



Taiwanese species of the ant genus *Technomyrmex* (Formicidae: Dolichoderinae)

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Abstract

The Taiwanese species of the ant genus *Technomyrmex* are revised with recently collected material. Five species are recognised, three in the *T. albipes* species group and two in the *T. bicolor* species group, including one new species, *T. formosensis* **sp. nov.**, and two newly recorded species. The occurrence of *T. albipes*, previous records of which were based on misidentifications, is confirmed for the first time in Taiwan. The structure of genitalia is compared between winged and wingless males of *T. brunneus*.

Key words: *Technomyrmex*, Taiwan, new species, queen description, male genitalia

Introduction

The ant fauna of Taiwan was reviewed by Terayama (2009). He recognized two species in the genus *Technomyrmex*, i.e., *T. brunneus* Forel, 1895 and *T. horni* Forel 1912, and excluded *T. albipes* (F. Smith, 1861) because previous records were based on misidentifications. *Technomyrmex brunneus* belongs to the *T. albipes* species group, which consists of some very closely related species (Bolton, 2007). We have found three species of this group in Taiwan, the true *T. albipes*, *T. brunneus*, and *T. difficilis* Forel 1892. *Technomyrmex horni* Forel, 1912 belongs to the *T. bicolor* species group, in which 12 species are known in Asia (Bolton, 2007). These species are morphologically very similar to each other, and some can be separated mainly by body colour. *Technomyrmex horni* was originally described from Taiwan (Pilam, Taitung county), but no additional records were available until now. We collected several colony series of this species from various sites in Taiwan and redescribe it based on plentiful material. In addition, we found another species of the *T. bicolor* group that is described below as *T. formosensis* **sp. nov.**

Materials and methods

Most of the specimens examined are point-mounted. In case of series from colonies, colony codes are given in parentheses after the collector name (e.g., TW10-SKY-15). The type specimens of the new species and photographed specimens of the other species are given voucher codes (specimen identifiers; YLL- and LCM-).

For well-known species such as those in the *Technomyrmex albipes* group, only a diagnosis and measurements for the head width, head length and scape length are presented. More detailed descriptions of them are available in Bolton (2007). The queen, and winged and wingless males of *T. brunneus* are redescribed in more detail. For the two species of the *T. bicolor* group, *T. formosensis* **sp. nov.** and *T. horni*, full descriptions are given. For the latter Bolton (2007) gave a detailed description of the syntypes from Taiwan, but this time we examined many more specimens from several places in Taiwan. The terminology and methodology for describing males follows Boudinot (2013, 2015).

The specimens were examined under stereomicroscopes (Leica Z16 APO, Wetzlar, Germany and SMZ18, Nikon). Multi-focused montage images were produced using Helicon Focus 6.3.5 (Helicon Soft Ltd., Kharkiv, Ukraine) from a total of 25 to 30 source images (3264 x 2448 pixels) per view taken with a digital camera (Leica DFC490, Wetzlar, Germany) attached to a stereomicroscope. Lastly, the pictures were edited in Photoshop CC (Adobe® Photoshop® software).

Measurements and indices. We generally follow those in Bolton (2007), but omit some of them used by him and add others that seem useful for *Technomyrmex*. All measurements are expressed in millimeters.

Eye length (EL)—the maximum length of the compound eye.

Eye width (EW)—the maximum width of the compound eye.

Head length (HL)—the distance between the anterior clypeal margin and the posterior margin of the head in full-face view. If the anterior clypeal margin has a median emargination, then the mid-point of a line connecting the anteriormost parts of the lateral lobes is used; in the same way if the posterior margin of the head is concave, then the mid-point of a straight line between the apices of the most projecting parts is used.

Head width (HW)—the head width excluding the eyes.

Mesonotal width (MsW)—the maximum width of the mesoscutum in dorsal view.

Pronotal width (PrW)—the maximum width of the pronotum in dorsal view.

Scape length (SL)—the length of the antennal scape, excluding the basal constriction.

Total body length (TL)—the body length roughly measured from the anterior margin of the head to the tip of the gaster in stretched specimens.

Cephalic index (CI)—HW divided by HL, x 100.

Scape index (SI)—SL divided by HW, x 100.

Specimen Depositories:

NMNS—National Museum of Natural Science, Taichung county, Taiwan.

SKYC—Seiki Yamane Collection, Japan.

TFRI—Taiwan Forestry Research Institute, Taipei county, Taiwan.

Taxonomy

Key to species from Taiwan (workers; only applicable to Taiwanese species)

1. Frontal carina and dorsum of frons immediately mesad of frontal carina without standing hairs. Anterior margin of clypeus with large median emargination (Fig. 1A). Gastral tergite I without standing hairs. TL greater than 2.5 (generally >3). Body brown to blackish brown but in one species partly yellowish brown *bicolor* group...2
- Frontal carina generally with two standing hairs. Anterior margin of clypeus nearly straight, at most very shallowly emarginate (Fig. 1B). Gastral tergite I with many standing hairs. TL less than 2.5 (often <2). Body almost entirely blackish brown except for part of legs *albipes* group...3
2. Body entirely dark brown to black, rarely with brownish tinge on head and mesosoma. With mesosoma in profile, dorsal outline of propodeum convex, rounded into declivity without posterodorsal angle; straight-line length of dorsal face of propodeum less than depth of propodeal declivity to spiracle (Fig. 1C) *T. formosensis* sp. nov.
- Head and gaster brown to dark brown, mesosoma yellowish brown, showing more or less bicolorous pattern, but body sometimes uniformly light brown. With mesosoma in profile, dorsal outline of propodeum straight to weakly convex, often with weak impression posteriorly; straight-line length of dorsal face of propodeum greater than depth of propodeal declivity to spiracle (Fig. 1D). *T. horni*
3. Mandible with distinct longitudinal groove on its dorsal face along outer margin (Fig. 1E). With head in profile, eye located at or slightly behind midlength of head. *T. brunneus*
- Mandible without longitudinal groove along outer margin (Fig. 1F). With head in profile, eye located more anteriorly on head, in front of midlength. 4
4. Dorsum of head behind level of posterior margin of eye without standing hairs (Fig. 1H) *T. albipes*
- Dorsum of head behind level of posterior margin of eye with a pair of standing hairs (Fig. 1G) *T. difficilis*

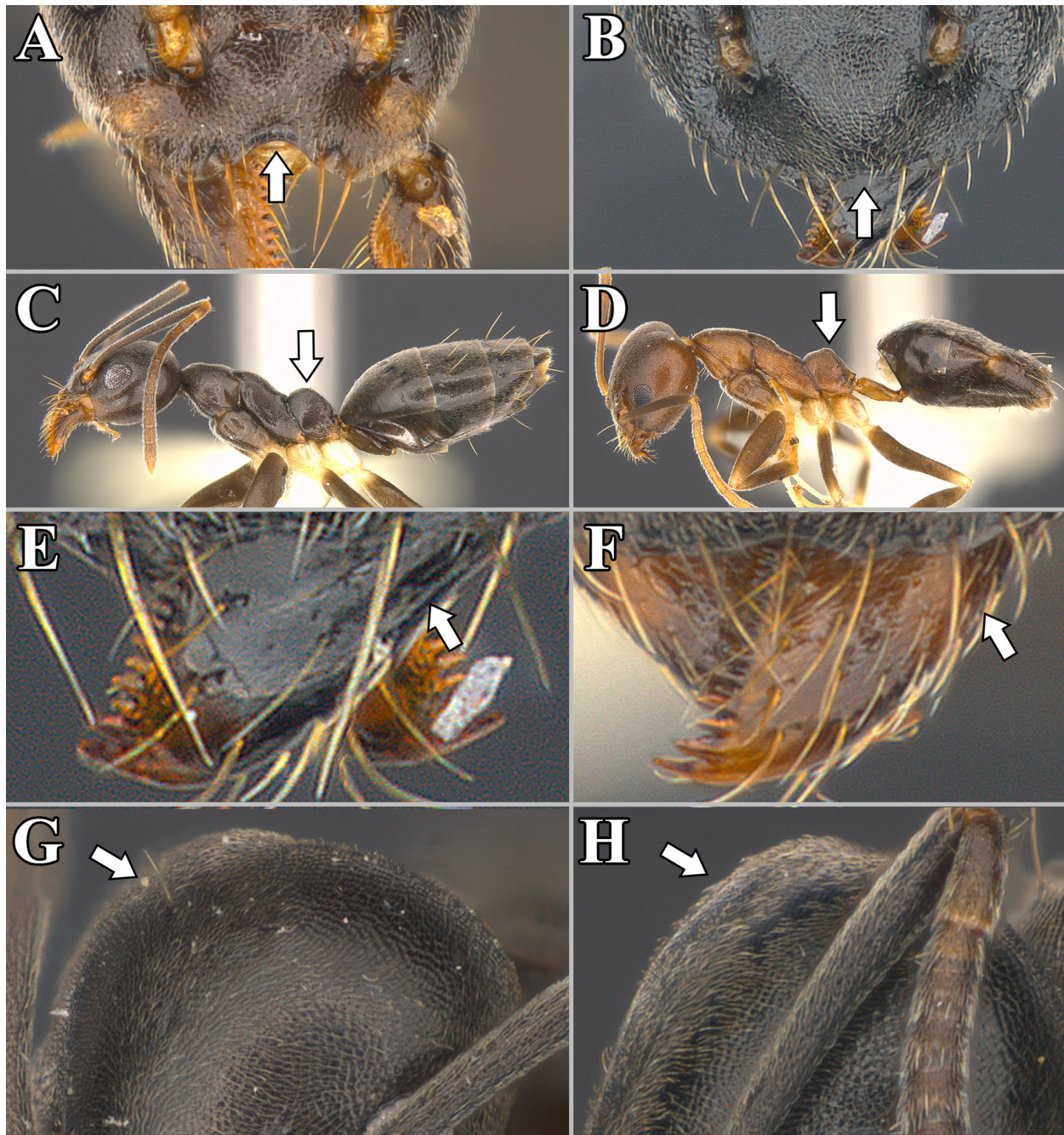


FIGURE 1. *Technomyrmex* workers. Clypeus: A, *T. formosensis* sp. nov. (YLL12) & B, *T. brunneus* (LCM00042). Habitus (profile): C, *T. formosensis* sp. nov. (YLL12) & D, *T. horni* (LCM00066). Mandible: E, *T. brunneus* (LCM00042) & F, *T. albipes* (LCM00068). Vertex: G, *T. difficilis* (LCM00067) & H, *T. albipes* (LCM00068).

Technomyrmex albipes species group

Technomyrmex albipes (F. Smith, 1861)

(Fig. 2)

Worker diagnosis. Measurements (n=5). TL around 2.6, HW 0.53–0.57, HL 0.56–0.60, SL 0.50–0.53, CI 93–95, SI 93–96. Head slightly longer than broad. With head in profile, eye located in front of midlength of head. Mandible without longitudinal groove (Fig. 2C). Dorsum of head behind level of posterior margin of eye without standing hairs (Fig. 1H). Standing hairs on gastral tergites II & III relatively short, at most as long as antennal pedicel. Body almost entirely black, except for tarsi of legs and tip of antenna yellowish.

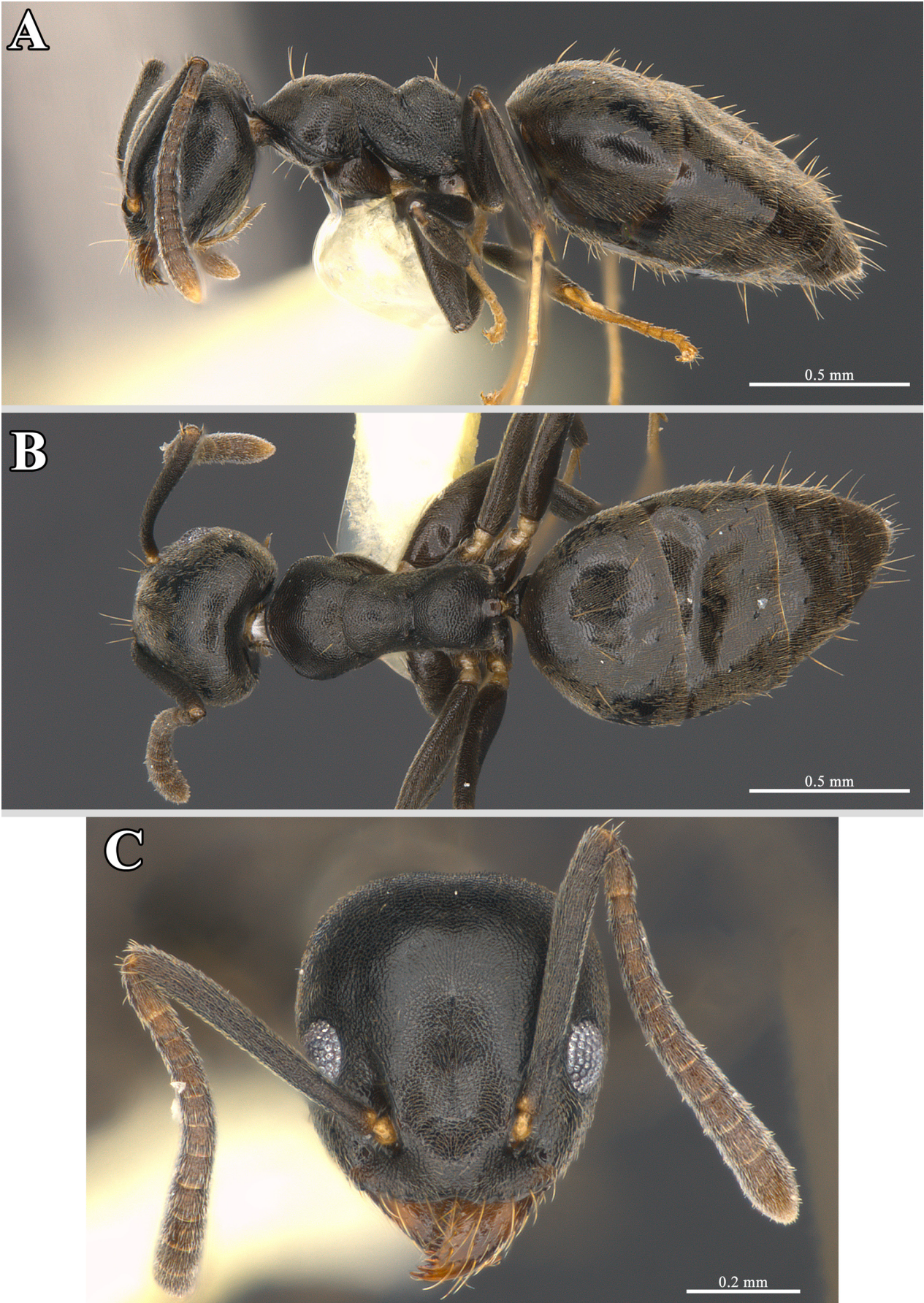


FIGURE 2. *Technomyrmex albipes* worker (LCM00068). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

Distribution. Oriental (new to Taiwan) and Indo-Malayan regions, Hawaii, Oceania, Afrotropical and Palearctic (Europe) regions, Caribbean Islands (for more information, see Bolton, 2007, AntWeb v7.3.5, 2017).

Specimens examined (NMNS, SKYC, TFRI). Nantou county: 2 workers, Huisun Exp. Forest (500–800 m alt.) 24.0896°N, 121.0305°E, 27–30.iv.2017, C. M. Leong leg. Taitung county: 16 workers, Chihpen (hotel garden), 24.iv.2010, Sk. Yamane (TW10-SKY-15).

Remarks. This small ant is a famous tramp widely found in warmer regions of the world. Until Bolton (2007) published the excellent revision several related species in the *T. albipes* group had been confused with *T. albipes*. According to Bolton (2007) most of the previous records for '*T. albipes*' from China, Taiwan and Japan (eg., Terayama, 1991; Yamauchi *et al.*, 1991; Japanese Ant Database group, 2003) were probably based on misidentifications. Although Bolton (2007) did not cite any record of *T. albipes* from Thailand, Indochina, China, Taiwan and Japan, this species actually occurs in most of these areas (e.g., Jaitrong *et al.*, 2016; Yamane, unpubl.); however, Japan apparently lacks it (Terayama *et al.*, 2014). Although Terayama (2009) excluded this species from the ant fauna of Taiwan, recent collections revealed its occurrence there.

Although Bolton (2007) resolved most taxonomic confusion in this species group, there still remain some unsolved problems. For example, very restricted information is available about the nesting habits of *T. albipes* in spite of its common occurrence as a tramp. Bolton enumerated a few instances for the nesting site of this species, namely, internodes of a myrmecophyte, plant spathes and rot holes in wood. However, some carton nests on tree leaves have been found in Borneo and Malay Peninsula for 'this species' as well as nests in restricted spaces such as rotting wood, dead twigs etc. (Yamane and Tsuji, personal obs.). This suggests that *T. albipes* (*sensu* Bolton) may actually be a complex of sibling species. More information on nesting site and DNA data from various localities are needed to resolve this problem.

***Technomyrmex brunneus* Forel, 1895**

(Figs. 3–9)

Technomyrmex modiglianii var. *angustior* Forel, 1912: 71. Taiwan (Akau).

?*Technomyrmex albipes* var. *brunneipes* Forel: Terayama, 1991: 80 (in list, misidentification).

Technomyrmex brunneus Forel: Bolton, 2007: 73; Terayama, 2009: 200 (in key), 239 (in list).

Worker diagnosis. Measurements (n=10): TL 2–3, HW 0.59–0.70, HL 0.60–0.72, SL 0.58–0.70, CI 88–102, SI 91–100. With head in profile, eye located at or behind midlength of head (Fig. 3A). Mandible with distinct longitudinal groove along its outer margin (Fig. 1E). Dorsum of head behind level of posterior margin of eye without standing hairs. Body almost entirely black, except for tarsi of legs yellowish and tip of antenna brownish (Fig. 3A).

Queen description. Measurements (n=2). TL 3.5, 3.8; HW 0.81, 0.82; HL 0.80, 0.80; SL 0.71, 0.69; EW 0.15, 0.16; EL 0.23, 0.23; CI 101, 103; SI 88, 84. Very similar to worker in structure, pilosity and coloration except for mesosoma that bears wings. Head slightly longer than or almost as long as broad. Mandible with longitudinal groove. Anterior margin of clypeus with narrow and shallow median emargination (Fig. 4C). Anterior ocellus larger than posterior ocelli. With mesosoma in profile, mesonotum anteriorly gently sloping and posteriorly flat; mesopleuron divided into two parts by weak and incomplete suture (Fig. 4A). Propodeum with short dorsum; side of propodeum not demarcated from metapleuron; declivity flat; spiracle located on propodeal side at level of midlength of declivity.

Almost entire surface of body very finely and densely punctate and mat; gaster with more superficial punctation and weakly shiny; mandible, petiole and coxae of legs much more shiny.

Winged male description. Measurements (n=3). TL 2.5, HW 0.65–0.69, HL 0.61–0.66, SL 0.20–0.24, EW 0.22–0.23, EL 0.30–0.31, CI 103–107, SI 31–35. Head (Fig. 6C) slightly broader than long, with convex lateral margins and broadly rounded posterior margin. Clypeus with anterior margin straight to very shallowly emarginate, posteriorly demarcated from frons by delicate suture. Eye large, with head in full-face view its maximum length subequal to distance from its posterior margin to summit of head, distinctly breaking lateral margin of head. Ocelli much larger than in queen; posterior ocelli widely separated from each other. Antenna 13-segmented; scape short, only slightly longer than segments II (pedicel) and III combined. Pronotum very short medially on dorsal face, but lateral face large. Mesonotum massive and roundly produced dorsally, with anterior slope rather steep (Fig. 6A);

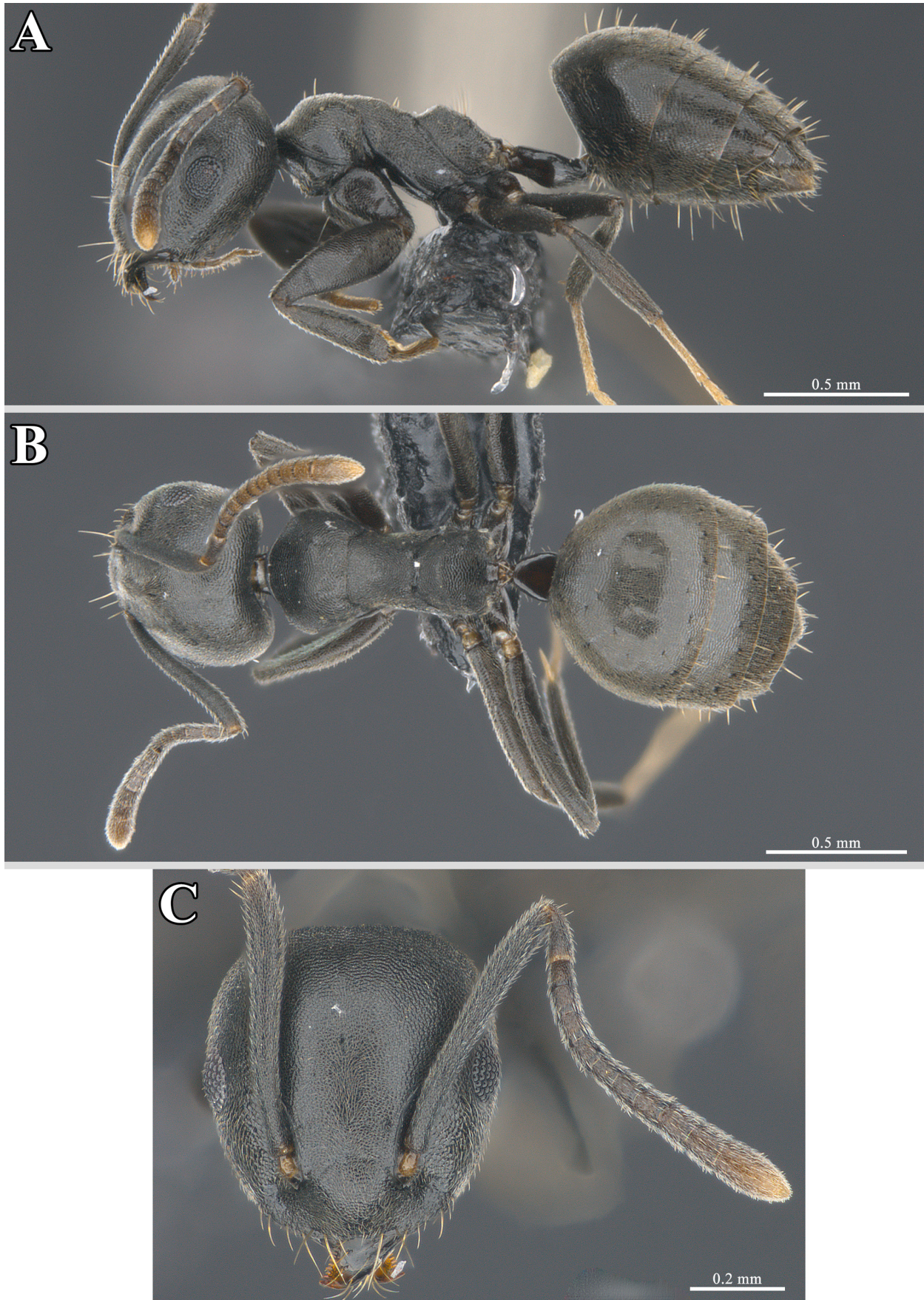


FIGURE 3. *Technomyrmex brunneus* worker (LCM00068). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

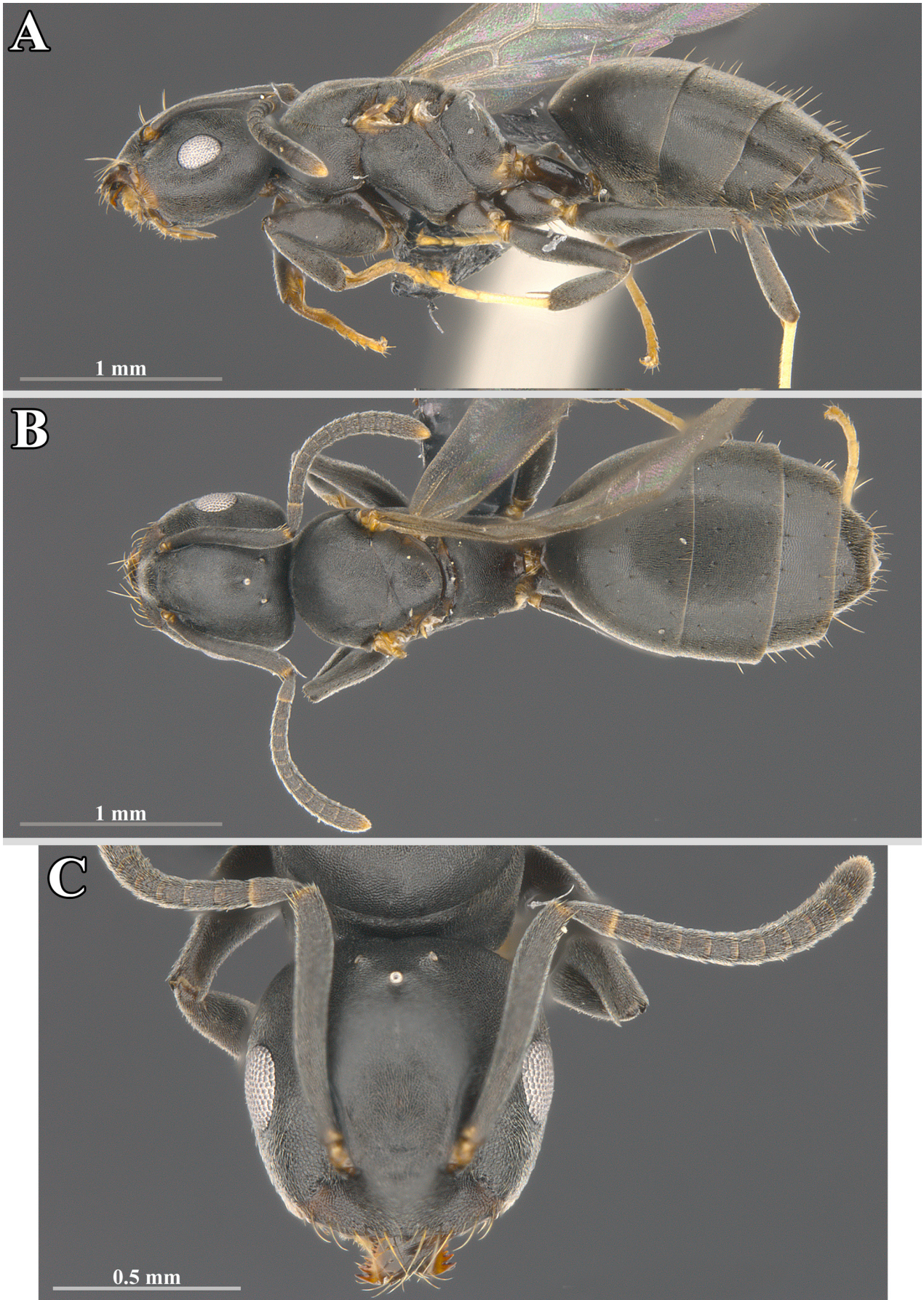


FIGURE 4. *T. brunneus* queen (LCM00051). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

mesopleuron divided into two parts by indistinct suture (Fig. 6A), demarcated from metapleuron by deep suture; mesoscutellum seen in dorsal view very narrow, strongly narrowed posteriorly (Fig. 6B). Metanotum very short (just a mere band); metapleuron not demarcated from lateral face of propodeum; metapleural gland orifice large. Petiole hidden beneath gaster. Genitalia very large, exposed, occupying more than 1/3 of entire gaster.

Standing pilosity very poor, seen only in anterior portion of head around mouthparts including anterior margin of clypeus, on gastral venter and around tip of gaster; frontal carina lacking any standing hairs; all hairs on ventral surfaces of mesosoma and gaster appressed. Body almost entirely black; mandible, maxillary and labial palpi, antennal segment II yellowish; tarsi of all legs whitish.

In wing venation, the queen and winged male are very similar to each other (Figs. 5, 7).

Wingless male description. Measurements (n=3). TL 2.5, HW 0.61–0.65, HL 0.59–0.63, SL 0.22–0.24, EW 0.17–0.18, EL 0.23, CI 103–105, SI 35–38. In general habitus similar to worker, but easily separable from the latter by the presence of ocelli (note that intercaste females often with ocelli) and exposed genitalia. Head similar to that of winged male. Pronotum longer and mesonotum less massive than in winged male. With mesosoma in profile, mesonotum strongly and roundly convex dorsally; mesopleuron not divided into upper and lower portions; mesoscutellum not differentiated. Metanotal groove distinct, without flat dorsum of metanotum; metapleuron not demarcated from propodeal side. Genitalia exposed but much smaller than in winged male.

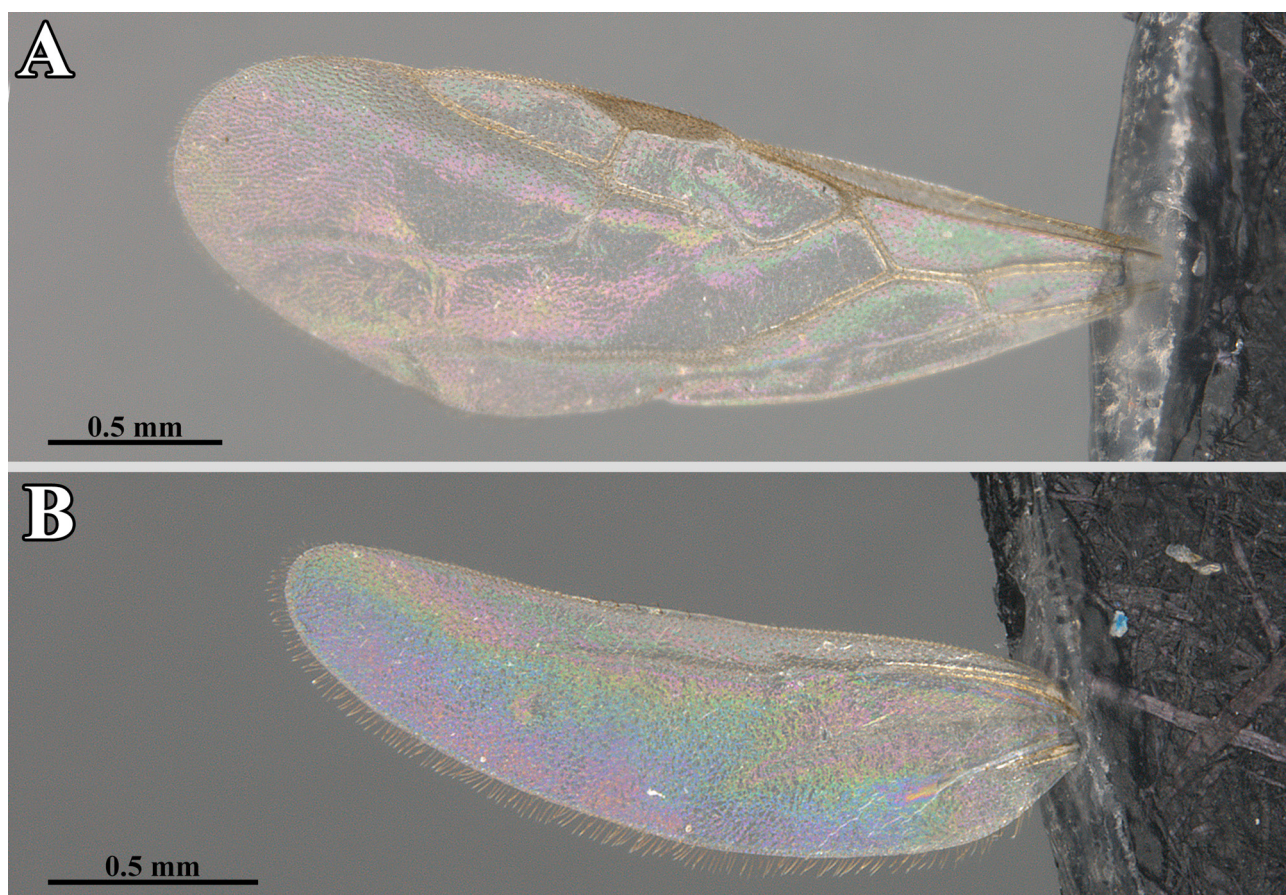


FIGURE 5. *T. brunus* queen (LCM00051). A, fore wing & B, hind wing.

Standing pilosity poor, confined to anterior margin of clypeus, mandible, venter and tip of gaster and coxae of all legs. Almost entire body dark reddish brown; antenna lighter with segment II (pedicel) yellowish; mandible yellowish; tarsi of all legs whitish.

Comparison of genitalia between winged and wingless males. Winged males have significantly larger genitalia than wingless males: for instance, capsule approximately 3.4 times, penisvalva 1.6 times, and volsella 1.6 times as long as those in the latter (Fig. 9). Moreover, winged and wingless males have distinctly different morphologies in genital capsule, abdominal sternum IX, and volsella. The telomere (Fig. 9B) is in lateral view elongate with subparallel upper and lower margins and round apex in winged males (but thicker with convex lower

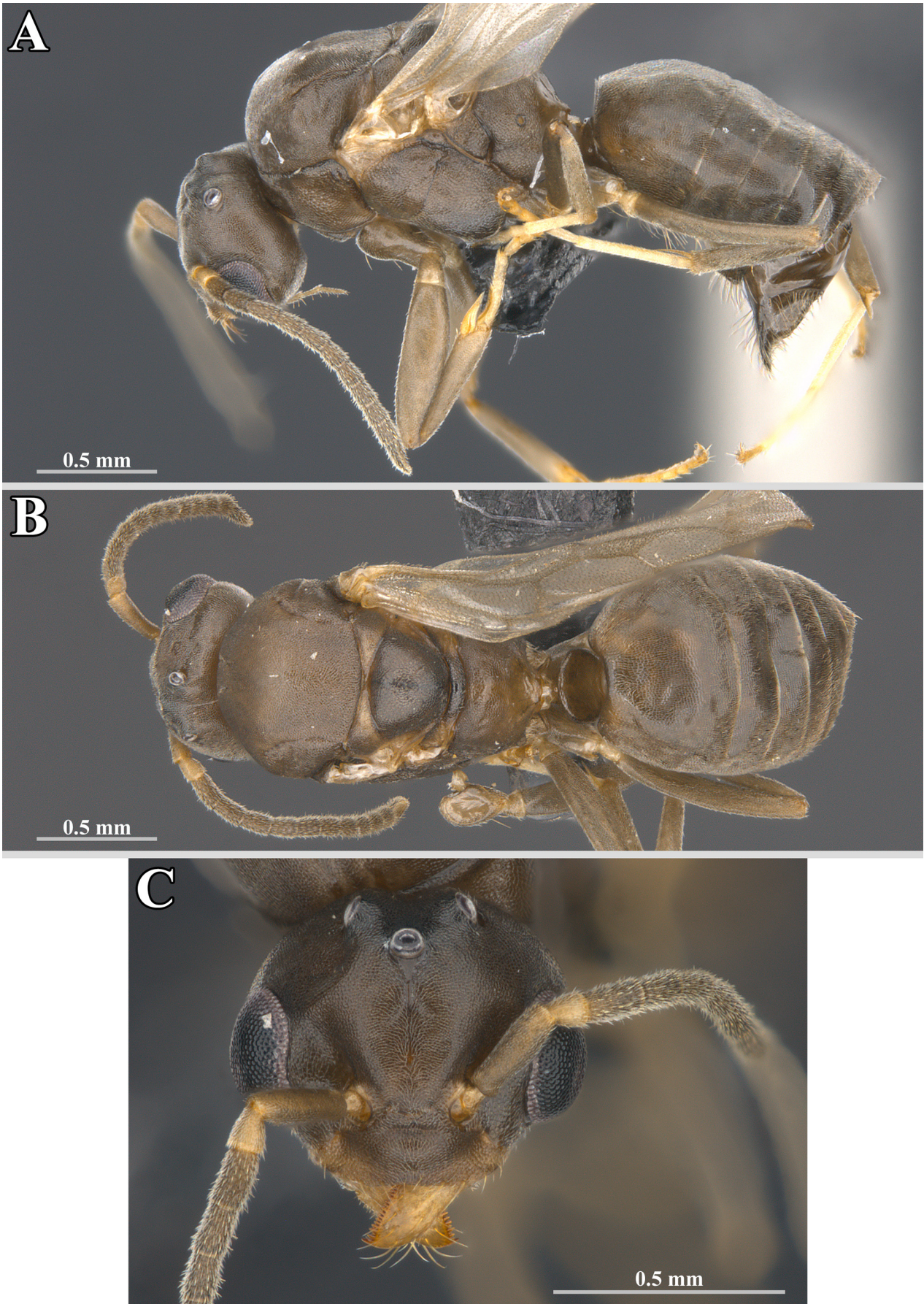


FIGURE 6. *T. brunus* winged male (LCM00044). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

margin and acute apex in wingless males). The sternum IX (Fig. 9D) in dorsal view has well-developed posterolateral corners and a deep median notch in the former (with weaker posterolateral corners and a shallower median notch in the latter). The valvura (Fig. 9E) is thicker in the former than in the latter. The ventral margin of the volsella (Fig. 9F) bears a well-developed hook in the former (but the hook smaller and equipped with a series of small teeth in the latter). Thus, the structure of genital sclerites shows remarkable differences between winged and wingless males (see also Ogata *et al.*, 1996).



FIGURE 7. *T. brunnus* winged male (LCM00044). A, fore wing & B, hind wing.

Distribution. Tropical to warm temperate Asia from Sri Lanka through India and China to Japan (Bolton, 2007; Japanese Ant Database, 2003; Shimana and Yamane, 2009). It was recently found in New Guinea to be a dominant ant in a lowland secondary forest (Klimes *et al.*, 2015).

Specimens examined (NMNS, SKYC, TFRI). Nantou county: 2 workers, Shen Mu, 23.5221°N, 120.8399°E, 11.ii.2012, S. H. Lin leg. (OTFA19); 18 workers, Huisun Exp. Forest (500–800 m alt.), 24.0896°N, 121.0305°E, 27–30.iv.2017, C. M. Leong leg.; 1 worker, Jihyuetan (Sun Moon Lake), 1.iii.1988, S. Aoki leg. Tainan county: 1 worker, Hsia Tou Tsai, 23.0716°N, 120.5190°E, 10.vii.2011, S.H. Lin leg. Taipei county: 1 worker, Fu Jhou Shan, 25.0177°N, 121.5524°E 30.ix.2016, C.M. Leong leg. (CWFA04); 10 workers, 10 winged males, 10 wingless males, 10 alate & 10 dealate queens from a colony, Fu Jhou Shan, 25.0177°N, 121.5524°E, 21.x.2017, C.M. Leong leg. (CML20170521-Col.-1); 12 workers, Tamsui, 26.iii.2012, T. Yamasaki leg.; 6 workers, Wulai (near field station), 20.iv.2010, nest in dead stem, Sk. Yamane leg. (TW10-SKY-02); 11 workers, Wulai, 20.iv.2010, lower vegetation, Sk. Yamane leg.; 4 workers, Fushan (600–650 m alt.), 22–23.ix.1997, Sk. Yamane leg.; 3 workers, Wa Chih Shin, 24.0934°N, 121.0311°E, 5.x.2012, S. H. Lin leg. (OTFA21). Yunlin county: 2 workers, Ping Ting, 10.vii.2010, S. H. Lin leg. (OTFA03 & 04).

Remarks. This tramp species is very common and widely distributed in Taiwan. However, biological information is still limited. A colony was found in a dead stem of a tree in Wulai. One of us (CML) located another colony in dry decayed wood in Fu Jhou Shan, from which numerous workers, winged and wingless males, and winged queens were collected (for intercastes and wingless sexuals, see Tsuji *et al.*, 1991, Yamauchi *et al.*, 1991, and Ogata *et al.*, 1996).

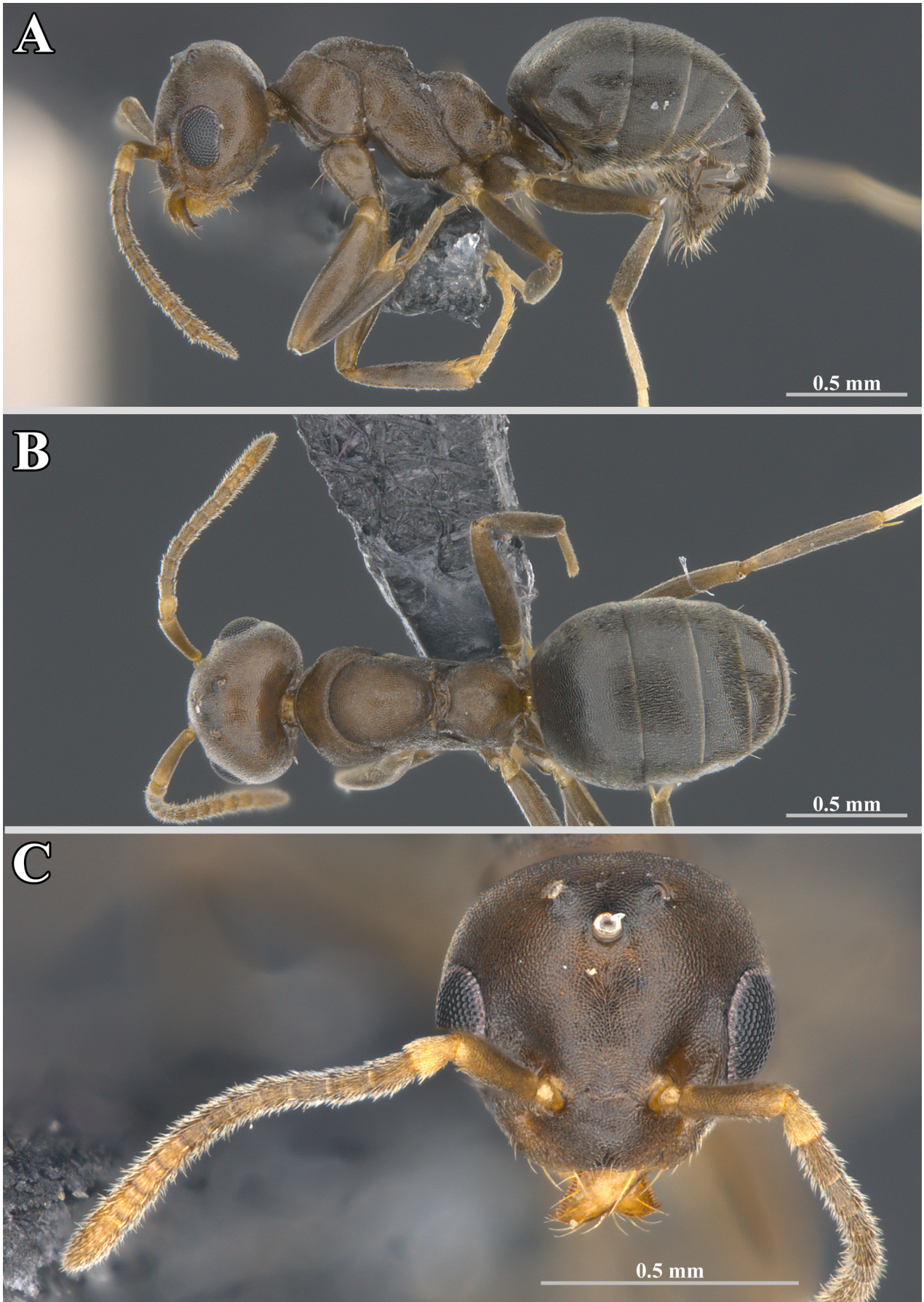


FIGURE 8. *T. brunus* wingless male (LCM00045). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

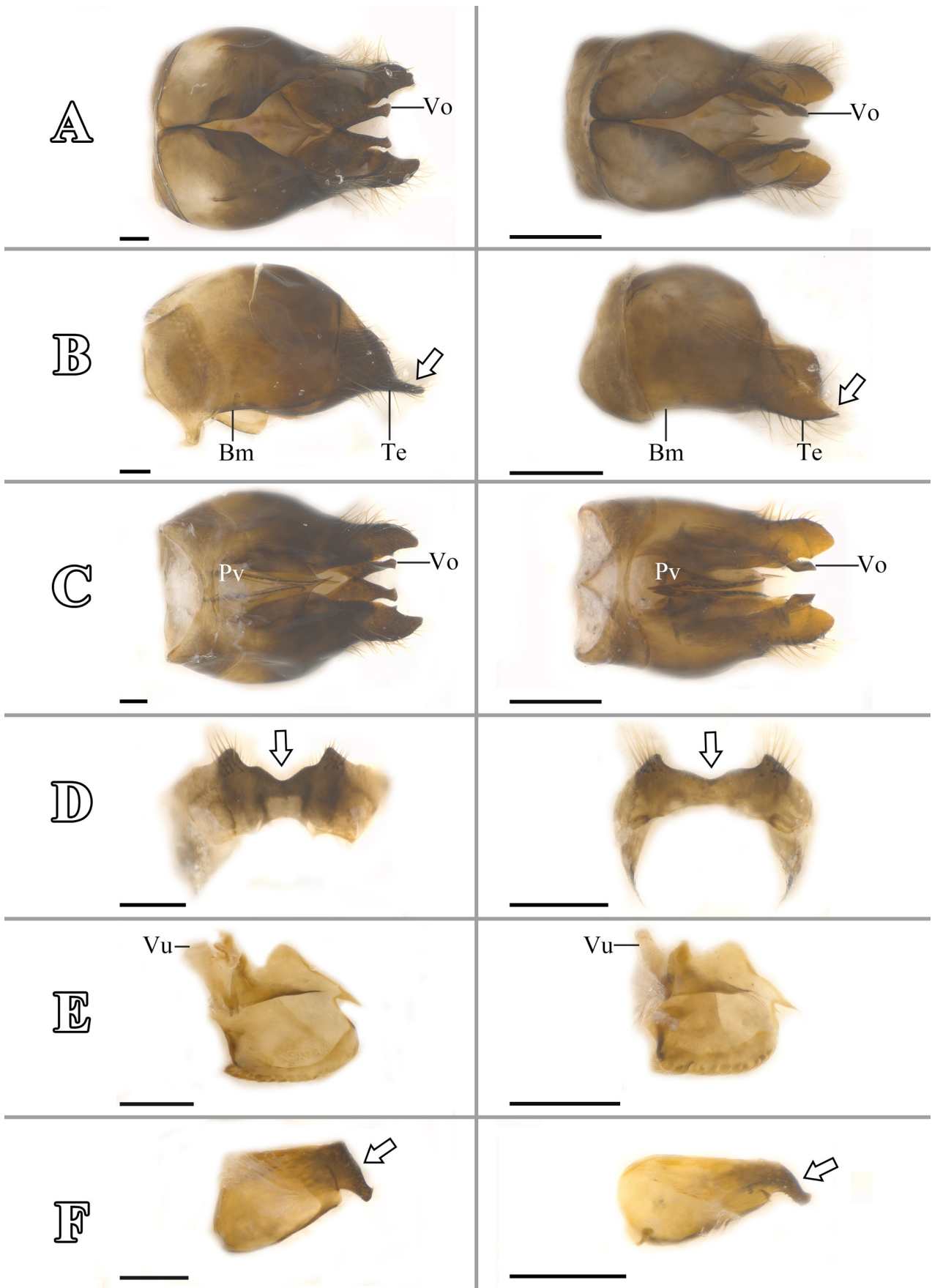


FIGURE 9. *T. brunnus* winged male (left; LCM00046), wingless male (right; LCM00047). A, genital capsule (dorsal view), B, lateral view & C, ventral view; D, abdominal sternum IX; E, penisvalva; F, volsella. (Scale bar = 0.2 mm). Bm (basimere), Pv (penisvalva), Te (telomere), Vc (valviceps), Vo (volsella), Vu (valvula).

Technomyrmex difficilis Forel, 1892

(Fig. 10)

Worker diagnosis. Measurements ($n=1$). TL ca. 2.5. HW 0.54, HL 0.60, SL 0.56, CI 90, SI 104. With head in profile, eye located in front of midlength of head (Fig. 10A). Mandible without longitudinal groove. Dorsum of head behind level of posterior margin of eye with a pair of standing hairs (Fig. 1G). Body almost entirely black, except for tarsi of legs and antennal flagellum yellowish brown.

Distribution. Australia, New Guinea, Philippines, Micronesia, Mariana Is., Lesser Sunda Is., Borneo, Singapore, Malay Pen., Thailand, Indo-China, Taiwan (new record), Madagascar, USA (Florida), and Puerto Rico.

Specimens examined. Taitung county: 1 worker, Lanyu Is., 22.080°N, 121.5136°E, 20.vii.2013, T. H. Wu (OTFA17) (NMNS).

Remarks. This is a famous tramp ant spreading over warmer regions of the world, except for the African continent (Bolton, 2007). In Taiwan only one worker specimen was collected from Lanyu (Orchid) Island. Nothing is known about the nesting biology of this species in Taiwan.

Tecnomymex bicolor group

Technomyrmex formosensis sp. nov.

<http://zoobank.org/8C13E50F-48A7-4F50-AC47-60B40734A2A0>

(Figs. 11, 12)

Holotype worker: Sun Moon Lake (760 m alt.), ca. 23.8574°N, 120.9384°E, 5.vii.2017, nest in decayed wood (Sk. Yamane leg., TW17-SKY-39) [NMNS, unique specimen identifier *YLL01*]. Paratype workers: 12 workers from the same colony [NMNS, SKYC, TFRI, unique specimen identifiers *YLL02–13*].

Worker diagnosis. TL 2.5–3.5. Scape long (Fig. 11); SI > 1.30. Propodeal dorsum rounded into declivity, without distinct angle between them (Fig. 12A); straight-line length of propodeal dorsum less than length of declivity to spiracle. Metathoracic spiracle located close to metanotal groove; distance between them usually around one spiracle diameter. Body almost entirely dark brown to black except for legs, which are partly whitish or yellowish, and mid- and hind coxae milky white (Fig. 12A, B).

Worker description. Measurements ($n=10$ including holotype; values for holotype are in parentheses). TL 2.5–3.5, HW 0.69–0.76 (0.69), HL 0.78–0.89 (0.80), SL 0.88–0.99 (0.91), EW 0.15–0.18 (0.17), EL 0.20–0.24 (0.22), PrW 0.46–0.54 (0.46), MsW 0.28–0.36 (0.29), CI 85–89 (86), SI 127–132 (132). Head seen in full-face view longer than broad, with weakly convex lateral margin and almost straight to shallowly emarginate posterior margin, broadest at level of eye (Fig. 11). Clypeus posteriorly demarcated from frons by weak suture, anteriorly broadly emarginate forming large lateral lobes; inner margin of this emargination smoothly meeting with anterior margin of clypeus (lobe) without angle. Eye located slightly in front of midlength of head; its outer margin approaching lateral margin of head but not breaking the latter (Fig. 11); distance between anterior margin of eye and mandibular base subequal to eye length. Antennal scape surpassing posterior margin of head by 2/5 of its length or more. Pronotum in dorsal view much longer and broader than mesonotum (Fig. 12B); posterolateral corner of pronotum produced backward. With mesosoma in profile (Fig. 12A), mesonotum sloping from level of pronotum toward metanotal groove; mesopleuron not differentiated from mesonotum. Metanotal groove distinct (Fig. 12B); metathoracic spiracle close to groove (anterior margin of propodeum), distance separating them one spiracle diameter or slightly more. Propodeum in profile with dorsal margin convex and gradually rounded into declivity; no distinct angle present between dorsum and declivity; straight-line length of dorsum less than length of declivity to spiracle (Fig. 12A).

Head very finely and densely puncto-reticulate and mat; sculpture weaker on venter of head and legs; mesosoma with stronger and coarser puncto-reticulation than on head. Sculpture on mandible and lower part of propodeal declivity much weaker. Petiole smooth and shiny.

Dorsum of cranium without standing hairs; clypeus with two pairs of long hairs arising from anterior margins of lateral lobes (Fig. 11). Mesosoma without standing hairs. Gastral tergites 2–4 each with 2 pairs of long hairs. Body dark brown to black. Mandible light brown; flagellum and legs rather reddish. Trochanters of all legs and mid- and hind coxae whitish; both extremities of femora, and tarsi of all legs yellowish.

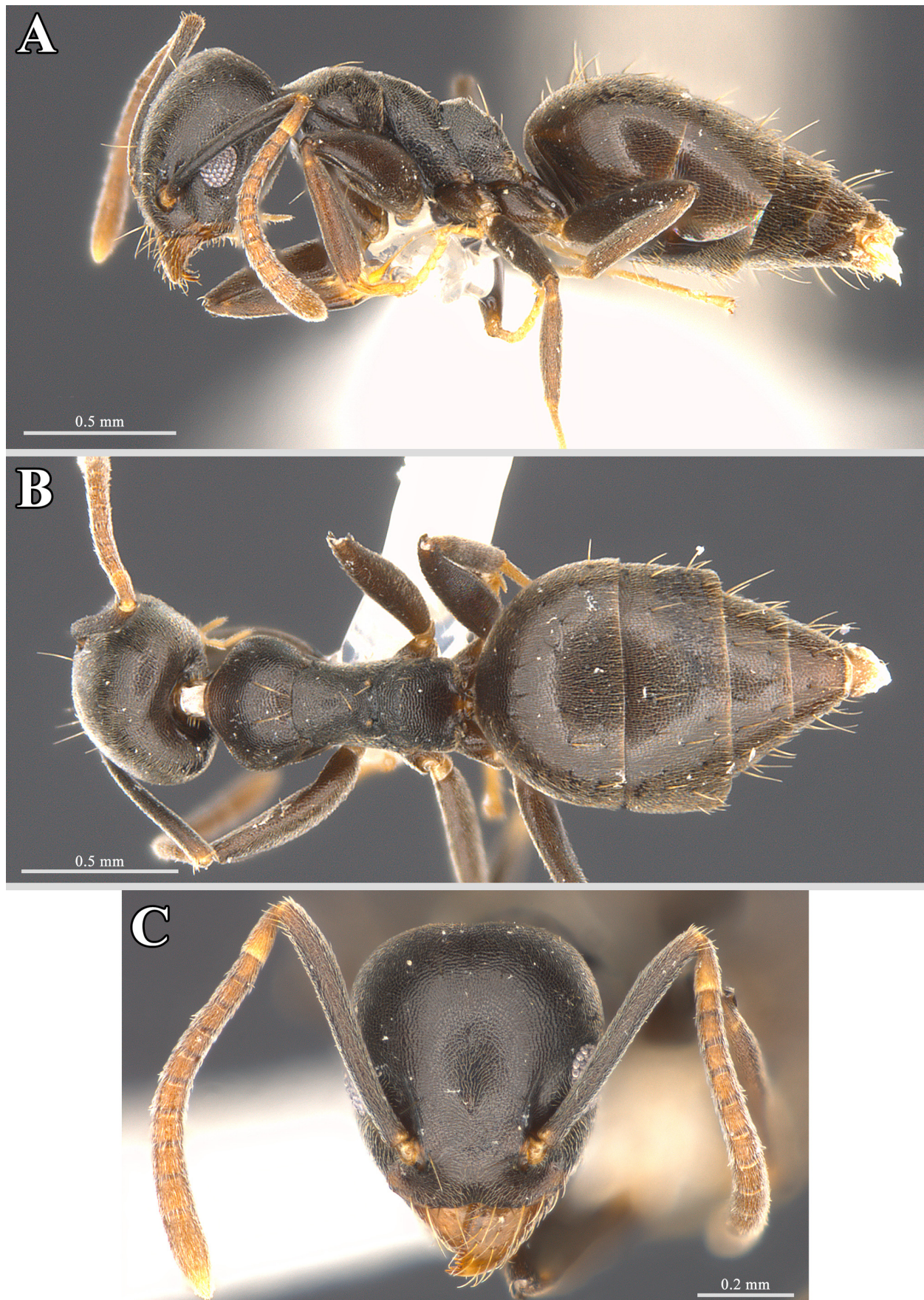


FIGURE 10. *Technomyrmex difficilis* worker (LCM00067). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.



FIGURE 11. *Technomyrmex formosensis* sp. nov. Paratype worker (YLL12). Head, full-face view.

Queen and male unknown.

Distribution. Taiwan.

Additional non-type material examined (MNMS, SKYC, TFRI). Chiayi county: 1 worker, Alishan, Shuisheliao, 3.vii.2017, E. and Sk. Yamane leg. Changhua county: 2 workers, Changhua-shi, Mt. Bagus, 24.0789°N, 120.5481°E, 6.vii.2017, Sk. and E. Yamane leg. Nantou county: 1 worker, Wushe, 23.viii.1987, M. Terayama leg.; 16 workers, Sun Moon Lake (760 m alt.), ca. 23.8574°N, 120.9384°E, 5.vii.2017, nest under stone, Sk. Yamane leg. (TW17-SKY-51); 2 workers, same loc. and date, E. and Sk. Yamane leg.; 6 workers, Huisun Exp. Forest (500-800 m alt.), 24.0896°N, 121.0305°E, 27–30.iv.2017, secondary forest, C. M. Leong leg.

Remarks. *Technomyrmex formosensis* sp. nov. is in coloration and structure very similar to *T. kraepelini* Forel, 1905 inhabiting the Sundaland region (syntype images examined; AntWeb, 2017). However, it is distinguished from the latter by a more slender body and longer antennal scape. Scape index is always more than 125 (up to 132) in the former, while it is constantly less than 125 (minimum 90) in the latter. The dorsum of the propodeum roundly convex, with no angle between it and the declivity in the former, while the propodeum has a more or less flat dorsal surface, with a rounded angle with the declivity in the latter. The present new species is also similar to *T. antennus* Zhou, 2000 from southern China (Zhou, 2000) in some respects such as the short dorsum of the propodeum and long antennae. However, in *T. antennus* the body colour is reddish brown as in *T. horni* (dark brown to black in *T. formosensis* sp. nov.), propodeal junction is angled (without angle in the latter), and the antennae and legs are yellowish brown (mainly black in the latter).

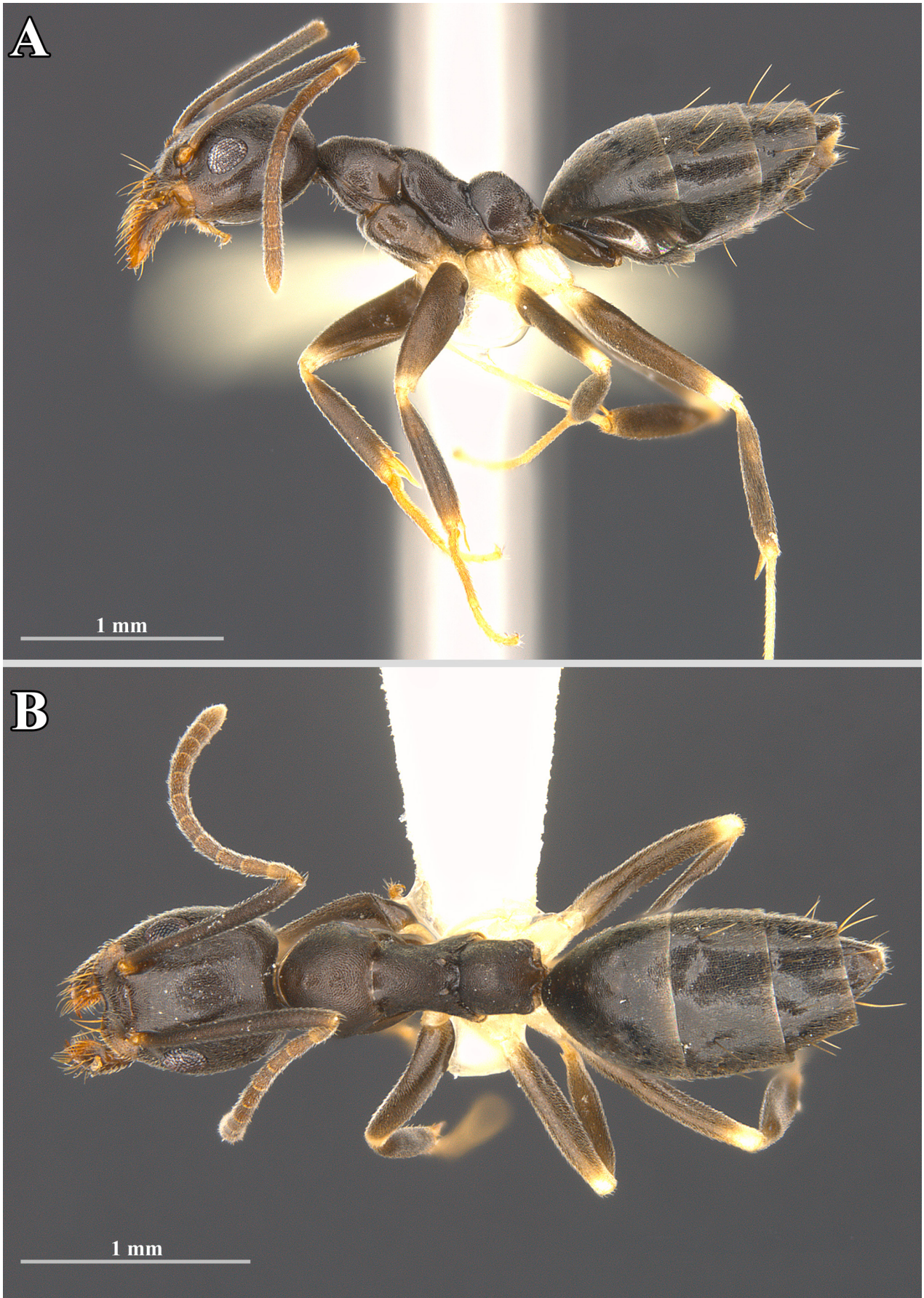


FIGURE 12. *T. formosensis* sp. nov. Paratype worker (YLL12). A, habitus in profile & B, ditto in dorsal view.

Technomyrmex horni Forel, 1912

(Figs. 13–16)

Worker diagnosis. TL 2.5–3.5. Scape long; SI > 118 in most specimens. Clypeus with large anterior incision; inner margin of this incision meeting with anterior clypeal margin in round but distinct angle (Fig. 13C). With propodeum in profile, dorsal face straight to slightly convex anteriorly, often with weak indentation posteriorly; posterodorsal angle round but distinct; straight-line length of propodeal dorsum greater than length of declivity to spiracle (Fig. 13A). Metathoracic spiracle far from metanotal groove; distance between them as long as two spiracle diameters or more. Head light brown to brown; mesosoma slightly paler, often with yellowish tinge; gaster dark brown (rarely whole body almost uniformly light brown); femora and tibiae dark brown with apices whitish; mid- and hind coxae milky white; tarsi of all legs whitish to yellowish.

Worker description. Measurements (n=10). TL 2.5–3.5, HW 0.71–0.92, HL 0.77–0.94, SL 0.87–1.10, EW 0.14–0.17, EL 0.18–0.23, PrW 0.46–0.59, MnW 0.26–0.37, CI 86–98, SI 113–130. Head (Fig. 13C) longer than broad, almost as long as broad in larger specimens; CI decreases with increase in head width; head in full-face view with roundly convex lateral margin and weakly concave posterior margin. Eye large, located in front of midlength of head, not breaking lateral margin of head when head is seen in full-face view (distance between outer margin of eye and lateral margin of head tends to be longer in larger specimens). Clypeus posteriorly margined with weak suture which is often indistinct, with deep and broad anterior emargination forming roundly produced lateral lobes. Frontal carinae weakly diverging posteriad, hardly attaining level of midlength of eye. Mandible with a series of 10 distinct teeth, followed by minute denticles on masticatory margin toward basal angle; third tooth (counted from apex) distinctly smaller than second and fourth. Antennal scape surpassing posterior margin of head by around 2/5 of its length. Pronotum in dorsal view distinctly broader than long, much broader than mesonotum (Fig. 13B); mesopleuron not demarcated from mesonotum but demarcated from metapleuron by deep suture (Fig. 13A); metathoracic spiracles located far from anterior margin of propodeum; distance between them as long as distance between spiracles. Propodeum massive, in dorsal view as broad as mesonotum, in profile (Fig. 13A) not demarcated from metapleuron; dorsum flat, often with weak indentation in front of posterodorsal corner that is roundly angled; straight-line length of dorsum greater than length of declivity to spiracle. Gastral tergite I distinctly narrowed basally, with straight basal margin that is as long as width of petiole.

Dorsum of head and mesosoma minutely and densely puncto-reticulate. Venter of head and legs more weakly sculptured and slightly shiny. Antennal scape microsculptured and dull. Mandible and petiole smooth and shiny. Gastral tergites with superficial sculpture and rather shiny.

Entire head excluding clypeus and mouthparts, and entire mesosoma except on propleuron without standing hairs. Anterior margins of lateral lobes of clypeus each with two long and strong hairs and several shorter and weaker ones. Mandible with dense somewhat appressed hairs on outer margin. Femora, tibiae and tarsi of all legs without standing hairs; fore coxa with two standing hairs on anterior face and a few shorter ones on posterior face. Gastral tergite I without standing hairs; II with one pair, III and IV each with two pairs of hairs; all tergites with dense appressed hairs that are similar to pubescence on head and mesosoma; gastral sternites each with a few standing hairs.

Head, mesosoma, fore coxa and petiole yellowish brown (head slightly darker). Gaster and femora and tibiae brown to dark brown. Mid- and hind coxae, and trochanters, both extremities of femora, and tarsi of all legs whitish to yellowish. (For a redescription of the syntypes, see Bolton, 2007).

Queen (previously undescribed). Measurements (n=2; 1 dealate and 1 alate queen). TL 4.5, 5.2; HW 0.97, 0.96; HL 1.01, 0.99; SL 1.00, 1.00; EW 0.25, 0.25; EL 0.32, 0.32; PrW 0.69, 1.04; MsW 0.82, 0.96; CI 96, 97; SI 103, 103. Head short, only slightly longer than broad, with weakly convex sides and very shallowly emarginate posterior margin (Fig. 14C). Clypeus anteriorly with broad, moderately deep median concavity; lateral lobes large with round anterior margins; clypeus posteriorly margined by suture. Eye large, almost reaching lateral outline of head or weakly breaking the latter. Distance between posterior ocelli much longer than that between posterior ocellus and anterior ocellus. Scape surpassing posterior margin of head by its 2/5 length (Fig. 14C). With mesosoma in profile (Fig. 14A), mesoscutum large composed of anterior slope and posterior flat portion; seen from above, mesoscutellum round, slightly broader than long (Fig. 14B); mesopleuron divided into two parts by a distinct suture; anepisternum distinctly margined with carina. Metanotum very short (just a narrow band); metapleuron not demarcated from propodeal side by suture. Propodeum with short dorsum and flat declivity, with pair of low tubercles between dorsum and declivity; straight-line length of propodeal dorsum shorter than length of declivity to spiracle; propodeal spiracle located on side of propodeum, very close to its posterior margin.

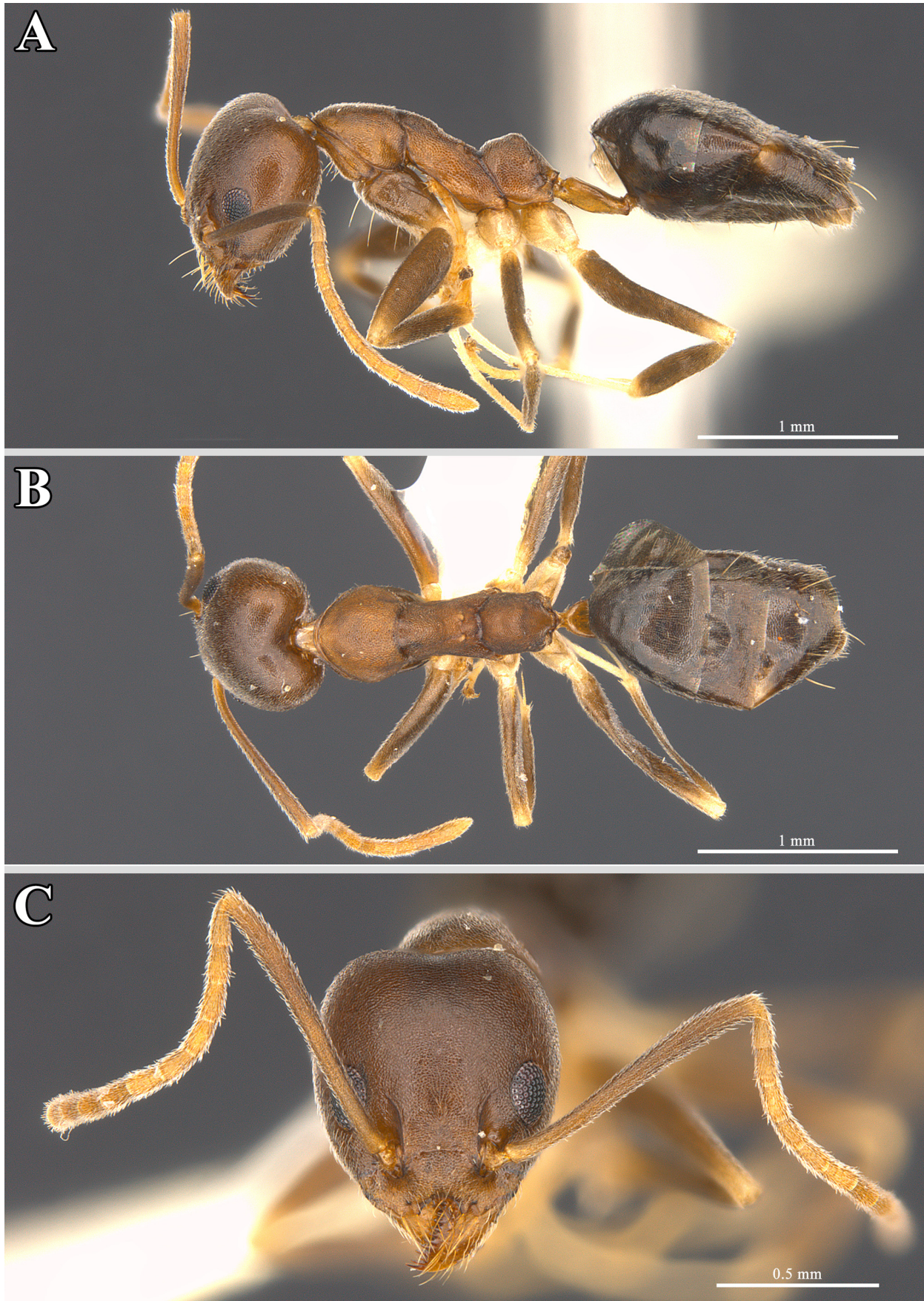


FIGURE 13. *Technomyrmex horni* worker (LCM00066). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

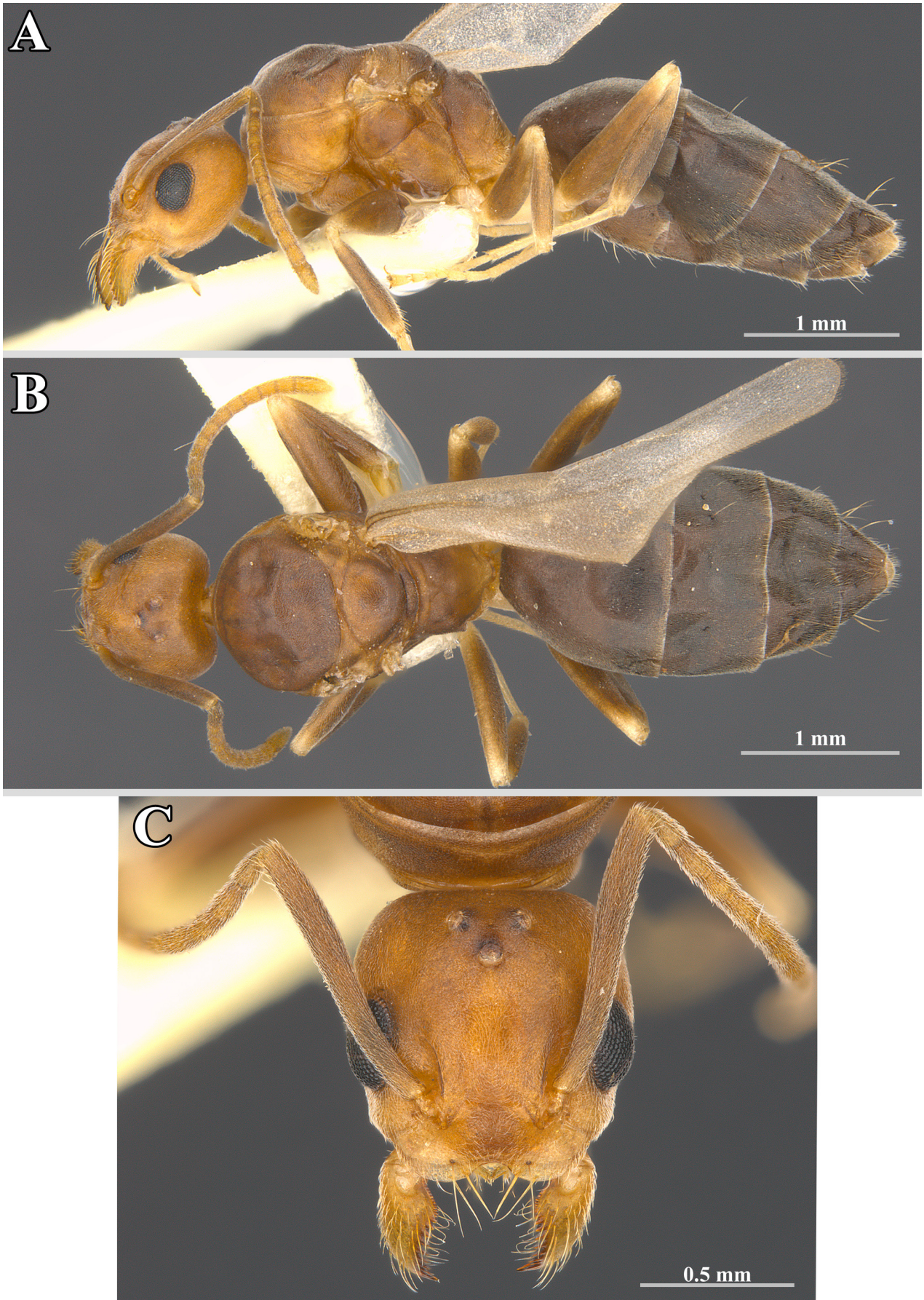


FIGURE 14. *T. horni* queen (LCM00065). A, habitus in profile, B, ditto in dorsal view & C, head in full-face view.

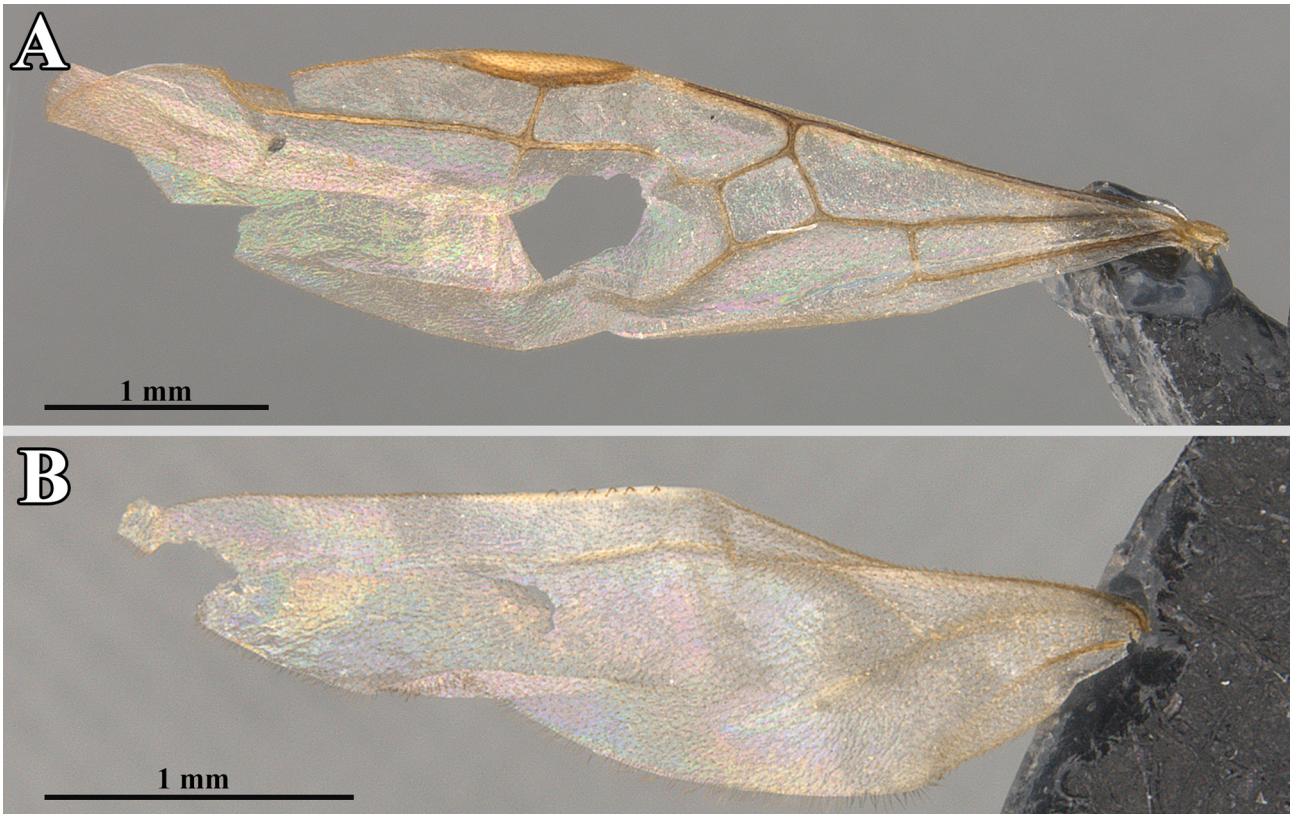


FIGURE 15. *T. horni* queen (LCM00065). A, fore wing & B, hind wing.

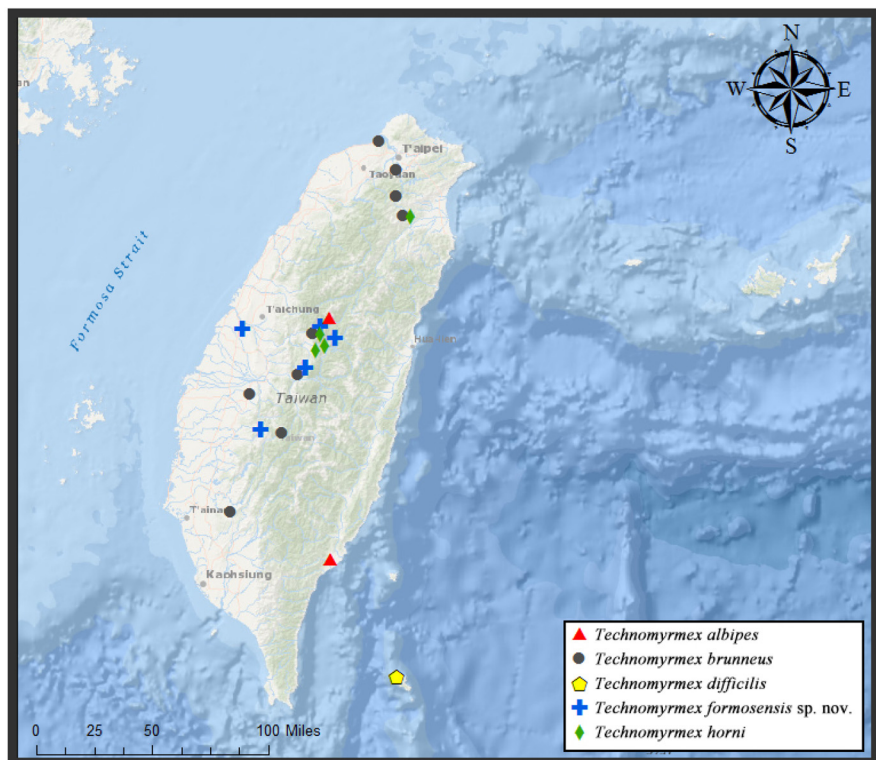


FIGURE 16. Collection sites of *Technomyrmex* species in Taiwan.

Almost entire body very finely and densely punctate and mat; mandible, mesoscutellum and gaster more shiny; petiole nearly impunctate and shiny. Pilosity and coloration almost the same as in the worker.

Distribution. Borneo, Krakataus, Singapore, Malay Pen., India, Sri Lanka, Thailand, China, Taiwan.

Specimens examined (MNMS, SKYC, TFRI). Chiayi county: 6 workers & 1 foundress queen, Alishan, Shuisheliiao (ca. 1,200 m alt.), 3.vii.2017, nest in dead bamboo, Sk. Yamane leg. (TW17-SKY-13); 2 workers, same loc. and date, Sk. Yamane leg. Nantou county: 2 workers, Nanshanchi, 22.viii.1987, M. Terayama leg.; 2 workers, Huisun Exp. Forest (500–800 m alt.), 24.0896°N, 121.0305°E, 27–30.iv.2017, secondary forest, C. M. Leong leg.; 7 workers, environs of Puli, Shikeng road, 23.9964°N, 121.0055°E, 6.vii.2017, nest under stone, Sk. Yamane leg. (TW17-SKY-63). Taipei county: 1 worker, Ulai, Fushan, 20.iv.2010, on *Mallotus* leaf, Sk. Yamane leg.; 7 workers, same loc. and date, nest in dead bamboo stem, Sk. Yamane leg. (TW10-SKY-05). Taitung county: 16 workers & 2 winged queens, Tungha (660 m alt.), 24.iv.2010, nest in crevice of rock, Sk. Yamane leg. (TW10-SKY-14); 7 workers, Dulanshan (650 m alt.), 24.iv.2010, lower vegetation, Sk. Yamane leg.

Remarks. Bolton (2007) noted that in *T. horni*, with the propodeum in profile the dorsum is flat to shallowly convex, but did not mention the weak impression just in front of the angle between the dorsum and declivity. This impression is very often seen in the specimens listed above. The specimens from higher elevations are darker in body colour than in those from lower elevations in both workers and queens. The variation in body proportion in workers is much more pronounced in this species than in the related Taiwanese species, *T. formosensis* **sp. nov.** (see CI and SI for both species). In the measurements the two queens (originated from different colonies) are almost identical except in the values for the pronotal width and mesonotal width; this may be because in the dealate queen the thorax shrinks after shedding the wings. The cell *dc1* of the forewing is present in *T. horni* (Fig. 15A), but absent in *T. brunneus* as the vein *1m-cu* is absent.

Conclusion

In the present study, we have added three species to the *Technomyrmex* fauna of Taiwan, including a new species in the *T. bicolor* species group. In total, we recognise five species from Taiwan (Fig. 16), of which three belong to the *T. albipes* species group, all being possibly alien tramp species (but *T. brunneus* can be native to Taiwan; cf. Yamane and Fukumoto, 2017). In this species group, *T. brunneus* is most common and most widely distributed in Taiwan, while *T. albipes* has only been found in two sites (Chipen, Taitung county and Huisun Exp. Forest, Nantou county), and for *T. difficilis* only one worker was collected from Lanyu Island, Pingtung county. On the other hand, the two species in the *T. bicolor* group seem native to Taiwan; the type localities of both species are in Taiwan. Of these *T. formosensis* is at present only known from Taiwan, while *T. horni* is widespread from Taiwan to Sri Lanka in the south and to Borneo in the east (Bolton, 2007). As mentioned by Bolton (2007) it is quite possible that more than one real species is concealed under the name '*horni*'. More material including sexuals and fresh specimens for DNA analyses from the whole distribution range is needed to clarify this problem. This species is also similar to the continental *T. obscurior* Wheeler, 1928 in structural characters. The material of *T. obscurior* is also not enough to discuss the relationship of these species. Finally, we admit that this revision is not complete and that more species will be found from Taiwan by more extensive and intensive faunal survey in the future.

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