

Ants of the genus *Lordomyrma* Emery (2) The Japanese *L. azumai* (Santschi) and six new species from India, Viet Nam and the Philippines (Hymenoptera: Formicidae: Myrmicinae)

ROBERT W. TAYLOR

Research School of Biological Sciences, Australian National University, Canberra, ACT, 2600, Australia.
Honorary Research Fellow, CSIRO Ecosystem Sciences, Canberra, ACT, 2601, Australia.
E-mail: robert.taylor@anu.edu.au

Abstract

Lordomyrma is recorded for the first time from India and mainland southeast Asia. The Japanese *L. azumai* is reviewed and six new worker-based species described: *L. lakshmi* (Kerala State, India); *L. hmong* (Lao Cai Province, Vietnam); *L. diwata*, *L. emarginata* and *L. idianale* (Mt Isarog, Luzon, Philippines) and *L. limatula* (Leyte, Philippines). Gynes are characterized for *L. azumai*, *L. hmong* and *L. limatula*. All taxa are diagnosed, illustrated, and their affinities discussed.

Key words: Ants, Formicidae, *Lordomyrma*, *Stenamma*, *Lasiomyrma*, taxonomy, new species, biogeography, Japan, Honshu, Shikoku, Kyushu, India, Kerala, Viet Nam, Lao Cai, Philippines, Luzon, Leyte, Mt Isarog

Introduction

This is the second paper (following Taylor, 2009) of a project seeking to review and name the many known undescribed morphospecies reasonably considered taxonomically congeneric with the somewhat aberrant ant *Lordomyrma furcifera* Emery (type-species of *Lordomyrma* Emery 1897) and its more conservative putative relative *L. azumai* (Santschi). The latter is arguably the least morphologically derived known *Lordomyrma* species (Taylor, 2009) and its characteristics may thus be very generally considered archetypal for the genus. In this analysis *L. azumai* provides key morphotaxonomic focus and *L. furcifera* nomenclatural reference. Importantly, authors following Yasumatsu (1950) and Brown (1952) have universally considered *azumai* to be congeneric with *furcifera* - that is accepted here as a given. *L. furcifera* was illustrated by Taylor (2009, figs 7, 8) and *L. azumai* is depicted below (Figs 1–8).

L. azumai is reviewed here; the first *Lordomyrma* species known from India and Viet Nam are described, and four species from the Philippines, two of which were previously genetically studied and discussed by Lucky & Sarnat (2010), are formally named (see abstract for list). Workers of all species and gynes of *L. azumai*, *L. hmong* sp. n. and *L. limatula* sp. n. are illustrated with extended-focus color macrophotographs. The *Lordomyrma* world species list is raised from 25 to 33, a tally which provisionally includes the taxa *bhutanense* (Baroni Urbani), and *sinense* (Ma, Xu, Makio & DuBois), which were transferred from *Stenamma* to *Lordomyrma* by Branstetter (2009). They are considered here to be *species inquirendae*, most conveniently assigned to *Lordomyrma* pending resolution of their true affinities (see below).

The record of an unidentified *Lordomyrma* species from Taiwan by Lin & Wu (2003) was not confirmed in Terayama's comprehensive monograph on the ants of Taiwan (2009).

Taylor (2009) indicated that the then-known Asian *Lordomyrma* morphospecies were basically similar in general conformation¹, with relatively low structural disparity (compared to some other faunas, notably those of

1. "Conformation" refers here to the general form and arrangement of the body tagmata appendages and limbs, including major processes like denticles, spines or crests, but not "superimposed" sculpturation, pilosity or color. Thus, *L. azumai* (Figs 1–4), *L. diwata* sp. n. (Figs 17–20) and *L. limatula* (Figs 29–32) have similar conformation despite their substantial differences in sculpture, pilosity and color, while *L. furcifera* (Taylor, 2009: figs 7,8) is very differently conformed.

New Guinea and New Caledonia). This proposition is broadly supported by the species described here (which were not known at the time of earlier discussion). *L. emarginata* **sp. n.** is conformationally less-generally *azumai*-like than the other Philippines taxa (or indeed most other known Asian species). Its presence in sympatric association with two other species on Mt Isarog, Luzon, implies that the Philippines archipelago might have been a center for evolutionary proliferation in *Lordomyrma*, and that there could be numbers of undescribed Philippines species awaiting initial collection and taxonomic processing.

Lucky & Sarnat (2010) genetically analyzed the Asian taxa *L. azumai*, *L. reticulata* Lucky & Sarnat (Sabah) and two Philippines species designated “*L. PH01*” and “*L. PH02*”. These were found to occupy a clade within a “*Lordomyrma sensu stricto*” phylad. Other investigated species (represented by samples from New Guinea, Fiji, Australia and New Caledonia) (Lucky & Sarnat, 2010 fig.1) constituted a monophyletic sister clade within *Lordomyrma s. str.*

The Lucky & Sarnat Philippines voucher specimens are deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts (G. D. Alpert *pers com*). *L. PH01* is illustrated (as *L. Pi01*) on the Antweb website¹. It is the species described here as *L. idianale* **sp. n.** and the *L. PH02* voucher is a specimen of *L. diwata* (*testé* Eli Sarnat).

The taxa analyzed by Lucky & Sarnat included a New Guinean morphospecies closely similar to *L. furcifera* (the voucher specimen illustrated on the Antweb site as “*Lordomyrma PG01*”). This taxon may reasonably be considered a proxy for the *Lordomyrma* nomenclatural type-species in phylogenetic analyses.

Note that the distributions broadly mapped by Lucky & Sarnat (2010, fig. 1) well exceed the known geographical records for *Lordomyrma* in Japan and the Philippines.

Descriptions of further new *Lordomyrma* species from peninsular Malaysia, Singapore, Borneo and the Indonesian archipelago are currently in preparation for part 3 of this series, which will review more generally the intraspecific morphological diversity observed among Asian and other taxa, and consider the process of taxonomically defining this exceptionally diverse yet apparently cohesive genus. A comprehensive key to all known Asian species will be included there.

Putative *Lordomyrma* species discussed by Branstetter (2009)

Two Asian species originally described in genus *Stenamma* Westwood were assigned to *Lordomyrma* by Branstetter (2009): (1) *Stenamma bhutanense* Baroni Urbani (1977) from Bhutan, and (2) *Stenamma sinense* Ma, Xu, Makio & DuBois (2007) from Shanxi Province, North China. Branstetter also recognized and illustrated voucher specimens of two additional similar morphospecies designated as (3) “*Lordomyrma* cf. *bhutanensis* 1” from Nepal (MCZC collection) and (4) “*Lordomyrma* cf. *bhutanensis* 2” from Yunnan Province, southern China (CASC collection)(see his figs 25–33, which also depict the *S. bhutanense* holotype).

These taxa in my opinion seem unlikely to be congeneric with *Lordomyrma furcifera* on morphological grounds, compromising their assignment to *Lordomyrma* however closely they might be related in Branstetter’s phylogeny (see also the more immediately relevant phylogeny of Lucky & Sarnat (2010) fig 3). They differ from the *Lordomyrma azumai* conformational paradigm as follows: (1) the absence of antennal scrobes and foveae, and (2) differences in clypeal structure, notably the presence of an anteromedian angle. Also, the conformation of the mesosoma and waist nodes is quite unlike that of any known morphospecies at present plausibly referable to *Lordomyrma*.

Some species or groups of species presently assigned to *Lordomyrma* lack antennal scrobes and foveae (see illustrations in Taylor, 2009). The several examples are widely separated geographically and conformationally dissimilar. Their similarities in this detail may be attributed in part to multiple homoplasy involving repeated secondary loss of the antennal foveae within the *Lordomyrma* clade. Antennal scrobes and foveae are synapomorphically present in most *Lordomyrma* species, including all of those known from mainland or archipelagic S.E. Asia.

A median clypeal point or denticle is present also in the New Guinea Highlands endemic nominal genus *Ancyridris* Wheeler, which has been previously discussed as a possible junior synonym of *Lordomyrma* (see

1. See <http://www.antweb.org/description.do?name=lordomyrma&rank=genus&project=allantwebants>

Taylor, 2010), and also (uniquely in known nominal *Lordomyrma* species) in *L. epinotalis* Mann (Ysabel, Solomon Islands), a species also illustrated in the Antweb gallery.

“*Ancyridris* cf. *polyrhachioides*” Wheeler (of Lucky & Sarnat, with voucher specimen illustrated on Antweb) and *L. epinotalis*, along with the Australian *Lordomyrma* AU02 of the Antweb gallery and the problematical taxa discussed by Branstetter, are excluded from the phyletic “triangle” which includes all species of “*Lordomyrma* sensu stricto” represented in Lucky & Sarnat fig 3, so they might in fact not be components of the ultimate *Lordomyrma* phylad, or taxonomically referable to *Lordomyrma*, though they are shown to be derived from common ancestral stock. All of them, incidentally, lack antennal foveae.

Eguchi *et. al* (2011: 16-18) suggest that the problematic species discussed by Branstetter are more likely congeneric with those of genus *Lasiomyrma* Terayama & Yamane (2000), which has three named species, respectively from Java, Sabah and Thailand (Jaitrong, 2010). This hypothesis should be further explored, as should the possible status of *Lasiomyrma* versus *Lordomyrma* versus *Ancyridris*. The status of *Lordomyrma epinotalis*, in particular, and its possible affinity with the named *Lasiomyrma* species needs to be critically assessed. That species and the Australian *Lordomyrma* AU02 of the Antweb gallery appear morphologically to be more closely related to the described *Lasiomyrma* species than to others assigned to *Lordomyrma* sensu stricto, as do several other similar undescribed Australian and Melanesian species represented in the ANIC. Apropos, on the basis of sting morphology, Kugler (1994) found *L. epinotalis* “very different from the other *Lordomyrma* species I have examined”, in a context where “With the exception of *L. epinotalis*, all of the *Lordomyrma* species examined (*L. caledonica* (André), *L. levifrons* (Mann), *L. punctiventris* Wheeler, *L. rouxi* (Emery), *L. striatella* (Mann) and *L. tortuosa* (Mann)) have several distinctive characters within the myrmicines” (Kugler, 1997, species list inserted). Placement in *Stenamma* of the taxa discussed by Branstetter seems genuinely inappropriate, as he indicated. That noted, they seem best provisionally accommodated as “*species inquirendae*” in either *Lordomyrma* or *Lasiomyrma*, mainly because convention requires discussion of such taxa in binomial combination. The *Lordomyrma* alternative is accepted here.

Procedural matters

Reference collections

ANIC—Australian National Insect Collection, Canberra, Australia; BMNH—The Natural History Museum, London, U. K; CASC—California Academy of Sciences, San Francisco, Ca, U.S.A.; DMGC—David M. General Collection, Manilla, Philippines; HSZC—Herbert and Salvacion V. Zettel collection, Vienna, Austria; IEBR—Entomological Collection of the Institute of Ecology and Biological Resources, Hanoi, Vietnam; LACM—Los Angeles County Museum of Natural History, Los Angeles, Ca, USA.; MCZC—Museum of Comparative Zoology, Harvard University, Cambridge, Ma, USA; PNMM—Philippine National Museum, Manila, Philippines; NHMW—Naturhistorisches Museum, Vienna, Austria; UCDC - University of California, Davis, Davis, Ca, USA; UPLB—Museum of Natural History, University of the Philippines at Los Baños, Laguna, Philippines; USCP—Entomological Collection, University of San Carlos, Cebu City, Philippines.

Taxonomic descriptions

The use of expressions like “as in the *L. azumai* description above” indicates specifically that the *wording* of the description referred to would be appropriate for inclusion in the description being read. Alternate species, each conforming to the words used, need not necessarily be “identical” in detail when compared. The same applies to other terms of comparison e.g. “like”, “as in”. The term “vestigial” is used advisedly where described structure (usually sculpturation) is considered rightly to be vestigially derived from a former condition.

Measurements and indices

All measurements are in mm., acquired using a digital micrometer attached to a stereomicroscope stage designed to move specimens across an eyepiece hairline: TL = aggregate total length (aggregate of: head and mandibles + mesosoma (or mesosoma and waist nodes) + gaster (or mesosoma + waist nodes and gaster) measured in lateral view; HW = maximum head width, frontal view (across the eyes if protrusive, otherwise at widest point behind the eyes); HL = head length *at midline*, frontal view; CI = cephalic index (HW x 100/HL); EL = maximum dimension

of eye in perpendicular view; OI = ocular index ($OL \times 100/HW$); SL = maximum chord length of scape excluding the articular condyle; SI = scape index ($SL \times 100/HW$); PW = maximum width of pronotum, dorsal view (including humeral tubercles when protrusive); SW = scutum width, width of scutum in square dorsal view; WL = mesosomal length (Weber's length) lateral view—see figure 10 for parameters); DPW = maximum width of petiole, dorsal view; DPpW = maximum width of postpetiole, dorsal view; GW = maximum width of gaster, dorsal view. Measurements details are given under each species for the holotype and/or the smallest and largest specimens in the series reviewed (ranked initially by surveying HW).

A new metric, The *Angle of Promesonotal Elevation* (APE) is introduced below.

In the workers of some “stocky” myrmicine ants the mesosoma is relatively short and compact, with the promesonotum inflated and elevated, so that in lateral view a straight line approximating the posterodorsal mesosomal profile (extending from the highest point of elevation of the promesonotum across the dorsal profile of the propodeum) encloses a relatively large angle when opposed to a similar line drawn across the aligned lateroventral margins of the mes- and metepisternites, crossing the coxal insertions. This conformation is well evidenced in many species of *Calyptomyrmex* Emery (see illustrations in Shattuck, 2011). The equivalent angle is usually much more acute in myrmicine workers with less-inflated mesosomas, and in some the defining lines are almost parallel. These angles are indicated on Figs 2 and 26 and discussed below under the *L. emarginata* heading. They are generally less-confidently quantified than dimensional measurements and should be reported as estimates, but when they differ to the degree illustrated in Figs 2 and 26 they have diagnostic value.

Geographical coordinates

Few subject specimen labels include geographical coordinates. Most cited here were acquired from standard published or on-line gazetteers. They refer to the place name immediately preceding their entries; not to the exact collection locality.

Illustrations

The standard illustration set comprises (1) Head, frontal view; (2) body, lateral view, to depict mesosoma and waist nodes; (3) body, dorsal view; (4) gaster, dorsal view. Scale is indicated in the captions by the measurements for HW, WL, PW (or SW for gynes) and GW. The apparatus for preparation of such illustrations is discussed in Taylor (2009:16).

Discussion of individual species

Lordomyrma azumai (Santschi)

(Figs 1–8)

Rogeria (*Rogeria*) *azumai* Santschi, 1941: 3, fig. 3, worker; *Minoo*, Osaka, JAPAN

= *Lordomyrma nobilis* Yasumatsu, 1950: 75, fig. 2, worker, male; *Mt Hikosan*, Kyushu, JAPAN (Synonymy: Brown, 1952: 124).

Lordomyrma azumai (Santschi), Brown, 1952: 124.

When describing the junior synonym *L. nobilis*, Yasumatsu (1950) perceptively recognised the congeneric relationship between this species and *L. furcifera*.

Distribution: The only *Lordomyrma* species known from JAPAN: *Eastern Honshu* (Chiba, Ibaraki and Tochi prefectures), *Southern Honshu* (south from Hyogo and Mie prefectures), *Shikoku* and *Kyushu*. A distribution map, with English-language keys and a synopsis of characters distinguishing *L. azumai* from other Japanese ants, is given by Imai *et al* (2003), complimenting the parallel, expanded Japanese edition of the same work in the Gakken Super Visual Encyclopedia series, and the Compact Disc and website versions issued by the Japanese Image Database Group.

L. azumai is considered “rather rare” (Imai *et al*, 2003). Masuko & Kannari (1980) reported biological observations, mainly from Mt. Kiyosumi, Chiba Prefecture, and noted details from previous Japanese-language papers by authors including Azuma and Yasumatsu. The ants were found patchily distributed in moist soil horizons with fresh to well-decomposed organic content under natural broadleaf forest. Nests were located under a stone, in

a crack in a stone, in a damp twig or a fallen nut. Four reported colonies collected during February were monogynous, larvae were present in good numbers, pupae were not reported. Alate gynes and males were present in mid-February nests, and a possible colony-founding dealate gyne was taken alone in leaf-litter in late March. Worker nest compliments ranged up to 86. When disturbed workers feign death by rolling-up their bodies and enclosing their antennae within the antennal scrobes.

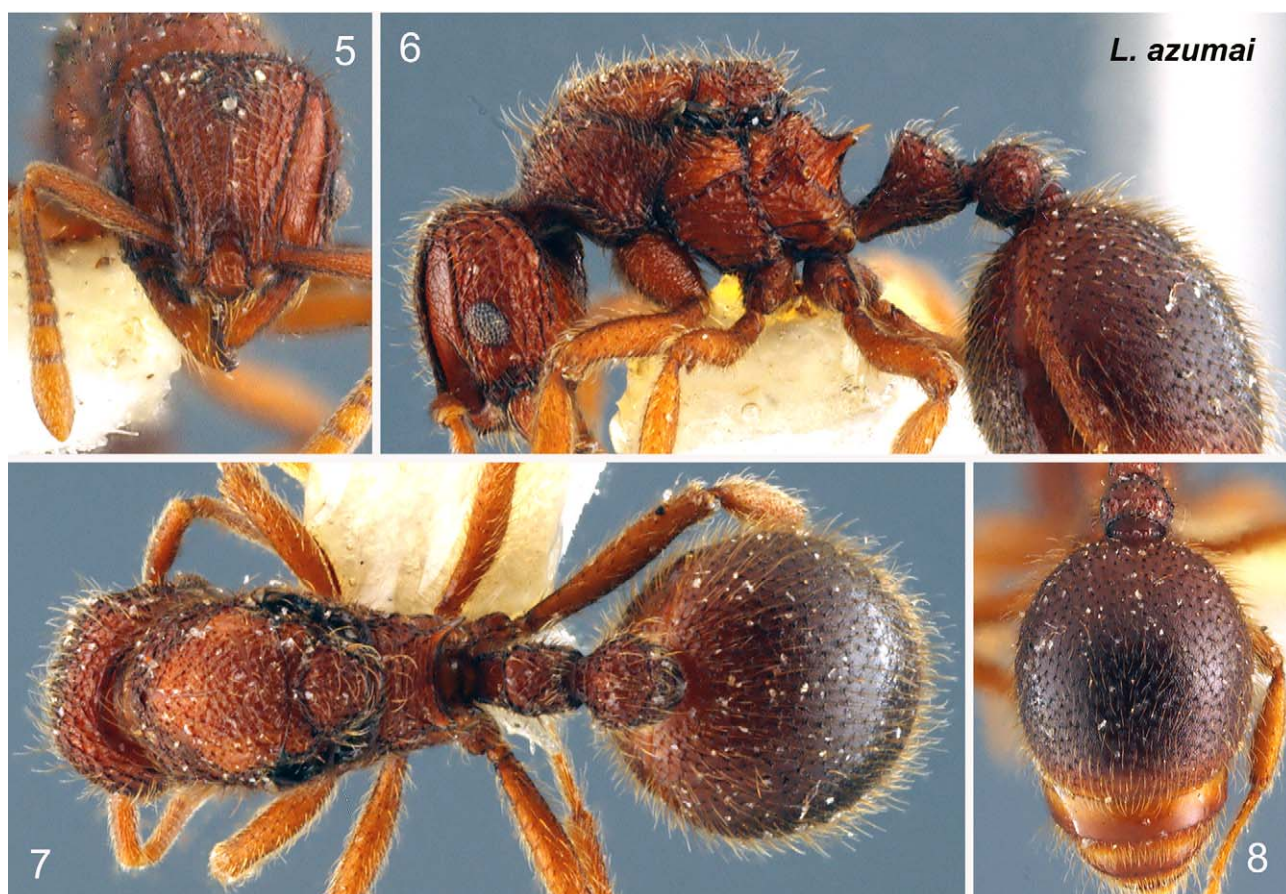


FIGURES 1–4. *Lordomyrma azumai*, worker (Mt Takakuma, Kyushu), HW 0.79mm, PW 0.61mm, WL 1.17mm, GW 1.19mm.

. *Material examined:* **JAPAN: HONSHU** - CHIBA: *Mt Kigosumi*, 3 workers (K. Masuko, 18 Feb 1978). Gifu: *9km E of Gero*, worker (I. Löbl, 31.7.1980, 450-550m.). - WAKAYAMA: *Kitayama-kyoo, Tado* (K. Azuma, 31.v.1951, 400m). HYOGO: *Aiyima near Kobe* (M. Azuma, 27. iv. 47; worker with labels reading “paratype” and “*Rogeria (Rogeria) azumai* Santschi 1941)(MCZC). **KYUSHU**- FUKUOKA: *Hikosan (Buzen)* worker with red MCZC paratype label, no 28740, and blue handwritten paratype label in *nobilis* = *azumai* unit tray (K. Yasumatsu, 6. viii 1940)(MCZC). - KAGOSHIMA: *Oosumi Peninsula, “Oonogara-dake” mountain trail, Mt Takakuma*, 31° 30’N, 130° 49’E, samples from 3 colony series (K. Eguchi, 9. viii. 2007: Eg09viii07-04 (3612 ft); Eg09viii07-06 (rotting wood fragment, 3612 ft); Eg09viii07-11 (3320 ft). - NAGASAKI: *Hirado I, Mt Yasumari*, 5 workers, male (H. Sakai, 10 Aug 1981, nest under stone). All ANIC unless indicated otherwise, donated by the collectors.

Worker: General features, conformation and color as illustrated. Antennal funiculus clavate but without delineation of a distinct segmentally defined club; the 3 apical segments progressively longer than those preceding them. Palpal formula maxillary 4; labial 3 (2 specimens dissected). When viewed from behind (perpendicular to the vertex) the top of the head rounds evenly on each side to join the sides. Promesonotum only slightly elevated in lateral view (APE relatively acute: *ca.* 25 °). Pronotal shoulders with small humeral nodules at either side of the raised section behind the nuchal collar, otherwise broadly rounded. Metanotal groove distinct in lateral view, lacking

a clearly incised suture, slightly depressed below propodeal summit, rising steeply to pronotal dorsum which is barely domed in profile. Petiole triangular in lateral-view with a short, weak transverse dorsal crest. Mandibles somewhat irregularly longitudinally striate. Clypeus smooth, shining. Frons and occiput longitudinally striate-rugose, the striae more-or-less reticulate at the sides, more straight medially, interstices filled with polished fine puncturation. Sides of head below and behind eyes rugose. Head ventrally smooth and shining. Microsculpture of antennal foveae minutely punctate-rugose, without directional orientation (much like the interstitial microsculpture of frons). Scapes and femora subopaque, densely minutely punctate. Anterior coxae microsculptured much like antennal foveae. Occipital collar finely granulose-reticulate. Dorsum and sides of mesosoma generally rugose like sides of head; propodeum less coarsely rugose, with transverse trend on dorsum, several short ribs spanning metanotal groove, a few transverse striae between bases of propodeal spines and on propodeal declivity. Petiole and postpetiole more finely rugose than sides of propodeum. Gaster dorsally and ventrally moderately shining, with arrayed minute point-punctures. These may be generally distributed, but in some specimens they are largely concentrated in rings or somewhat stellate clusters around the bases of the hairs of the moderately dense pilosity, and in more-or-less clearly defined narrow diagonal lines crossing at the hair-bases. In maximum expression this arrangement is seen under high magnification as an indistinct cross-hatch of narrow punctate lines enclosing shining diamond-shaped sections of smoother cuticle, with a hair-base and a cluster of surrounding punctae at each intersection. That pattern is more-or-less vestigial in some specimens. The smooth areas generally reflect vestiges of micropuncturation. Pilosity dense, as illustrated, the hairs curved, tapering, flexuous, whitish in color. Color generally medium reddish-brown, the gaster usually slightly darker than elsewhere, legs slightly lighter. Dimensions: TL 4.2–4.7 HW 0.79, 0.82; HL 0.82, 0.87; CI 96, 94; EL 0.14, 0.14; OI 18, 17; SL 0.62, 0.66; SI 78, 80; PW 0.61, 0.64; WL 1.17, -; DPW 0.21, 0.24; DPpW 0.26, 0.31; GW 1.08, 1.00.



FIGURES 5–8. *Lordomyrma azumai*, gyne (Takakuma Mts, Kyushu), HW 0.89mm, PW 0.70mm, WL 1.32mm, GW 1.19mm.

Gyne: Generally as illustrated. Basically similar to worker except for the presence of ocelli, relatively large eyes and the usual mesosomal and gastral attributes distinguishing gynes. The above characterization of worker sculpturation and pilosity applies. Ventral propodeal spine as in worker. Palpal formula not known. Wing venation

unavailable here. Dimensions: TL 4.9; HW 0.89; HL 0.92; CI 97; EL 0.18; OI 20; SL 0.62; SI 69; PW 0.70; SW 0.70; WL 1.32; DPW 0.27; DPpW 0.36; GW 1.19. Described from 2 dealate worker-associated specimens (1 measured): Takakuma Mts, Kagoshima (K. Eguchi accs Eg09viii07-04, Eg09viii07-11) (ANIC).

Diagnosis: Characterized by its simple general conformation, with relatively basic, unelaborated sculpturation and pilosity. I consider *L. azumai* to be the most structurally conservative known Asian *Lordomyrma* species - the taxon perhaps least divergent from the stock ancestral to all *Lordomyrma* species. This view is supported by the fact that the geographically peripheral *Lordomyrma* faunas of Australia and Fiji include species of similar conformation (Taylor, 2009).

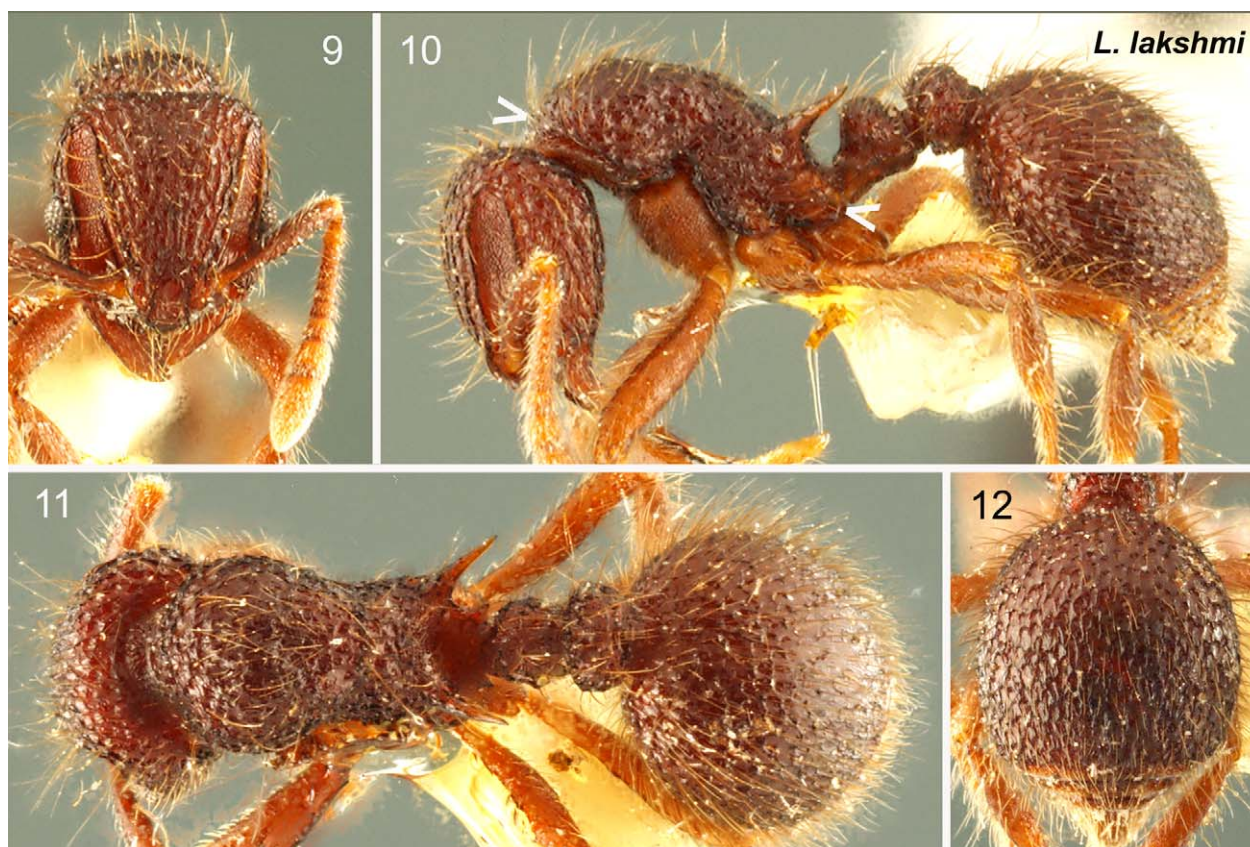
***Lordomyrma lakshmi* sp. n.**

(Figs 9–12)

Type locality: **INDIA:** KERALA: *Silent Valley Reserve, 16km W of Makkali* (Coordinates for Makkali: 11°26'N, 77°41'E.).

Type deposition: Holotype: MCZC. 2 Paratypes (Palghat Hills): ANIC. Remaining paratypes MCZC.

Material examined: **INDIA:** KERALA: *Cardamon H(ills). Valara Falls, 46km SW Munnar* (Besuchet, Löbl, Mussard #49, 450+m, 20 xi 1972) 4 paratype workers. *Palghat (= Palakkad) Hills, 10km N Malampuzha Dam* (Besuchet, Löbl, Mussard #54, 150m, 20 xi 1972) 3 paratype workers. *Silent Valley Reserve, 16km W of Makkali* (A.B. Soans & W.L. Brown, 9 April 1969) Holotype worker. Coordinates for *Malampuzha Dam*: 10°50'N, 76°41'E. Silent Valley Reserve is now designated “The Indira Gandhi National Park”. It may be reasonably assumed that these specimens were collected in rain forest.



FIGURES 9–12. *Lordomyrma lakshmi*, holotype worker, HW 0.82 mm, PW 0.62 mm, WL 1.06 mm, GW 1.00 mm.

Worker: General features and color as illustrated. Conformation of head, petiole, postpetiole and gaster as in *L. azumai*, the petiole a little more bulky. Mesosomal profile lacking a metanotal indentation; the promesonotal section more-or-less evenly arched, with a slight, very obtuse angle at the junction with the essentially straight posterodorsal propodeal profile—that angle marks a very faintly raised transverse posterior border to the

promesonotum, which is barely more pronounced than the adjacent sculptural elements and lacks an accompanying incised suture. Pronotal humeri broadly rounded in dorsal view, lacking nodules equivalent to those of *L. azumai*. Propodeal spines longer than in *L. azumai*, slightly curved posteriad in lateral view and very acute; straight in dorsal view and divergent - the degree of divergence variable, from almost parallel to enclosing an angle of ca. 80 degrees. Antennal club of 3 segments very weakly differentiated. Scapes moderately shining, somewhat roughly micropunctate. Mandibles smooth, shining, with a few scattered small punctures and faint vestiges of longitudinal striation. Clypeus moderately shining, generally smooth. Frons moderately coarsely longitudinally striate-rugose, the striae diverging from the midline laterally to parallel the antennal scrobes. Sides of head sculptured like frons. Head ventrally smooth and shining. Antennal foveae densely, finely shagreened, with no trace of longitudinal elements. Occipital collar shining medially with a very finely shagreened margin. Mesosomal dorsum with rugosity like frons, but lacking longitudinal elements. Sides of mesosoma similar to promesonotal dorsum, the rugosity slightly stronger and more shining. Sculpture of propodeal dorsum like promesonotum. Declivity generally smooth, shining, dorsal section shagreened like anterior coxae. Petiole and postpetiole sculptured similarly to propodeal dorsum. Gaster somewhat irregularly punctate rugose; the punctural elements extended longitudinally, the narrow ridges separating them forming an obscure reticulum, posterior section of first tergite and exposed sections of those behind with dense, minute point-punctuation. First gastral sternite sculptured similarly to its tergite but less-strongly so. Anterior coxae subopaque, more finely shagreened than antennal foveae. Second and third coxae moderately shining, with traces of effaced shagreening. Legs otherwise very finely, irregularly shagreened. Pilosity as described for *L. azumai*. Color overall dull medium-dark reddish-brown; antennae and legs lighter orange-brown. Dimensions (Holotype, smallest paratype, largest paratype): TL 3.6, 3.5, 3.9; HW 0.82, 0.83, 0.92; HL 0.83, 0.84, 0.95; CI 99, 99, 97; EL 0.15, 0.15, 0.16; OI 18, 18, 17; SL 0.57, 0.59, 0.62; SI 69, 71, 67; PW 0.62, 0.61, 0.70; WL 1.06, 1.04, 1.13; DPW 0.25, 0.24, 0.30; DPpW 0.32, 0.30, 0.38; GW 1.00, 0.90, 1.04.

Etymology: Named for the Hindu goddess Lakshmi, the embodiment of beauty, grace and charm.

***Lordomyrma hmong* sp. n.**

(Figs 13–20)

Type locality: **VIETNAM**: LAO CAI: *Ban Khoang, Sa Pa*. (22°21' 0 N, 103°52' 0 E)

Type deposition: Holotype, paratype gyne: IEBR. Paratype worker: ANIC.

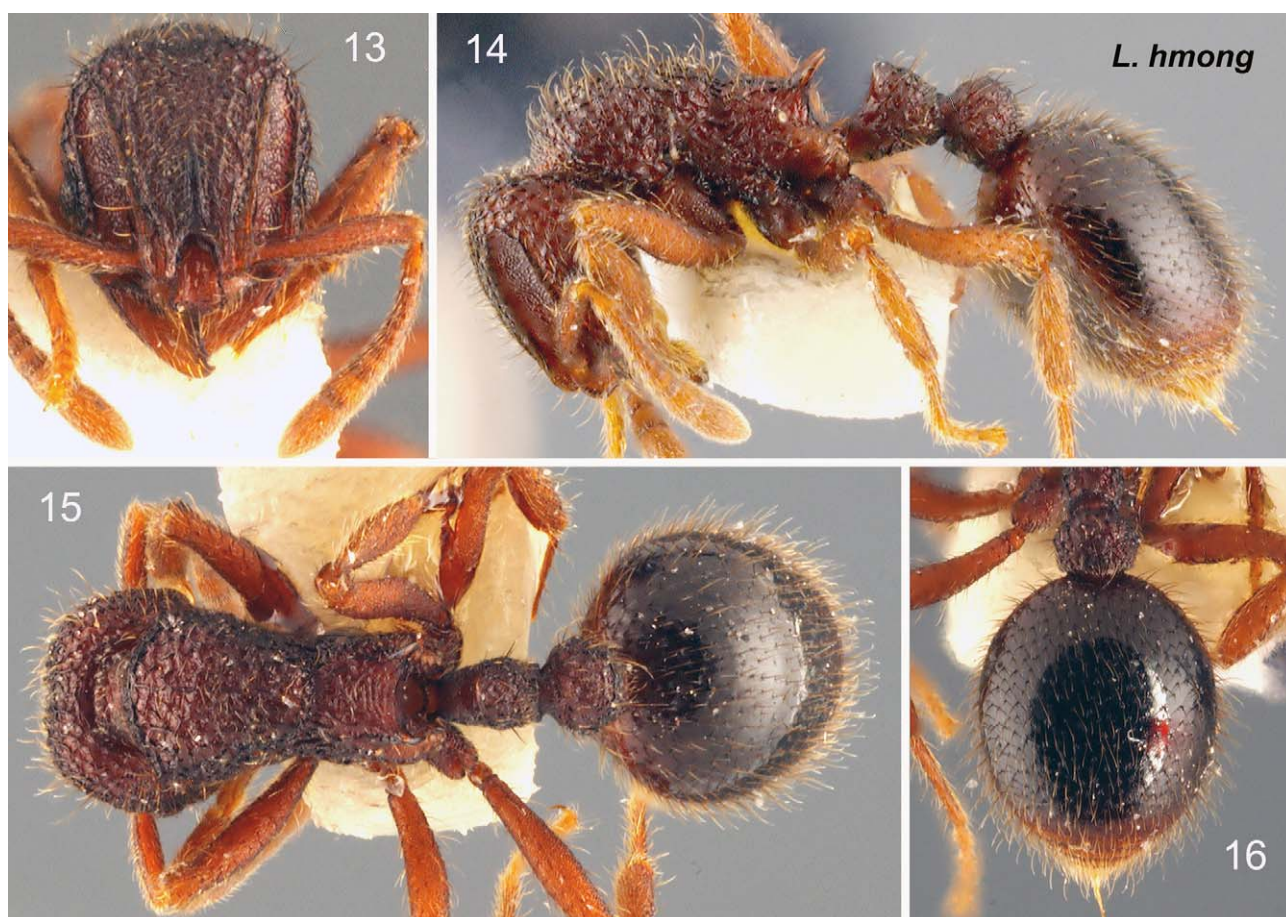
Distribution, material examined. Known only from the holotype, a single paratype worker and paratype dealate gyne, collected together at the type locality in the Hoang Lien Son mountains in far northern Vietnam (K. Eguchi Acc Eg07x06-09, 07/x/2006, 1600- 1700m.).

Worker: General features as illustrated. Conformationally very similar to *L. azumai*. The sculpturation and pre-gastral pilosity essentially as described for that species. Pronotal humeral nodules equivalent to those of *L. azumai* present. Gaster with pilosity as in *L. azumai*; smooth and strongly reflective, with minute very finely incised micro-striate stellae at the base of each hair. These structures become slightly larger and more dense posteriad. Color more-or-less uniformly dark reddish-brown, the gaster more blackish-brown than elsewhere; legs and antennae, lighter, brighter orange-brown. Dimensions: (holotype, paratype): TL 4.2, 4.4; HW 0.86, 0.87; HL 0.91, 0.93; CI 94, 94; EL 0.19, 0.18; OI 22, 21; SL 0.62, 0.63; SI 72, 72; PW 0.65, 0.63; WL 1.22, 1.21; DPW 0.28, 0.27; DPpW 0.36, 0.37; GW 1.02, 1.04.

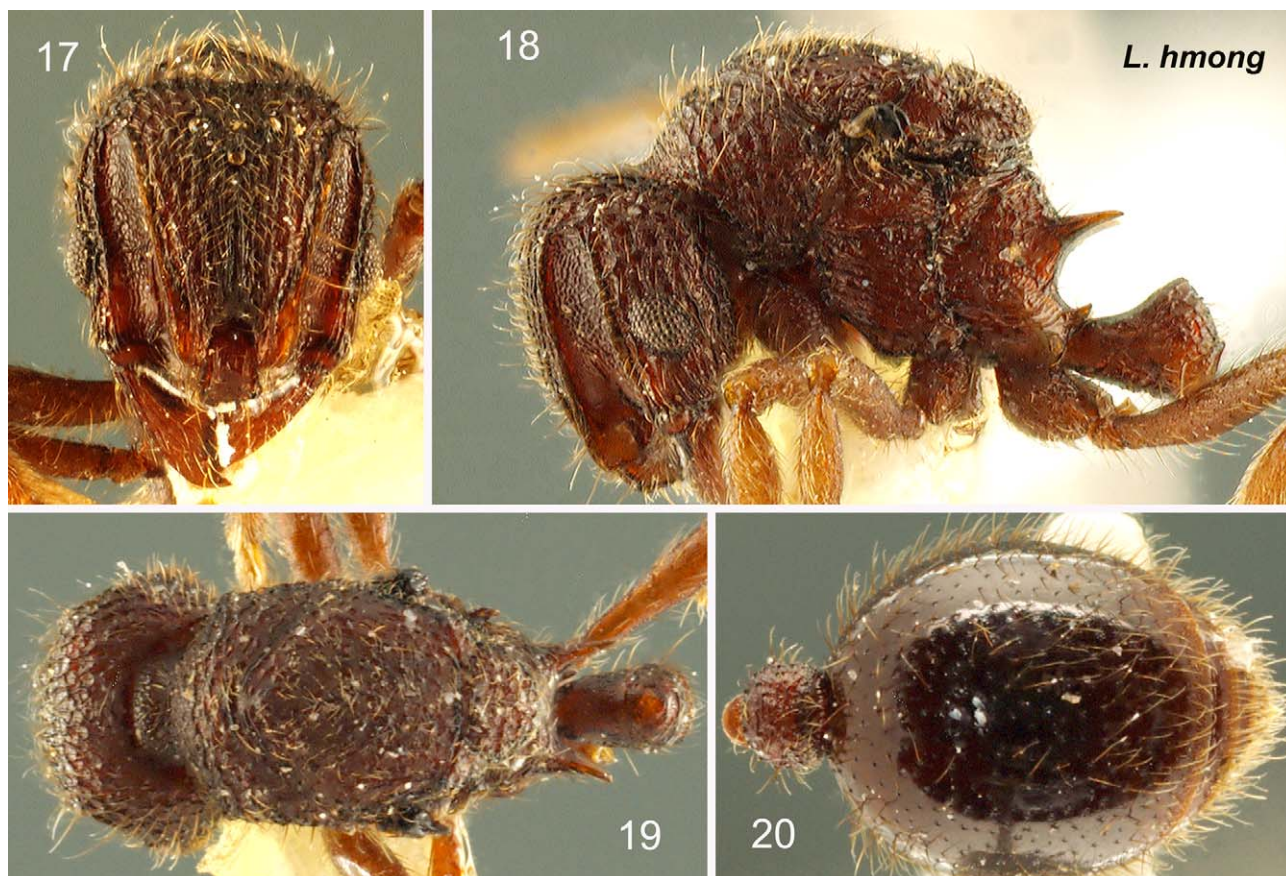
Gyne: Generally as illustrated. Differing from the worker similarly to *L. azumai*. Eyes proportionately larger than in that species (OI 25 versus 20). Dimensions: TL 4.6; HW 0.84; HL 0.89; CI 94; EL 0.21; OI 25; SL - ; SI - ; PW 0.68; SW 0.69; WL 1.29; DPW 0.25; DPpW 0.36; GW 1.11.

Diagnosis: *L. hmong* is distinguished from the Japanese *L. azumai* by its darker, more uniform coloration, less-intensively sculptured gastral dorsum and proportionately large eyes in the gyne (see Figs). These taxa are doubtless closely related. They could represent geographical variants of a single species, and this should be considered when future collections from intermediate Chinese localities are assessed. Approximately 2,800 km separate the *hmong* type locality from extreme southern Japan.

Etymology: Named for the Hmong people of northern Vietnam.



FIGURES 13–16. *Lordomyrma hmong*, holotype worker, HW 0.86 mm, PW 0.65 mm, WL 1.22 mm, GW 1.02 mm.



FIGURES 17–20. *Lordomyrma hmong*, paratype gyne, HW 0.84 mm, PW 0.68 mm, WL 1.29 mm, GW 1.11 mm.

***Lordomyrma diwata* sp. n.**

(Figs 21–24)

Type locality: **PHILIPPINES:** LUZON: *Mt Isarog National Park, Panicuason Village, Camarines Sur* (13°39' 28.5"N, 123°20' 11.2"E)

Distribution; Material examined: Known from the holotype and 8 paratype workers collected at the type locality (J. Caceres, 23 or 24-x-2006, ex leaf litter).

Type deposition: Holotype, 2 paratypes: UPLB. Single paratypes in ANIC, BMNH, DMGC, LACM, MCZC, PNM.



FIGURES 21–24. *Lordomyrma diwata*, holotype worker, HW 0.74 mm, PW 0.54 mm, WL 0.96 mm, GW 0.73 mm.

This is the taxon designated *Lordomyrma* PH02 by Lucky & Sarnat (2010).

Worker: General features as illustrated. Conformation similar to *L. azumai* (Figs 1–4); vertexal margin broadly rounded in frontal view. Mesosoma proportionately short, its promesonotal profile more elevated and more evenly arched than in *azumai*. Promesonotal shoulders in dorsal view more evenly rounded, lacking nodules equivalent to those of *L. azumai*. Antennal scapes as in *L. azumai*. A generally shining species with sculpturation relatively reduced and reflective. Mandibles and clypeus smooth and shining, the former with a few scattered piligerous point-punctures. Frons anteromedially and behind smooth and strongly shining, with a band of vestigial longitudinal striate-rugosity on each side to beyond the level of the eyes. Sides of head coarsely punctate-rugose. Head ventrally smooth and shining. Antennal foveae generally smooth, strongly reflective, with very faint vestiges of fine shagreening near the antennal insertions. Occipital collar smooth behind, anterior section weakly shagreened. Promesonotal dorsum smooth, highly reflective with a few scattered piligerous punctae, more dense

laterally. Propodeal dorsum moderately rugose, the declivity smooth and shining, without transverse striae between the spines. Sides of mesosoma behind pronotum moderately coarsely rugose but shining. Petiole anterodorsally smooth and shining, elsewhere punctate-rugose. Postpetiole similarly punctate-rugose. Gaster dorsally smooth and shining with scattered small piligerous point-punctures and a band of minute microreticulation behind; ventrally shining, with somewhat effaced dense moderate puncturation. Antennal funiculi densely, minutely punctate. Anterior coxae smooth, strongly reflective; middle and hind coxae with trace transverse striae; legs otherwise smooth with a few scattered punctae and traces of shagreening at the femoral bases. Pilosity as illustrated. Color generally dark mahogany-brown, the antennae and legs lighter brown. Dimensions: (Holotype, smallest paratype, largest paratype): TL 3.2, 2.8, 3.4; HW 0.74, 0.70, 0.75; HL 0.77, 0.72, 0.78; CI 96, 97, 96; EL 0.15, 0.15, 0.16; OI 20, 21, 21; SL 0.51, 0.49, 0.53; SI 69, 70, 71; PW 0.54, 0.50, 0.0.57; WL 0.96, 0.94, 1.02; DPW 0.20, 0.20, 0.22; DPpW 0.25, 0.24, 0.26; GW 0.73, 0.72, 0.75.

Diagnosis: The generally smooth sculpturation readily distinguishes *L. diwata* from other known Philippines and Asian *Lordomyrma* species.

Sympatric associations: Sympatric on Mt Isarog with *L. emarginata* and *L. idianale*.

Etymology: Diwata are mythical forest nymphs in Philippines folklore.

***Lordomyrma emarginata* sp. n.**

(Figs 25–28)

Type locality: **PHILIPPINES:** LUZON: *Mt Isarog National Park, Panicuason Village, Camarines Sur* (13°39'28.5"N, 123°20'11.2"E)

Material examined: Known from the holotype (J. Caceres, 24-x-2006, ex leaf litter) and a single paratype, both workers, collected separately at the type-locality (J. Caceres, 23-ix-2006).



FIGURES 25–28. *Lordomyrma emarginata*, holotype worker, HW 1.24 mm, PW 0.89 mm, WL 1.58 mm, GW 1.39 mm.

Type deposition: Holotype: UPLB. Paratype: MCZC.

Worker: A relatively distinctive species, as illustrated. Clypeus, antennae and head shape generally as in *L. azumai*. Antennal funiculus clavate but without delineation of a distinct segmentally defined club. Head relatively broad behind eyes (HW there almost as great as HW across eyes); vertexal margin in facial view shallowly but clearly concave. When viewed from behind (perpendicular to the vertex) the top and sides of the head merge bilaterally to form a tightly rounded angle of ca. 90°. Mesosoma compact, relatively short (WL:HL ratio = 1.27 versus 1.35 in *L. azumai*); Promesonotum inflated and strongly elevated (APE approximating 45-50° versus ca. 25° in *L. azumai* - compare Figs. 2, 22); humeri squared in dorsal view, but lacking nodules equivalent to those of *L. azumai*. Metanotal groove relatively weakly indented in lateral view, lacking an incised suture. Propodeal dorsum sloping strongly posteriad, outline in profile feebly concave; propodeal spines small, acute, squarely erect. Petiolar summit narrowly, sharply acutely transverse, the apex weakly emarginate in frontal view; minutely, obtusely bilaterally denticulate. Pre-gastral body surfaces almost entirely coarsely and more-or-less uniformly rugose, as illustrated, the rugal surfaces smooth and strongly reflective. Head ventrally smooth. Nucal collar finely roughly punctate. Propodeal declivity transversely striate. Gaster subopaque, generally shagreened with overlying fine net-like reticulum, strongest anteriorly. Mandibles finely longitudinally striate. Antennal scapes vaguely, very finely longitudinally striate-punctate. Anterior coxae coarsely, regularly transversely striate; middle and hind coxae with a few similar striae on their upper surfaces; legs otherwise sculptured like scapes. Pilosity as illustrated. Color generally dark, blackish-brown, the gaster more reddish. Antennae and legs lighter orange-brown. Dimensions: (holotype; paratype): TL 5.3, 5.2; HW 1.24, 1.20; HL 1.25, 1.22; CI 99, 98; EL 0.21, 0.21; OI 17, 18; SL 0.87, 0.85; SI 70, 71; PW 0.89, 0.88; WL 1.58, 1.58; DPW 0.42, 0.39; DPpW 0.046, 0.45; GW 1.39, 1.32.

Sympatric associations: Sympatric on Mt Isarog with *L. diwata* and *L. idianale*.

Etymology: Named for the emarginate transverse petiolar dorsum.

***Lordomyrma idianale* sp. n.**

(Figs 29–32)

Type locality: **PHILIPPINES:** LUZON: CAMARINES SUR: *Mt Isarog National Park, Panicuason Village*, (13°39'28.5"N, 123°20'11.2"E).

Type deposition: Holotype: UPLB. Single Camarines Sur paratypes: ANIC, BMNH, DMGC; LACM, MCZC, UCD. Mt Makiling and National Botanic Gardens paratypes: MCZC, ANIC.

Distribution, material examined: Known only from southern Luzon, as follows. **PHILIPPINES:** LUZON: CAMARINES SUR: *Mt Isarog National Park, Panicuason Village*, (13°39'28.5"N, 123°20'11.2"E) holotype and 5 paratype workers (Jan Caceres, 24-x-2006, ex leaf litter); same data, dated 23-ix-06, 3 paratype workers; same data but also citing Naga City, paratype worker (R.D. Serillano, 09-viii-03); same data but also citing Naga City, paratype worker (D. General, G. Alpert et al, 13°40'11"N, 123°19'47"E, Nara Plantation, understory leaf litter). LAGUNA: *Mt Makiling* (14°08'N, 121°12'E?) 6 paratype workers (B.A. Morse, Feb 1968, rainforest berlesate, near summit). *Philippine National Botanic Garden, 28 km South of Real* (14°12'N, 12°09'E) 4 paratype workers collected together (B.B. Lowery, 4 ix. 1978, between volcanic rocks, rainforest, 300m).

This is the taxon designated *Lordomyrma* PH01 by Lucky & Sarnat (2010).

Worker: General features as illustrated. Conformation of head, mesosoma, waist nodes and gaster similar to *L. azumai*. The head a little less expanded behind the eyes in frontal view; vertexal margin weakly convex; humeral nodules equivalent to those of *L. azumai* lacking; promesonotum barely raised above propodeal dorsum in profile; propodeal spines acute, relatively small, proportionately about half as long as in *L. azumai*. Antennal club obscurely 3-jointed. Metanotal groove with several raised transverse ribs. Pre-gastral body surfaces almost entirely reticulate-rugose, the interspaces smooth and shining, as illustrated. Incorporated traces of longitudinal striae between the antennal scrobes. Clypeus shining. Antennal foveae very finely densely punctate. Head ventrally smooth and shining. Propodeal declivity more-or-less smooth, shining, with traces of effaced transverse striae. Gaster smooth, shining, with minutely sculptured stellae at the hair bases; the surface overlain with a minutely incised microreticulum posteriorly. Exposed terminal gastral tergites similarly sculptured. Anterior coxae smooth, shining, with very faint traces of fine, transverse sculpturing. Remaining coxae and legs shining, with relatively weak traces of puncturation. Pilosity as illustrated. Color dark mahogany, the antennae and legs more lightly

reddish-brown. Palpal formula Maxillary 3: Labial 2 (National Botanic Gardens specimen dissected). Dimensions (Holotype which is the largest specimen, smallest paratype (Panicuason Village): TL 3.5, 3.2; HW 0.76, 0.69; HL 0.79, 0.74; CI 96, 93; EL 0.16, 0.15; OI 21, 22; SL 0.55, 0.49; SI 71, 71; PW 0.57, 0.52; WL 1.02, 0.96; DPW 0.24, 0.21; DPpW 0.26, 0.25; GW 0.79, 0.74.

Diagnosis. Readily distinguished by its intense sculpturation, *L. idianale* is smaller than the similarly sculptured *L. emarginata*, and more closely conforms to the *azumai* configuration.

Etymology: Named for Idianale, the ancient Luzonese Tagalog goddess of living things.

Sympatric associations: Sympatric on Mt Isarog with *L. diwata* and *L. emarginata*.



FIGURES 29–32. *Lordomyrma idianale*, holotype worker, HW 0.76 mm, PW 0.57 mm, WL 1.02 mm, GW 0.79 mm.

***Lordomyrma limatula* sp. n.**

(Figs 33–40)

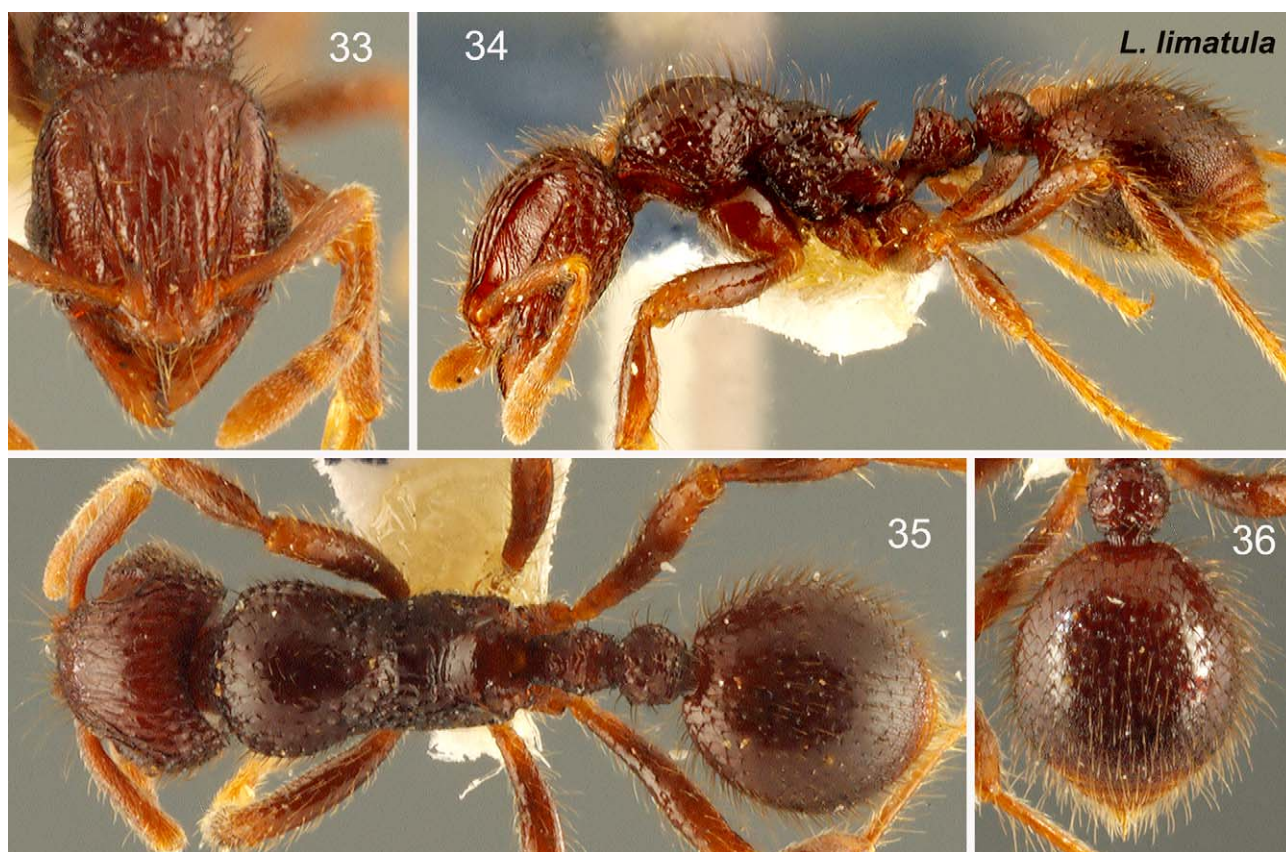
Type locality: **PHILIPPINES:** LEYTE: *Lago-lago River, Leyte State University, Baybay* (Coordinates for Baybay City are: 10°40'N, 124°49'E)

Material examined: Known only from the type series, comprising the holotype, 13 worker paratypes, and 11 paratype gynes. **PHILIPPINES:** LEYTE: *Lago-lago River, Leyte State University, Baybay* (H. Zettel & C. Pangantihon, 19. 3. 2005).

Type deposition: Holotype, paratype gyne: UPLB. Paratypes: ANIC: 2 workers, 2 gynes; NHMW: 2 workers, gyne; USCP: worker, gyne. Remaining paratypes HSZC.

Worker: General features as illustrated. Conformation similar to *L. azumai*. Vertexal margin weakly convex in frontal view; humeral nodules lacking; the mesosomal dorsal profile in lateral view almost straight: promesonotum

barely raised above propodeal dorsum, metanotal groove relatively weakly depressed; propodeal spines proportionally a little shorter than in *L. azumai*. In side view the promesonotum rises sharply from the relatively narrow nuchal collar. Mandibles smooth and shining, with a few very small piligerous punctures. Clypeus smooth and shining. Frons with scattered incomplete, slightly sinuous fine longitudinal costulae, the intervening surfaces largely smooth and shining, minutely weakly rippled in reflected light. Sides of head more densely sculptured, moderately rugose. Antennal scrobes shining, with quite strongly effaced traces of fine puncturation. Promesonotum smooth, shining dorsally, with moderately fine traces of effaced punctate-rugosity laterally and posteriorly, extending to dorsum and sides of propodeum. Nuchal collar shining, almost without sculpturation. Propodeal declivity smooth, shining. Petiole and postpetiole somewhat obscurely transversely sculptured. Gastral dorsum smooth, shining, with relatively small, somewhat obscure stellae at the hair-bases, minutely microreticulate posteriorly. Anterior coxae brightly reflective with no trace of sculpturation; very weak traces of transverse striae on second and third coxae; legs otherwise smooth, shining, with minute piligerous punctures. Pilosity as illustrated. Color uniformly rich Siena-brown, antennae and legs a shade lighter. Dimensions: (Holotype, smallest paratype, largest paratype): TL 3.4, 3.0, 3.4; HW 0.76, 0.73, 0.78; HL 0.81, 0.79, 0.82; CI 94, 92, 95; EL 0.17, 0.15, 0.17; OI 22, 20, 22; SL 0.59, 0.56, 0.58; SI 78, 76, 74; PW 0.58, 0.56, 0.58; WL 1.03, 1.00, 1.04; DPW 0.21, 0.21, 0.22; DPpW 0.29, 0.27, 0.29; GW 0.74, 0.73, 0.81.



FIGURES 33–36. *Lordomyrma limatula*, holotype worker, HW 0.76 mm, PW 0.58 mm, WL 1.03 mm, GW 0.74 mm.

Gyne: General features as illustrated. Dimensions (smallest paratype, largest paratype): TL 3.9, 4.0; HW 0.84, 0.86; HL 0.85, 0.86; CI 99, 100; EL 0.23, 0.23; OI 27, 27; SL 0.57, 0.58; SI 68, 67; PW 0.61, 0.63; SW 0.70, 0.69; WL 1.19, 1.22; DPW 0.24, 0.24; DPpW 0.30, 0.31; GW 0.93, 0.92.

Diagnosis. Readily distinguished from other species discussed here by the relatively reduced sculpturation, which differs clearly from that of the somewhat similar *L. diwata*.

Etymology: The name refers to the polished promesonotum of this species.



FIGURES 37-40. *Lordomyrma limatula*, paratype gyne, HW 0.84 mm, PW 0.61 mm, WL 1.19 mm, GW 0.93 mm.

Acknowledgements

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APPENDIX. Lest history be forgotten

Keizo Yasumatsu (1908–1993) and William L. Brown Jr (1922–1997) contributed important papers referred to above. In the Chinese Theater of World War 2 they served respectively in the Japanese Army and United States Air Force. After the war, when preparing a co-authored paper on *Camponotus herculeanus* (Yasumatsu & Brown, 1951), they discovered that while in China both had collected ants at the same locality on the same date, both armed and alert for possible confrontation with enemy personnel (Bill & Doris Brown, *pers com*, 1962). Myrmecology fortunately survived the occasion!