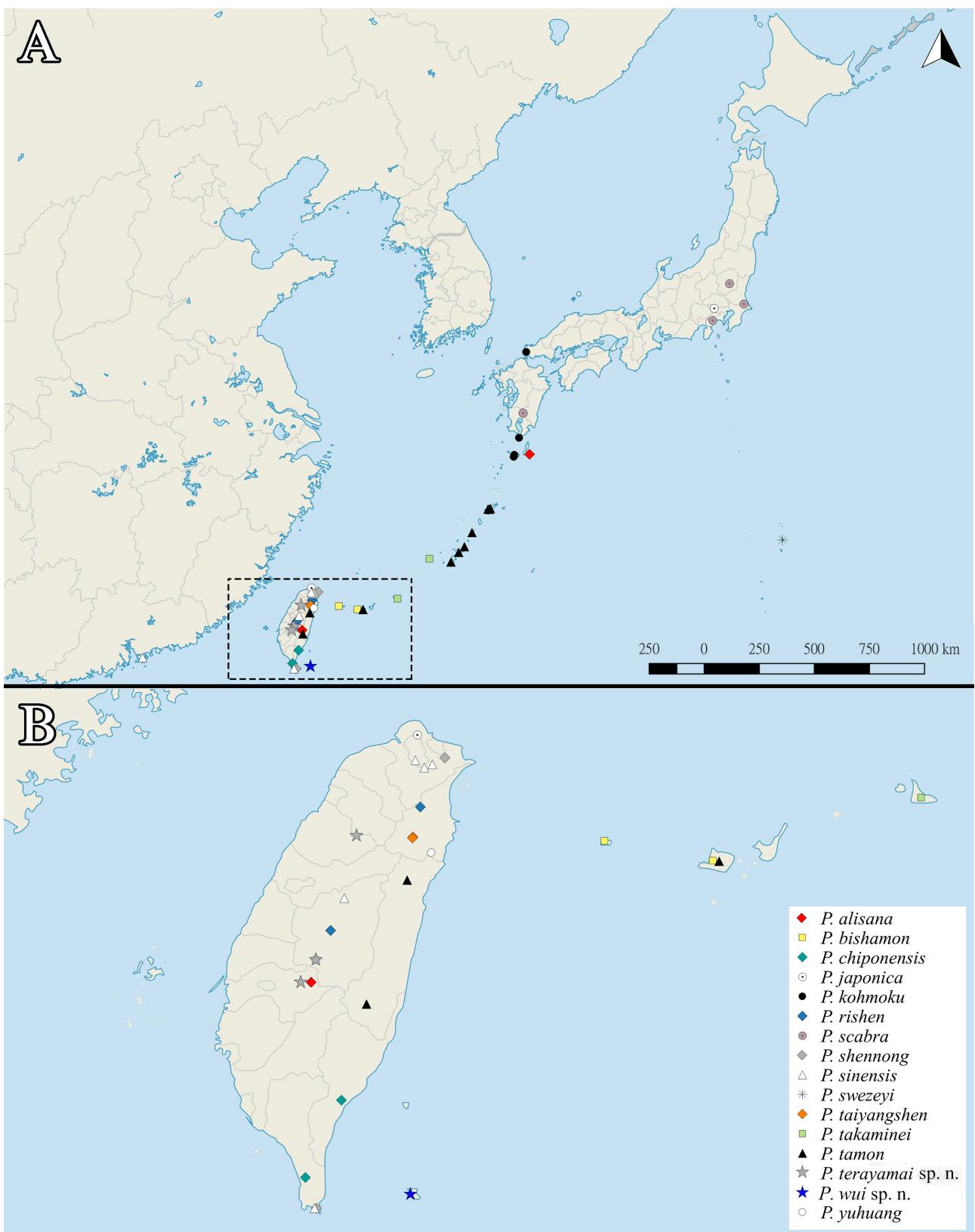
**FIGURE 71.** *P. wui* sp. n. paratype alate queen (CMPon004), A: body, lateral view, B: body, dorsal view.

Antennal scape, when laid backward, with a remaining distance of about 20% of the scape length to the posterolateral corner; average ratio of the length of antennomeres  $\frac{7^{th}}{6^{th}} : \frac{8^{th}}{6^{th}} : \frac{9^{th}}{6^{th}} : \frac{10^{th}}{6^{th}} = 1.00 : 1.35 : 2.38 : 3.47$  ( $n=2$ ).

**Mesosoma.** Mesosomal dorsum in lateral view convex (Fig. 72A). Pronotum in dorsal view arched, with acutely convex anterior margin and slightly convex lateral margins (Fig. 72B). Metanotal groove distinct with a fine suture. Lateral mesopleural suture distinctly incised. Propodeal dorsum in dorsal view broad with straight and parallel lateral margins. Posterodorsal corner of propodeum rounded, propodeal dorsum and declivity forming approximatively a 125 angle.



**FIGURE 72.** *P. yuhuang* holotype worker, A: body, lateral view, B: body, dorsal view, C: head, full-face view, D: specimen label.



**FIGURE 73.** A: Map of *Ponera* species distribution in Taiwan and Japan, based on the examined specimens and type-specimen records; B: Zoom on Taiwan.

**Metasoma.** Petiolar node in dorsal view thick and arched, with moderately convex anterior margin and straight posterior margin (Fig. 72B). Petiolar node in lateral view moderately thick and rectangular, with straight anterior and posterior margins, anterodorsal corner forming a right angle, anterodorsal corner as high as posterodorsal corner (Fig. 72A). Subpetiolar process with small and circular fenestra, anteroventral corner blunt, almost straight ventral margin, posteroventral corner concave without distinct teeth. Third abdominal tergum distinctly broader than long (ATI: 85) with straight anterior and posterior margins, straight lateral margins.

**Sculpture.** Head densely punctate. Mandible sparsely punctate. Mesosoma evenly punctate. Mesopleuron with slightly striate lower portion and sparsely punctate upper portion. Metapleuron and propodeum densely striate, but especially smooth in the portion contained between metapleuron and propodeum. Propodeal declivity smooth and shining. Lateral face of petiole evenly punctate, posterior face shining, dorsum with few punctures. The third and fourth abdominal segments evenly punctate, other segments smooth and shining with few punctures.

**Pubescence.** Head, antennae, mesosoma, petiole, and gaster with evenly distributed short hairs. Mesopleuron, metapleuron, propodeum and lateral face of petiole with few short hairs. Dorsal and ventral faces of head, anterior margin of clypeus, sides of mandibles, dorsum of petiolar node, gastral sterna and posterior half of gastral terga with many long erect hairs. Subpetiolar process with a few long erect hairs.

**Color.** Body color black brown. Mandible, clypeus, antennae, legs, and apex of metasoma lighter.

**Description of queen.** Unknown.

**Description of male.** Unknown.

**Distribution.** Taiwan (Yilan county: Mysterious Lake).

**Remarks.** *P. yuhuang* was described from a single specimen, for which the external morphology cannot be clearly observed. We redescribed *P. yuhuang* based on the holotype and additional specimens. Although *P. yuhuang* is closely related to *P. taiyangshen*, differences in the antennal segment ratios and the form of the subpetiolar teeth can demonstrate that they are separated species.

## Acknowledgments

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**TABLE 1.** Head width of 32 East Asian *Ponera* species and their associated values for the number of individuals measured, mean values, standard deviations and coefficients of variation.

| Species                | Range in mm (references)              | Present study |           |       |       |
|------------------------|---------------------------------------|---------------|-----------|-------|-------|
|                        |                                       | N             | Mean (mm) | SD    | CV    |
| <i>P. shennong</i>     | 0.27–0.28 (Terayama, 2009)            | 2             | 0.276     | 0.009 | 0.031 |
| <i>P. szaboi</i>       | 0.30–0.31 (Taylor, 1967)              |               |           |       |       |
| <i>P. baka</i>         | 0.33 (Xu, 2001)                       |               |           |       |       |
| <i>P. swazeyi</i>      | 0.32–0.34 (Taylor, 1967)              | 1             | 0.336     | NA.   | NA.   |
| <i>P. xantha</i>       | 0.35 (Xu, 2001)                       |               |           |       |       |
| <i>P. incerta</i>      | 0.36–0.40 (Taylor, 1967)              |               |           |       |       |
| <i>P. bishamon</i>     | 0.38–0.39 (Terayama, 1996)            | 3             | 0.387     | 0.007 | 0.019 |
| <i>P. yuhuang</i>      | 0.37–0.40 (Terayama, 2009)            | 2             | 0.372     | 0.001 | 0.004 |
| <i>P. pianmanae</i>    | 0.40 (Xu, 2001)                       |               |           |       |       |
| <i>P. chiponensis</i>  | 0.39–0.43 (Terayama, 1986)            | 6             | 0.406     | 0.015 | 0.038 |
| <i>P. taiyangshen</i>  | 0.37–0.46 (Terayama, 2009)            | 14            | 0.425     | 0.024 | 0.056 |
| <i>P. terayamai</i>    | 0.43–0.47 (This study)                | 12            | 0.438     | 0.012 | 0.027 |
| <i>P. longlina</i>     | 0.45 (Xu, 2001)                       |               |           |       |       |
| <i>P. japonica</i>     | 0.41–0.50 (Taylor, 1967)              | 5             | 0.443     | 0.026 | 0.058 |
| <i>P. nangongshana</i> | 0.48 (Xu, 2001)                       |               |           |       |       |
| <i>P. guangxiensis</i> | 0.47–0.50 (Zhou, 2001)                |               |           |       |       |
| <i>P. oreas</i>        | 0.47–0.51 (Taylor, 1967)              |               |           |       |       |
| <i>P. diodonta</i>     | 0.50 (Xu, 2001)                       |               |           |       |       |
| <i>P. wui</i>          | 0.49–0.52 (This study)                | 4             | 0.505     | 0.011 | 0.022 |
| <i>P. tamon</i>        | 0.44–0.58 (Terayama, 1996)            | 22            | 0.481     | 0.023 | 0.048 |
| <i>P. sinensis</i>     | 0.47–0.56 (Taylor, 1967)              | 17            | 0.528     | 0.018 | 0.034 |
| <i>P. bawana</i>       | 0.53 (Xu, 2001)                       |               |           |       |       |
| <i>P. pentodontos</i>  | 0.53–0.55 (Xu, 2001)                  |               |           |       |       |
| <i>P. rishen</i>       | 0.54–0.60 (Terayama, 2009)            | 7             | 0.576     | 0.024 | 0.042 |
| <i>P. paedericera</i>  | 0.55–0.60 (Zhou, 2001)                |               |           |       |       |
| <i>P. menglana</i>     | 0.58–0.60 (Xu, 2001)                  |               |           |       |       |
| <i>P. hubeiensis</i>   | 0.59–0.63 (Wong <i>et al.</i> , 2009) |               |           |       |       |
| <i>P. alisana</i>      | 0.58–0.65 (Terayama, 1986)            | 4             | 0.631     | 0.016 | 0.026 |
| <i>P. chapmani</i>     | 0.61–0.70 (Taylor, 1967)              |               |           |       |       |
| <i>P. scabra</i>       | 0.61–0.70 (Taylor, 1967)              | 3             | 0.624     | 0.019 | 0.031 |
| <i>P. takaminei</i>    | 0.65–0.75 (Terayama, 1996)            | 7             | 0.601     | 0.024 | 0.040 |
| <i>P. kohmoku</i>      | 0.68–0.77 (Terayama, 1996)            | 6             | 0.731     | 0.030 | 0.041 |

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