



## Revision and redefinition of the crematogastrine ant genus *Tetheamyрма* BOLTON, 1991, with the description of a new species and the first description of the dealate queen (Hymenoptera: Formicidae)

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### Abstract

The crematogastrine ant genus *Tetheamyрма* BOLTON, 1991 is revised, based on morphological analysis of a new species and an independent molecular study. Because of morphological disparity between the genotype species and the new species, the genus is redefined. The worker and queen of *Tetheamyрма bidentata* sp.n. are described. The female reproductive caste of *Tetheamyрма* is described for the first time. A key to the species and a distribution map are provided.

**Key words:** *Tetheamyрма bidentata*, revision, Formicidae, Philippines.

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### Introduction

Specimens of the remarkable ant described were first collected from leaf litter from Samar Island, Philippines, as by-catch of a mite (Acari) survey. The specimens keyed out to *Mayriella* FOREL, 1902 in Bolton's generic guide (BOLTON 1994) but did not look like it. *Mayriella* has deep antennal scrobes and large eyes, which are absent in the unknown ants, but there are some similarities between them and *Mayriella*, namely: a reduced number of antennal segments, with an antennal club formula of 10 : 2; a bidentate anterior clypeal margin; and the absence of spongiform tissue ventrally on the waist nodes.

The senior author had a chance to bring the specimens to the Museum of Comparative Zoology (MCZ) and consult with the experts there, Edward O. Wilson, Gary Alpert, and Stefan Cover, but they could not determine the genus of these ants. High-resolution images were sent to Barry Bolton, who opined that the ants may belong to the genus *Tetheamyрма* BOLTON, 1991. However, there were many morphological differences, particularly the lack of spongiform tissue, which seemed to preclude this classification. BOLTON (1991) defined *Tetheamyрма* as another myrmicine lineage which developed spongiform tissue, independently of *Strumige-*

*nys* F. SMITH, 1860 and *Dacetinops* BROWN & WILSON, 1957.

Without fresh specimens for DNA sequencing, the true generic identification of this ant remained uncertain until recently. In early 2015, the junior author collected fresh conspecific specimens from Luzon Island: one dealate queen from leaf litter on Mt. Natib in Bataan Province and one worker from Mt. Banahaw in Laguna Province. Coincidentally, Michael Branstetter requested the loan of these ants for nondestructive extraction of DNA for a global phylogenomic study of ants and other Hymenoptera.

Using targeted enrichment of ultraconserved elements (UCEs), BRANSTETTER & al. (2017) found strong support that the unknown ants from Luzon Island, originally labeled in their dataset as "GenusPH01\_sp\_EX1093", belonged to the genus *Tetheamyрма* (Fig. 1), also confirming Bolton's preliminary opinion based on morphology.

Meanwhile, we continued to collect fresh specimens from the islands of Samar and Mindanao, providing us with enough material to describe this new species of *Tetheamyрма* and to describe the female reproductive caste of this genus for the first time. The morpho-

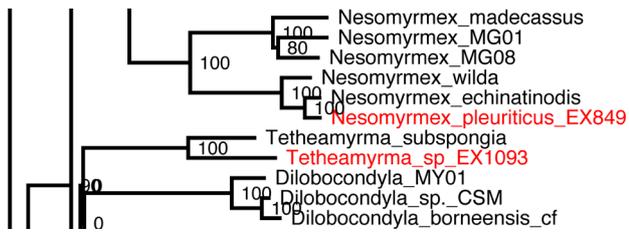


Fig. 1: Portion of phylogenetic tree indicating congeneric relationship of *Tetheamyрма subspongia* BOLTON, 1991 and “*Tetheamyрма\_sp\_EX1093*” from Mt. Banahaw, Laguna Province, Luzon Island, Philippines (BRANSTETTER & al. 2017, supplementary Fig. S2).

logical disparity between the genotype species and the new species compels a revision and redefinition of the genus.

### Methods and abbreviations

Specimens were examined and measured using a Leica S8APO stereomicroscope with ocular micrometer. Images were kindly provided by Michael Branstetter, Jack Longino, and Mac Pierce and by AntWeb.

The following measurements and indices are reported:

CI	Cephalic index: $HW / HL \times 100$ .
EL	Maximum eye length along the maximum diameter.
HL	Maximum head length in full-face (dorsal) view, measured from the anterior-most point of the clypeal margin to the posterior-most point of head capsule.
HW	Maximum head width in full-face (dorsal) view.
ML	Mesosomal length (Weber’s Length) measured from the anterior edge of the pronotum (excluding the collar) to the posterior edge of the propodeal lobe.
PW	Maximum width of pronotum in dorsal view.
SI	Scape index: $SL / HW \times 100$ .
SL	Length of scape, excluding the basal neck and condyle.

Depositories of type material:

ANIC	Australian National Insect Collection, Canberra, Australia.
BMNH	Natural History Museum, London, UK.
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA.
MHNG	Muséum d’Histoire Naturelle, Geneva, Switzerland.
NHMW	Naturhistorisches Museum, Wien, Austria.
PNMNH	Philippine National Museum of Natural History, Manila, Philippines.
UPLB	University of the Philippines Los Baños Museum of Natural History, Los Baños, Laguna, Philippines.

All field collections were conducted under the permits of either the PNMNH or the Philippine Department of Environment and Natural Resources.

### Taxonomy

#### Genus *Tetheamyрма* BOLTON, 1991

**Type species:** *Tetheamyрма subspongia* BOLTON, 1991, by monotypy.

*Tetheamyрма* in Myrmicinae: Stenammini: BOLTON 1994: 106, BOLTON 1995: 403.

*Tetheamyрма* in Myrmicinae: Crematogastrini: WARD & al. 2015: 77.

#### Redescription of worker (changes in genus definition numbered)

Monomorphic ants. Head and mesosoma densely rugoreticulate dorsally, laterally, and ventrally, except for smooth genal bridge. Head pilosity composed of fine hairs of varying lengths and flexibility.

Antennae with 10 - 11 segments, with very large 2-segmented apical club (1). Antennal scape short, just reaching or barely exceeding posterior margin of compound eye. Antennal scrobe absent. Compound eye small, located laterally, just forward of midlength of head. Frontal carina present or absent (2). Frontal lobe wide, completely concealing torulus, wider than median part of clypeus inserted between them. Posterior median clypeus narrowly inserted between frontal lobes. Anterior clypeus medially with a pair of setae straddling midpoint. Median clypeus narrowly bicarinate. Mandible triangular.

In lateral view, palp formula 2,2 (undissected). Mesosoma in profile with smoothly convex dorsal outline. Metanotal groove impressed or obsolete (3). Propodeum with short, acute, triangular spines. Infradental lamella between propodeal spine and metapleural lobe present or absent (4). Propodeal lobe low and rounded. Propodeal spiracle conspicuous, variable in location. Petiole sculptured. Anteroventral petiolar process present. Anteroventral postpetiolar process present or absent (5). Spongiform tissue on venter of petiole, postpetiole, and first gastral sternite present or absent (6). Spine absent from mesotibia and metatibia. Sting simple and functional.

#### Key to the species of *Tetheamyрма* BOLTON, 1991

- 1 Spongiform tissue absent from ventral surfaces of petiole, postpetiole, and first gastral sternite; antenna with 10 segments; frontal carina just reaching level of anterior margin of eye; anteromedian clypeus produced into a bidentate process (Philippines) (Figs. 2a - c, 3a - c) ..... ***bidentata* sp.n.**
- Spongiform tissue present on ventral surfaces of petiole, postpetiole, and first gastral sternite; antenna with 11 segments; frontal carina not reaching level of anterior margin of eye; anteromedian clypeus medially emarginate but not produced into a bidentate process (Malaysia) (Fig. 4a - c) ..... ***subspongia* BOLTON, 1991**



Fig. 2: *Tetheamyрма bidentata* sp.n. Paratype worker. (a) Full-face view; (b) lateral view; (c) dorsal view; (d) labels. Images courtesy of M. Pierce and J.T. Longino.

## Species accounts

### *Tetheamyрма bidentata*

#### GENERAL & BUENAVENTE sp.n.

Figures 2a - c, 3a - c

Holotype worker measurements (mm): CI 100, EL 0.05, HL 0.41, HW 0.41, ML 0.45, PW 0.26, SI 58, SL 0.24.

Paratype worker measurements (n = 17, mm) [mean value and range]: CI 96 (87 - 111), EL 0.05 (0.05 - 0.06), HL 0.46 (0.41 - 0.50), HW 0.44 (0.40 - 0.50), ML 0.51 (0.45 - 0.58), PW 0.30 (0.26 - 0.34), SI 57 (50 - 66), SL 0.25 (0.21 - 0.29).

**Worker:** Monomorphic ants. Head densely rugo-reticulate dorsally, laterally, and ventrally, except for smooth genal bridge. Frontal lobes sculptured. Head pilosity composed of stiff decumbent hairs about as long as distance between them. In full-face view, head widest behind eyes, narrowing slightly anteriorly. Posterior margin of head shallowly emarginated. Antennae with 10 segments, with

very large 2-segmented club. Antennal scape short, just reaching level of posterior margin of eye, smooth except for piligerous punctures, with short decumbent hairs. Antennomeres 3 to 8 much broader than long. Antennal scrobe absent. Compound eye small, composed of about eight ommatidia, located laterally, entirely forward of midlength of head. Frontal carina short, slightly beyond level of anterior margin of eye. Frontal lobes broad, completely concealing torulus, much wider than posterior clypeus inserted between them. Median clypeus narrowly bicarinate, with carinae starting at posterior clypeus and terminating at the apices of bidentate process. Anterior clypeal margin produced into median bidentate process. Mandible triangular, smooth. Mandibular dentition composed of apical and subapical teeth, a short diastema, third tooth (shorter than subapical tooth), and three to four denticles. Basal external margin of mandible smooth.

In lateral view, palp formula 2,2 (undissected). Occipital carina present. Mesosomal outline smoothly con-



Fig. 3: *Tetheamyрма bidentata* sp.n. Paratype dealate queen. (a) Full-face view; (b) lateral view; (c) dorsal view; (d) labels. Images courtesy of M. Pierce and J.T. Longino.

vex. Promesonotal suture absent. Metanotal groove very weakly impressed. Mesosoma densely rugo-reticulate dorsally and laterally. Metapleuron and propodeal declivity smooth. Mesosomal pilosity composed of short, erect hairs on dorsum, except for glabrous propodeal declivity. Propodeal declivity steeply sloped. Propodeum with short, acute, triangular spines. Infradental lamella between propodeal spine and metapleural lobe absent. Metapleural lobe low and rounded. Propodeal spiracle circular, somewhat posteriorly directed. Petiole rugo-reticulate dorsally and laterally. Petiole blocky with short peduncle and straight anterior face. Anterodorsal corners of petiole node produced into acute angles. Anteroventral subpetiolar process present. Anteroventral subpetiolar process finely reticulate. Anteroventral subpostpetiolar process present. Anterior face of postpetiole sharply differentiated from dorsal face. Spongiform tissue absent from petiole, postpetiole, and gaster. Spurs absent from mesotibia and metatibia. Sting simple and functional.

In dorsal view, mesosoma rugo-reticulate, widest at the pronotal humeri with lateral margins converging posteriad. Propodeal spines slightly divergent. Petiole

node transverse, broader than long. Petiole and postpetiole rugo-reticulate. Dorsum of gaster smooth between piliferous scalloped foveae. Foveae diminishing in size posteriorly from anterior third of tergite. Gastral pilosity composed of erect fine hairs slightly longer than distance between them.

In ventral view, genal bridge bounded laterally by a longitudinal carina.

Sculpture: antennal scape smooth to weakly reticulate; head, mesosoma, petiole, and postpetiole dorsally and laterally reticulate, with smooth interstices; mandibles, metapleuron, propodeal declivity smooth; subpetiolar process finely reticulate; gaster smooth between scalloped foveae that bear long, fine setae; foveae diminishing in size posteriorly from anterior third of tergite.

Pilosity: head with short, fine, decumbent, recurved setae arising from interstices of reticulate sculpture; a pair of setae straddle anterior median clypeus; a pair of longer setae extend laterally from lateral margin of head behind eyes; antennal scape with short decumbent hairs; a short, decumbent hair may arise from center of compound eye;

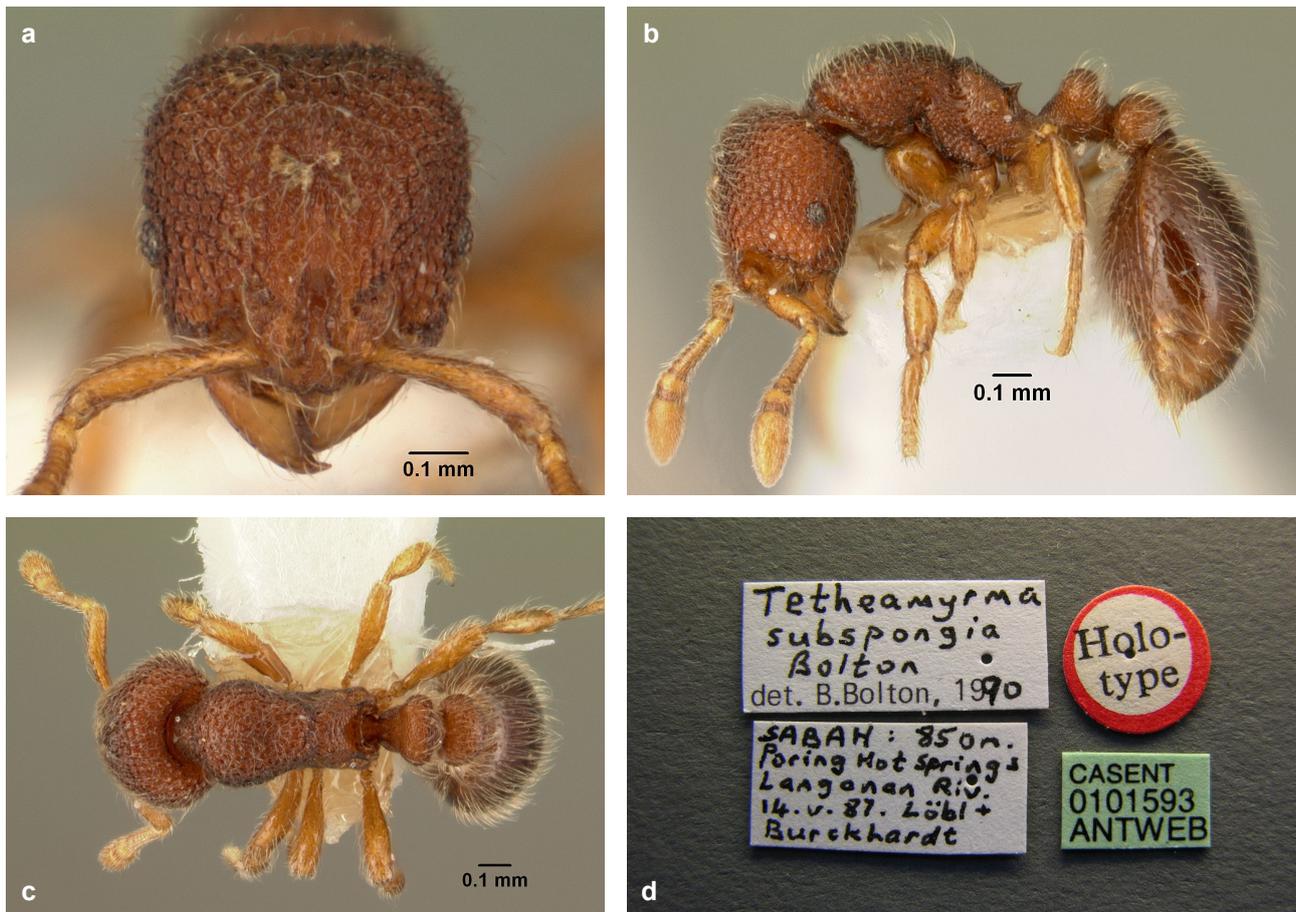


Fig. 4: *Tetheamyрма subspongia* BOLTON, 1991. Holotype worker. (a) Full-face view; (b) lateral view; (c) dorsal view; (d) labels. Images courtesy of AntWeb (unidentified image creator).

mesosoma, except propodeal declivity, with fine, short erect setae; petiole, postpetiole, and gaster with longer fine, erect setae.

Color: dark reddish brown with brown appendages.

**Queen:** Measurements (mm): CI 103, EL 0.11, HL 0.50, HW 0.51, ML 0.66, PpH 0.18, PpL 0.13, PpW 0.18, PSL 0.10, PtH 0.18, PtL 0.21, PtW 0.19, PW 0.43, SI 54, SL 0.28.

Larger than worker in all dimensions. In full-face view, head similar to worker except for the presence of ocelli and larger compound eyes. Compound eye with about 50 ommatidia. In lateral view, anterior outline of pronotum precipitous. Dorsal margin of mesosoma moderately flat. Wing scars present. Epimeral sclerite absent. Deep, sinuous suture between posterior margin of pronotum and anterior margin of mesopleuron. Mesopleuron divided by broad, transversely carinate, sulcus. Metanotum dorsally flat, triangular. Propodeal declivity very steep. Propodeal spines triangular. Propodeal spiracle below midlength on sclerite. In dorsal view, mesosoma areolate. Promesonotal suture and metanotal groove impressed. Sculpture, pilosity and color as in worker.

Material examined: HOLOTYPE: worker, PHILIPPINES: Samar Island, Western Samar, Municipality of Paranas, Barangay San Isidro, Mukalog Creek, N11°52'01.4", E 125° 12' 47.2", 174 meters above sea level (m a.s.l.),

12. - 15.III.2016, leg. P.A.C. Buenavente, (collection code PACB128), PNM13637. PARATYPES: 1 worker, same data as holotype, (collection code PACB157), PNM13627; 4 workers, same data as holotype, (collection code PACB131), PNM13628 through PNM13631; 6 workers, same data as holotype, (collection code PACB152), PNM13632 through 13636, and PNM13638; Luzon Island, 1 dealate queen, Bataan, Municipality of Samal, Barangay Palili, Sitio Bakyas, site "B", N14° 43' 08.3", E 120° 23' 46.4", 836 m a.s.l., 02.II.2015, leg. P.A.C. Buenavente and J. Baroga, (collection code PACB19), PNM10769; 1 worker, Laguna, Mt. Banahaw, Municipality of Majayjay, Barangay Bukal, Sitio Pitonggabi, N 14° 05' 57.3", E 121° 28' 50.2", 793 m a.s.l., 24.III.2015, leg. P.A.C. Buenavente, (collection code PACB102), CASENT0633220, ADMAC DNA voucher, PNM13643; Mindanao Island, 1 worker, Davao Oriental, Municipality of San Isidro, Mt. Hamiguitan, Barangay La Union, Sitio Tumaguite, N06° 43' 36.6", E 126° 10' 58.8", 1300 m a.s.l., 04. - 06.VII.2016, (D.E.M. General, P.A.C. Buenavente) (collection code PACB165), PNM13642; 1 worker and 1 dealate queen, Davao Oriental, Municipality of San Isidro, Mt. Hamiguitan, Barangay La Union, Sitio Tumaguite, N06° 43' 59.4", E 126° 09' 58.1", 989 m a.s.l., 04. - 06.VII.2016, leg. D.E.M. General and P.A.C. Buenavente, (collection code PACB169), PNM13641 and

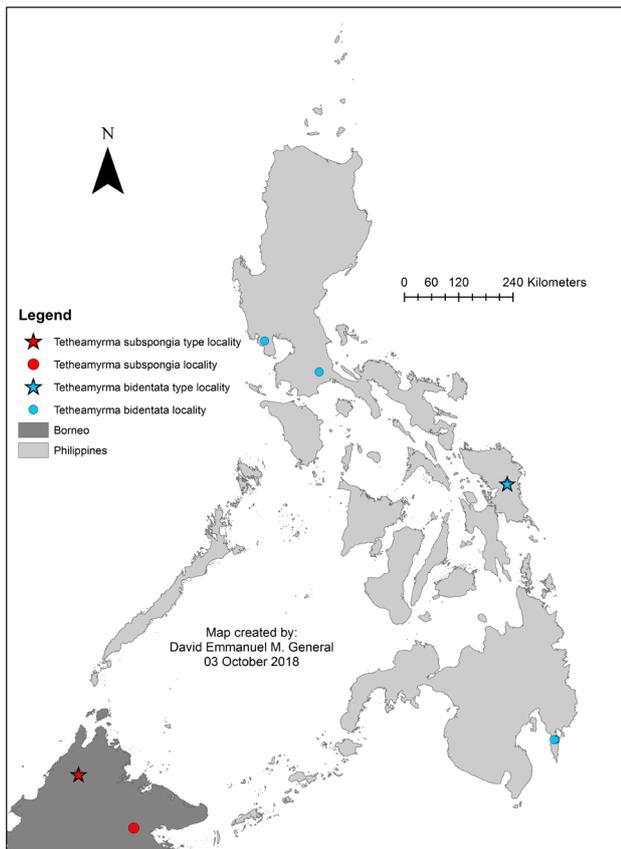


Fig. 5: Distribution map of the species of *Tetheamyрма* BOLTON, 1991. Blue star = type locality of *Tetheamyрма bidentata* sp.n. Blue circles = other known localities for *T. bidentata* sp.n. Red star = type locality of *Tetheamyрма subspongia* BOLTON, 1991. Red circle = other known locality of *T. subspongia*.

(collection code PACB170), PNM13644; 2 workers, Davao Oriental, Municipality of San Isidro, Mt. Hamiguitan, Barangay La Union, Sitio Tumaguite, N 06° 44' 05.1", E 126° 08' 34.1", 396 m a.s.l., 16. - 17.VII.2016, leg. P.A.C. Buenavente, (collection code PACB182), PNM13639 and PNM13640. All specimens are deposited in NMNH, with accession numbers that start with "PNM".

**Bionomics:** This species was collected in elevations ranging from about 170 to 1300 m a.s.l. It was collected from leaf litter in good secondary and primary forest.

**Etymology:** The specific epithet refers to the bidentate anterior clypeal margin of this species.

### ***Tetheamyрма subspongia* BOLTON, 1991**

Figure 4a - c

*Tetheamyрма subspongia* BOLTON, 1991: 10; worker described; MALAYSIA (Sabah) [Holotype not seen].

Measurements (mm; from original description of holotype): CI 92, EL 0.08, HL 0.55, HW 0.51, ML 0.66, PW 0.36, SI 63, SL 0.32.

**Worker:** Monomorphic ants. In full-face view, head widest behind compound eyes. Posterior margin of head shallowly emarginate. Lateral head margin slightly converging anteriorly. Antennae with 11 segments, with very

large 2-segmented apical club. Antennal scape short, just exceeding posterior margin of compound eye. Antennal scape shallowly reticulate, with short decumbent hairs. Antennomeres 3 - 9 much broader than long. Antennal scrobe absent. Compound eye small, composed of about 10 ommatidia, located laterally, just forward of midlength of head. Frontal carina short, barely reaching anterior margin of eye. Frontal lobes wide, completely concealing torulus, wider than median clypeus inserted between them. Median clypeus narrowly inserted between frontal lobes. Median clypeus narrowly bicarinate. Anterior clypeus medially with a pair of setae straddling midpoint. Anterior clypeal margin medially emarginate. Mandible triangular, mostly smooth. Mandibular dentition composed of six teeth without a diastema. Basal external margin of mandible smooth. Head densely rugo-reticulate dorsally, laterally, and ventrally, except for smooth genal bridge. Frontal lobes sculptured. Head pilosity composed of fine flexuous hairs of varying lengths.

In lateral view, palp formula 2,2. Occipital carina present. Mesosomal outline smoothly convex. Metanotal groove impressed. Mesosoma densely rugo-reticulate dorsally and laterally. Metapleuron and propodeal declivity rugo-reticulate. Mesosomal pilosity composed of erect hairs on dorsum of various lengths, except for glabrous propodeal declivity. Propodeum with short, acute, triangular spines. Infradental lamella between propodeal spine and metapleural lobe present. Metapleural lobe low and rounded. Propodeal spiracle conspicuous, more than one propodeal spiracle diameter from base of propodeal spine. Petiole microreticulate, nodiform. Anterodorsal corners of petiole node rounded. Anteroventral petiolar process present. Postpetiole microreticulate. Anterior face of postpetiole rounded smoothly into dorsal face. Anteroventral postpetiolar process absent. Spongiform tissue present on venter of petiole, postpetiole, and first gastral sternite. Sting simple and functional. Spine absent from mesotibia and metatibia.

Petiole node transverse, broader than long. Petiole and postpetiole microreticulate. Dorsum of gaster smooth between piliferous punctures. Gastral pilosity composed of dense flexuous hairs.

Non-type material [not examined]: 1 worker, MALAYSIA: Borneo Island, Sabah, Danum Valley, West Trail, N 4.9656°, E 117.79937° ± 50 m, 220 m a.s.l., 20.VIII.2010, leg. P.S. Ward, ex. Winkler extraction of leaf litter (collection code PSW16443-83) CASENTO106305 (<https://www.antweb.org/specimen.do?name=casent0106305>).

### **Discussion**

This genus appears to be restricted to forests in good condition on Borneo and in the Philippines (Fig. 5). The genus is variable, with two species that are quite different from each other. The key provides just a few salient differences between the type species, *Tetheamyрма subspongia*, and *T. bidentata* sp.n. The most important morphological feature of *T. subspongia*, the spongiform tissue on the venter of the petiole, postpetiole and first gastral segment, is

absent from *T. bidentata*. It is possible that this absence represents a secondary loss of spongiform tissue in *T. bidentata*.

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### References

- ANTWEB. 2018: AntWeb. – <<https://www.antweb.org>>, retrieved on 16 July 2018.
- BOLTON, B. 1991: New myrmicine ant genera from the Oriental Region (Hymenoptera: Formicidae). – *Systematic Entomology* 16: 1-13.
- BOLTON, B. 1994: Identification guide to the ant genera of the world. – Harvard University Press, Cambridge, MA, 222 pp.
- BOLTON, B. 1995: A new general catalogue of the ants of the world. – Harvard University Press, Cambridge, MA, 504 pp.
- BRANSTETTER, M.G., LONGINO, J.T., WARD, P.S. & FAIRCLOTH, B.C. 2017: Enriching the ant tree of life: enhanced UCE bait set for genome-scale phylogenetics of ants and other Hymenoptera. – *Methods in Ecology and Evolution* 8: 768-776.
- WARD, P.S., BRADY, S.G., FISHER, B.L. & SCHULTZ, T.R. 2015: The evolution of myrmicine ants: phylogeny and biogeography of a hyperdiverse ant clade (Hymenoptera: Formicidae). – *Systematic Entomology* 40: 61-81.