

ORIGINAL ARTICLE

Taxonomic review of the ant genus *Dilobocondyla* from China (Hymenoptera: Formicidae), with a revised key to the known species

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Abstract Three species of the myrmicine ant genus *Dilobocondyla* are recognized in China: *D. gaoyureni*, *D. fouqueti* and *D. rufida* **sp. nov.** The new species is described based on the worker and the gyne castes, and can be distinguished from the others by the relatively shorter petiole and the obvious bicolored body. A revised key to the known species of the world based on worker caste is presented.

Key words *Dilobocondyla*, new species, China, taxonomy.

1 Introduction

Dilobocondyla Santschi, 1910 is a small genus under the subfamily Myrmicinae (Hymenoptera: Formicidae). It consists of 20 species and one subspecies, restricted in the Oriental and Indo-Australian Regions (Bolton, 2018), and known to be arboreal (Wheeler, 1924). Wheeler (1924) provided a key to the species of the genus for the first time. Bharti & Kumar (2013) described five new species from the Oriental Region and provided a revised key to the known species. In the same year, Zettel & Bruckner (2013) described four new species and provided a provisional key to the workers of Philippine. Other contributions to the taxonomy of the genus including Wheeler (1935), Taylor (1991), Wang & Wu (1992) and Varghese (2006), in which, two species and one subspecies were described, and one synonym was proposed. Although the concept of the genus is relatively robust, the species-level classification seems to be far from completion.

By identifying the ant specimens from the Insect Collection of Guangxi Normal University, a new species with remarkably unique body color pattern was found. The new species is clearly distinguishable from its congeners by the unique body color pattern, such as its body black with red gaster. We herein describe the new species to the list of Chinese ants. An updated key to the known species of the world based on worker caste is also provided.

2 Materials and methods

All materials examined were deposited in the Insect Collection of Guangxi Normal University, Guilin, China. Observation of the specimens was carried out with a Nikon SMZ745 stereomicroscope. High-quality multifocused montage

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images were produced with a Leica DFC 450 digital imaging system and Leica Application Suite V4.3 software®. All measurements are in millimeters (mm). Standard measurements and indices are as defined by Bolton (1975), with addition of ED and MSL as below.

CI—Cephalic Index, $HW \times 100 / HL$;

DPI—Dorsal Petiole Index, $DPW \times 100 / PL$;

DPW—Dorsal Petiole Width, maximum width of petiole in dorsal view;

ED—Eye Diameter, maximum diameter of eye;

HL—Head Length, straight-line length of head in perfect full-face view, measured from the midpoint of the anterior clypeal margin to the midpoint of the posterior margin, or to the terminal horizontal line while some species with the posterior margin concaved;

HW—Head Width, maximum width of head in full-face view, excluding the eyes;

LPI—Lateral Petiole Index, $PH \times 100 / PL$;

MSL—Mesosoma Length, diagonal length of the mesosoma in lateral view, measured from the point at which the pronotum meets the cervical shield to the posterior basal angle of the metapleuron;

PH—Petiole Height, height of petiole measured in lateral view from the apex of the ventral (subpetiolar) process vertically to a line intersecting the dorsalmost point of the node;

PL—Petiole Length, length of petiole measured in lateral view from the anterior process to the posteriormost point of the tergite, where it surrounds the gastral articulation;

PW—Pronotal Width, maximum width of pronotum measured in dorsal view;

SI—Scape Index, $SL \times 100 / HW$;

SL—Scape Length, straight-line length of the antennal scape, excluding the basal constriction or neck;

TL—Total Length, total outstretched length of the individual, from the mandibular apex to the gastral apex.

3 Taxonomy

Dilobocondyla Santschi, 1910

Dilobocondyla Santschi, 1910: 283. Type-species: *Atopomyrmex selebensis*, by subsequent designation of Wheeler, W.M., 1911: 162.

Mesomyrma Stütz, 1911: 363 (as subgenus of *Podomyrma*). Type-species: *Podomyrma (Mesomyrma) cataulacoidea*, by monotypy.

Synonymized by Emery, 1912: 102.

Diagnosis. In full-face view, head nearly quadrate. Mandibles triangular. Palp formula 4, 3. Clypeus anterior margin notched in the center. Frontal carinae conspicuous. Antennae 12-segmented, with distinct 3-segmented club. Eyes large and convex. Metanotal groove generally impressed. Petiole generally cylindrical, anteroventral corner toothed. Spur formula 0, 0.

Distribution. China (Zhejiang, Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Yunnan, Xizang, Hainan), Vietnam, Philippines, Borneo, Malaysia, Singapore, New Guinea, Australia.

Dilobocondyla fouqueti Santschi, 1910

Dilobocondyla fouqueti Santschi, 1910: 283. (Syntype worker images examined, AntWeb, CASENT0912885, photoed by Z. Lieberman).

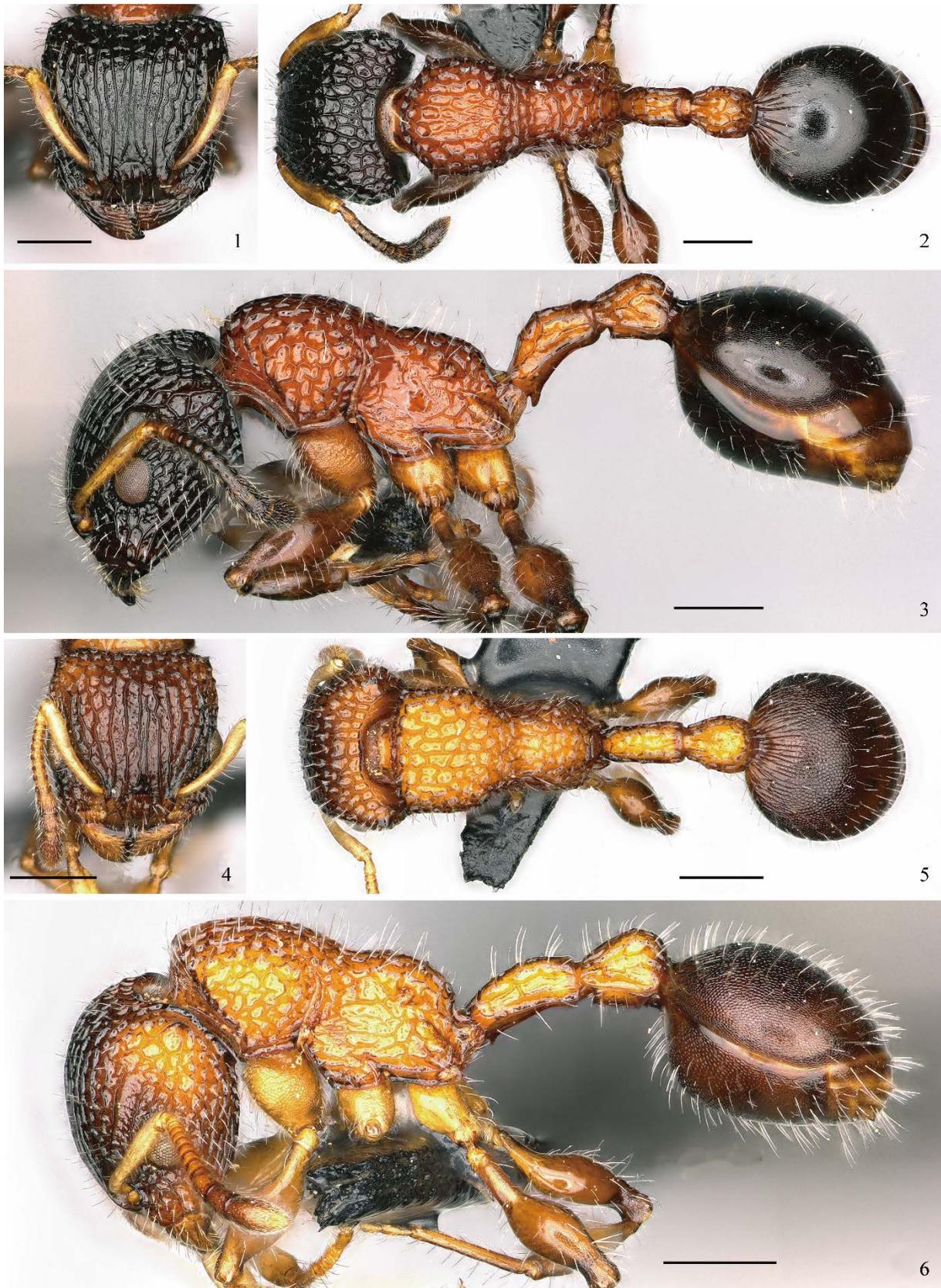
Dilobocondyla fouqueti var. *lighti* Wheeler, W.M., 1927: 6. Synonymized by Wang & Wu, 1992: 562. (not examined).

Diagnosis. The species can be distinguished from other species of *Dilobocondyla* by the imperceptible hexagonal micro-reticulations. Its micro-reticulations on gasteral dorsum are also much more subtler than other species, which can be easily observed.

Material examined. 1 worker, CHINA: Hainan, Wuzhishan, Hudiemuchang Scenic Spots, 18.86°N, 108.67°E, 715 m, 5.IV.2016, leg. Zhilin Chen, No. G160376; 2 workers, CHINA: Hainan, Wuzhishan, Redaiyulin Scenic Spots, 18.87°N, 108.69°E, 850 m, 5.IV.2016, leg. Zhilin Chen, No. G160302.

Description. Worker (Figs 1–3). TL 5.6–5.7, HL 1.28–1.31, HW 1.27–1.28, CI 99–100, SL 0.81–0.83, SI 64–65, ED 0.24–0.26, PW 0.86–0.87, MSL 1.73–1.75, PL 0.54–0.55, PH 0.31–0.34, DPW 0.27–0.28, LPI 57–58, DPI 50–52 ($n=3$).

In full-face view, head nearly quadrate, posterior margin concave medially, posterior corners bluntly angled, lateral margins weakly convex. Mandibles triangular, masticatory margin 6-toothed, with large apical and preapical teeth, and 4 additional small teeth. Clypeus flat, without median longitudinal carina, anterior margin notched in the center. Frontal carinae conspicuous, curved outward, reaching to 3/4 of head length. Antennae 12-segmented, with distinct 3-segmented



Figures 1–6. *Dilobocondyla* workers. 1–3. *D. fouqueti*. 4–6. *D. gaoyureni*. 1, 4. Head, full-face view. 2, 5. Body, dorsal view. 3, 6. Body, lateral view.

club; apices of scapes reaching to 3/4 of head length. Eyes large and convex.

In lateral view, promesonotal dome weakly convex, a little higher than propodeum. Metanotal groove weakly impressed. Dorsum of propodeum slightly convex, posterodorsal corner rounded. Propodeal lobes well developed, with rounded apices. Petiole relatively longer, 1.7 times as long as high, dorsal margin strongly convex, anteroventral corner toothed. Postpetiole roughly triangular, incrassate posteriorly, dorsum strongly convex, higher than petiole. Gaster ovate.

In dorsal view, pronotum roughly trapezoidal and narrowed posteriorly, humeral corner forming a small pointed denticle. Promesonotal suture absent. Mesonotum short and narrower than pronotum. Metanotal groove indistinct. Propodeum roughly rectangular and narrower than pronotum. Petiole narrow and rectangular, with lateral margins straight. Postpetiole broader than petiole and widening posteriorly, with convex lateral margins. Gaster ovate.

Mandibles longitudinally striate. Clypeus and vertex of head longitudinally rugose, the rest of head rugose-reticulate. Mesosoma, petiole and postpetiole rugose-reticulate, reticulation reduced on mesopleura and metapleura. Dorsum of gaster finely micro-reticulate and shining, first gastral tergite with sparse basal costulae. Whole body surface with abundant erect to suberect hairs. Head and gaster darkish brown to black, mesosoma and waist segments yellowish brown to reddish brown, scapes yellowish brown, legs blackish brown.

Distribution. China, Vietnam.

Dilobocondyla gaoyureni Bharti & Kumar, 2013

Dilobocondyla gaoyureni Bharti & Kumar, 2013: 32, figs 5–7. (Holotype worker images examined, AntWeb, ANTWEB1008026, photoed by H. Bharti).

Diagnosis. The species can be distinguished from *D. fouqueti* by the acutely angled posterior head corners, relatively lower petiolar dorsum, distinct micro-reticulations on the gaster, and the lighter body color. It also can be distinguished from *D. rufida* by the acutely angled posterior head corners, relatively longer petiole, and the lighter body color.

Material examined. 2 workers, CHINA: Hainan, Wuzhishan, Hudiemuchang Scenic Spots, 18.86°N, 108.67°E, 715 m, 5.IV.2016, leg. Zhilin Chen, No. G160335.

Description. Worker (Figs 4–6). TL 4.5–4.6, HL 1.03–1.04, HW 0.99, CI 95–96, SL 0.64–0.65, SI 64–65, ED 0.25, PW 0.76–0.77, MSL 1.43–1.45, PL 0.52, PH 0.27, DPW 0.25, LPI 52, DPI 48 ($n=2$).

In full-face view, head nearly rectangular, a little longer than width, posterior margin slightly concave medially, posterior corners acutely angled, lateral margins weakly convex. Mandible triangular, masticatory margin 6-toothed, with large apical and preapical teeth, and 4 additional small teeth. Clypeus without longitudinal median carina, anterior margin notched in the center. Frontal carinae conspicuous, curved outward, reaching to 3/4 of head length. Antennae 12-segmented, with distinct 3-segmented club, scapes reaching to 3/4 of head length. Eyes large and convex.

In lateral view, promesonotal dome convex, a little higher than propodeum, promesonotal suture absent. Metanotal groove moderately impressed. Dorsum of propodeum weakly convex, forming a rounded corner with declivity. Propodeal lobes well developed, with rounded apices. Petiole relatively longer, 2 times as long as high, dorsal margin moderately convex, anteroventral corner minutely toothed. Postpetiole roughly triangular, incrassate posteriorly, dorsum strongly convex, higher than petiole. Gaster ovate.

In dorsal view, pronotum trapezoidal, narrowed posteriorly, humeral corner forming a blunt tooth. Promesonotal suture absent. Mesonotum short and narrower than pronotum. Metanotal groove indistinct. Propodeum roughly rectangular and narrower than pronotum. Petiole narrow and rectangular, weakly widened posteriorly, lateral margins straight. Postpetiole broader than petiole and widening posteriorly, with convex lateral margins. Gaster ovate.

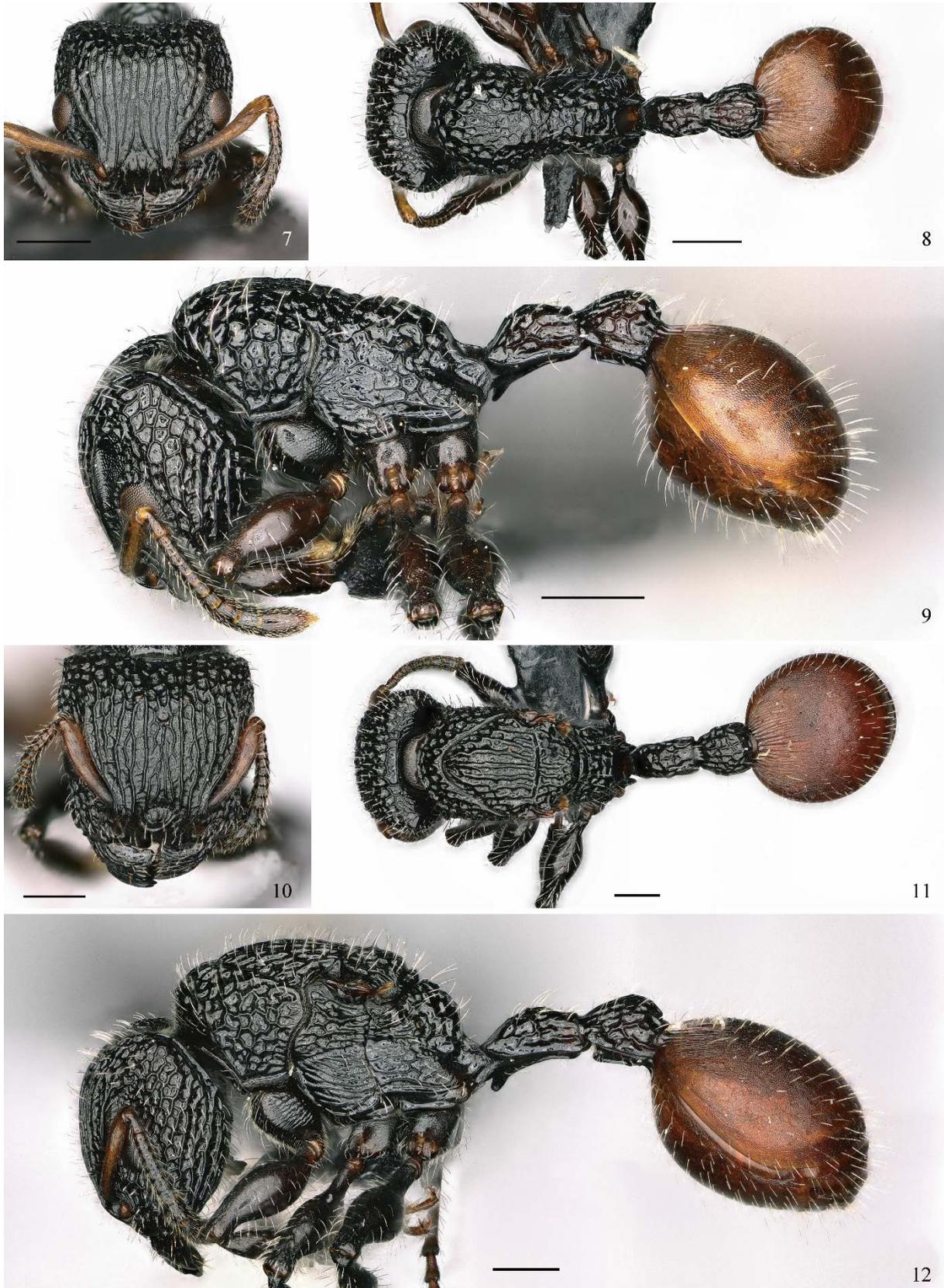
Mandibles longitudinally striate. Clypeus and vertex of head longitudinally rugose, the rest of head rugose-reticulate. Mesosoma, petiole and postpetiole rugose-reticulate, reticulation became weaker on mesopleura and metapleura. Gaster distinctly micro-reticulate and dull, first gastral tergite with abundant basal costulae. Whole body surface with abundant erect to suberect hairs. Head and legs brown; scapes, mesosoma and waist segments brownish yellow; gaster blackish brown.

Distribution. China (Guangdong, Hainan).

Dilobocondyla rufida sp. nov. (Figs 7–12)

Type materials. Holotype worker, CHINA: Guangxi, Fangchenggang, Fulong, 21.82°N, 107.95°E, 510m, 17.IV.2017, leg. Zhilin Chen, No. G170183. Paratype. 1 dealate gyne from the same colony with holotype worker.

Diagnosis. The new species is close to *D. fouqueti* Santschi, but can be distinguished from the latter by the relatively shorter petiole and more convex dorsum, distinct micro-reticulations on the gaster, and black colored mesosoma, petiole and postpetiole, and lightly colored gaster. The new species is also similar to *D. gaoyureni* Bharti & Kumar, but



Figures 7–12. *Dilobocondyla rufida* sp. nov. 7–9. Worker. 10–12. Female. 7, 10. Head, full-face view. 8, 11. Body, dorsal view. 9, 12. Body, lateral view.

distinguishable from the latter by the relatively shorter petiole and strongly convex dorsum, weakly depressed metanotal groove, bluntly angled posterior head corners, and black colored head, mesosoma and waist segments.

Description. Holotype worker (Figs 7–9). TL 5.3, HL 1.24, HW 1.23, CI 99, SL 0.81, SI 66, ED 0.30, PW 0.88, MSL 1.67, PL 0.50 PH 0.33, DPW 0.33, LPI 66, DPI 66.

In full-face view, head nearly rectangular, a little longer than width, posterior margin distinctly concaved medially, posterior corners bluntly angled, lateral margins weakly convex. Mandibles triangular, masticatory margin 6-toothed, with large apical, preapical and basal teeth, and three additional small but obvious teeth. Clypeus without longitudinal median carina, anterior margin notched in the center. Frontal carinae conspicuous, curved outward, reaching to 3/4 of head length. Antennae 12-segmented, with distinct 3-segmented club, scapes reaching to 3/4 of head length. Eyes large and convex.

In lateral view, promesonotal dome weakly convex dorsally, a little higher than propodeum, promesonotal suture absent. Metanotal groove weakly impressed. Dorsum of propodeum weakly convex, forming a broadly rounded corner with declivity. Propodeal lobes well developed, with rounded apices. Petiole relatively short, 1.7 times as long as high, with dorsal margin strongly convex, anteroventral corner largely toothed. Postpetiole roughly triangular, incrassate posteriorly, dorsum strongly convex, higher than petiole. Gaster ovate.

In dorsal view, pronotum broad and roughly trapezoidal, narrowed posteriorly, humeral corner forming a small pointed denticle. Promesonotal suture absent. Mesonotum short and narrower than pronotum. Metanotal groove indistinct. Propodeum roughly rectangular and narrower than pronotum. Petiole narrow and rectangular, weakly widened posteriorly, lateral margins straight. Postpetiole broader than petiole and widening posteriorly, with convex lateral margins. Gaster ovate.

Mandibles longitudinally striate. Clypeus and vertex of head longitudinally rugose, the rest of head rugose-reticulate. Mesosoma, petiole and postpetiole rugose-reticulate, reticulation became weaker on mesopleura and metapleura. Gaster distinctly micro-reticulate and dull, first gastral tergite with abundant basal costulae. Whole body surface with abundant erect to suberect hairs. Body black, scapes and gaster reddish brown, flagella and legs blackish brown.

Paratype gyne (Figs 10–12). TL 7.88, HL 1.69, HW 1.63, CI 96, SL 0.92, SI 56, ED 0.30, PW 1.33, MSL 2.56, PL 0.75, PH 0.44, DPW 0.44, LPI 59, DPI 59. Similar to the holotype worker with the following exceptions. Body relatively larger. Head with 3 ocelli and relatively larger eyes. Mesosoma massive and fully segmented, in lateral view mesosomal dorsum roundly convex, petiolar dorsum moderately convex; in dorsal view pronotum reversed V-shaped, scutum triangular, mesonotal suture weakly arched posteriorly, scutellum transverse and lunulate. Propodeum roughly trapezoidal and narrowed posteriorly, broader than long. Mesonotum with longitudinally ridged.

Habitat. The type series was found nesting in a small dead twig of *Rhododendron henryi* (Hance, 1881).

Etymology. The specific name refers to the reddish brown gaster.

Remarks. The body color pattern of the genus seems to be relatively unstable by examining the specimens and AntWeb's pictures. All known species can be classified roughly into "concolor" and obviously "bicolor" groups. The former group consists of 12 species and subspecies, *D. bangalorica*, *D. borneensis*, *D. chapmani*, *D. didita*, *D. fulva*, *D. oswini*, *D. sebesiana*, *D. selebensis*, *D. selebensis simalurana*, *D. silviae*, *D. rufobrunnea*, *D. yamanei*. And the latter group consists of 9 species, *D. cataulacoidea*, *D. carinata*, *D. eguchii*, *D. fouqueti*, *D. gaoyureni*, *D. gasteroreticulata*, *D. karnyi*, *D. propotriangulata*, *D. rugosa*. In the known bicolor species, the gaster is usually lighter than the head, or the same color as the head. *D. rufida* sp. nov. can be classified into the "bicolor" groups and can be distinguished from the other species of *Dilobocondyla* by its black colored mesosoma, petiole and postpetiole, and reddish brown gaster.

Key to worldwide species of *Dilobocondyla* based on worker castes (synthesized from Wheeler (1924), Bharti & Kumar (2013) and Zettel & Bruckner (2013); most figures cited from AntWeb).

1. Head in full-face view with posterior margin strongly and continuously concave (except for *D. fulva*) (Figs ANTWEB1008114, CASENT0914066) (Philippines) 2
 Head in full-face view with posterior margin nearly straight or only weakly concave in middle (Figs ANTWEB1008116, CASENT0914065)..... 8
2. Petiole with a sharp and highly raised transverse ridge (Fig. ANTWEB1008114); anterodorsal face of postpetiole with conspicuous longitudinal rugae (Fig. ANTWEB1008114; Philippines). *D. carinata* Zettel & Bruckner, 2013
 Petiole without transverse ridge (Fig. ANTWEB1008115); anterodorsal face of postpetiole differently sculptured, without conspicuous longitudinal rugae (Fig. ANTWEB1008115)..... 3
3. Mesosoma entirely or chiefly blackish brown or black (Figs ANTWEB1008117, ANTWEB1008118, CASENT0904711)..... 4
 Mesosoma yellowish to light brown (Figs ANTWEB1008115, CASENT0908982, FOCOL1970)..... 6
4. Antennal scrobe moderately developed, dorsally limited by fine frontal carina that posteriorly fading and not reaching posterior corners of head (Fig. CASENT0914066; Indo-Australian Region) *D. selebensis* (Emery, 1898)
 Antennal scrobe strongly developed, dorsally limited by prominent frontal carina that reaches posterior corner of head (Figs ANTWEB1008117, ANTWEB1008118) 5

5. Gastral tergite I with yellow base (Fig. ANTWEB1008117; Philippines)..... *D. rugosa* Zettel & Bruckner, 2013
 Gastral tergite I entirely dark (Fig. ANTWEB1008118; Philippines) *D. silviae* Zettel & Bruckner, 2013
6. Frontal carinae not continuing to posterior corners of head and not so prominent; antennal scrobes moderately deep (Fig. FOCOL1970; Australia and New Guinea) *D. cataulacoidea* (Stitz, 1911)
 Frontal carinae prominent, continuing to posterior corners of head; scrobes deeper..... 7
7. Boundary unobscured between dorsum of propodeum and declivity. Dorsum of mesosoma with reticulation, interspaces smooth and shining (Fig. CASENT0908982; Singapore)..... *D. fulva* Viehmeyer, 1916
 Boundary conspicuous between dorsum of propodeum and declivity. Dorsum of mesosoma with irregular rugae, appear dull (Fig. ANTWEB1008115; Philippines)..... *D. chapmani* Wheeler, W.M., 1924
8. Mesosoma, petiole, postpetiole and gaster almost unanimously color (Figs CASENT0908983, CASENT0914065, ANTWEB1008116) 9
 Mesosoma, petiole, postpetiole and gaster distinctly bicolor (Figs CASENT0178565, ANTWEB1008027) 14
9. Anterior margin of pronotum with distinct ridge (Sri Lanka) *D. didita* (Walker, 1859)
 Anterior margin of pronotum without ridge. 10
10. Posterior margin of head nearly straight. Petiole relatively shorted, with $DPI \geq 0.60$ (Fig. ANTWEB1008116; Philippines).....
 *D. oswini* Zettel & Bruckner, 2013
 Posterior margin of head with concavity at its middle. Petiole relatively elongated, with $DPI \leq 0.52$ (Fig. CASENT0914065)..... 11
11. Dorsal margin of propodeum in lateral view distinctly lower than pronotum (Figures see Varghese (2006); India).....
 *D. bangalorica* Varghese, 2006
 Dorsal margin of propodeum in lateral view almost at same level with pronotum, or slightly lower than pronotum (Fig. ANTWEB1008030) 12
12. Body brownish black; frontal triangle indistinct (Fig. CASENT0914065; Indo-Australian Region).....
 *D. borneensis* Wheeler, W.M., 1916
 Body red or yellowish brown; frontal triangle distinct (Fig. ANTWEB1008030) 13
13. Head slightly longer than width; clypeus with delicate carinae, with anterior margin feebly emarginated in middle. Petiole much longer, more than twice length of width (Indonesia)..... *D. karnyi* Wheeler, W.M., 1924
 Head wider than length; clypeus with a strong median and two lateral carinae, with anterior margin strongly emarginate in middle. Petiole comparatively short, less than twice length of width (ANTWEB1008030; Malaysia).....
 *D. yamanei* Bharti & Kumar, 2013
14. Mesosoma, petiole and postpetiole black; gaster distinctly reddish brown (Figs 7–9; China) *D. rufida* sp. nov.
 Mesosoma, petiole and postpetiole yellowish to blackish red; gaster brown to black..... 15
15. Gaster paler, with yellow pilosity (Indonesia)..... *D. sebesiana* Wheeler, W.M., 1924
 Gaster brown to black, with whitish pilosity 16
16. Petiole more than 2.5 times length of width; dorsal margin weakly convex (Figs ANTWEB1008026, ANTWEB1008029)..... 17
 Petiole less than 2 times length of width; dorsal margin distinct convex (Figs ANTWEB1008025, ANTWEB1008027)..... 18
17. Clypeus with 5 strong carinae. Body dorsum with subdecumbent hairs (Fig. ANTWEB1008026; China)
 *D. gaoyureni* Bharti & Kumar, 2013
 Clypeus with 3 strong carinae. Body dorsum with stiff erect hairs (Fig. ANTWEB1008029; Vietnam)
 *D. propotriangulata* Bharti & Kumar, 2013
18. Gaster smooth and shiny. Legs smooth, yellowish brown (Fig. CASENT0912885; China and Vietnam)
 *D. fouqueti* Santschi, 1910
 Gaster reticulate and opaque. Legs opaque with fine sculpture, blackish (Figs ANTWEB1008025, ANTWEB1008027) 19
19. Posterior corners of head blunt and not forming a dent. Posterior 1/3 of head dorsum without reticulation (Fig. ANTWEB1008025; Vietnam)..... *D. eguchii* Bharti & Kumar, 2013
 Posterolateral corners of head acute and forming a dent. Posterior 1/3 of head dorsum with reticulation. (Figs ANTWEB1008027 & CASENT0908984)..... 20
20. Head castaneous. Anterior lateral angles of pronotum acute. Dorsum of petiole slightly convex in profile. Petiole with a digitation (Figs ANTWEB1008027 & CASENT0908984; Indonesia)..... *D. selebensis simalurana* Forel, 1915
 Head blackish. Anterior lateral angles of pronotum blunt. Dorsum of petiole arcuate in profile. Petiole with a strong antero-ventral tooth (Fig. ANTWEB1008027; India)..... *D. gasteroreticulata* Bharti & Kumar, 2013

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