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RESEARCH ARTICLE

Two new species of the ant genus *Myrmecina* (Hymenoptera: Formicidae: Myrmicinae) from Sumatra

Два новых вида муравьев рода *Myrmecina* (Formicidae: Myrmicinae) с Суматры

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Abstract. Two new species of the ant genus *Myrmecina* Curtis, 1829 are described and illustrated based on the worker and queen castes collected in Sumatra, Indonesia under the names *M. andalas* **sp. nov.** and *M. nitidiuscula* **sp. nov.** Each species displays unique morphological characteristics. *Myrmecina andalas* **sp. nov.** is characterized by a combination of the following characteristics: head dorsally sculptured, with the ventrolateral area smooth and shiny; propodeal spine short, triangular, pointing dorsad and with a broad base; propodeal declivity vertical, with the posterodorsal angle almost 90°. *Myrmecina nitidiuscula* **sp. nov.** is characterized by a combination of the following characteristics: head dorsum largely smooth and shiny; propodeal spine triangular and pointing posteriad, with a very broad base. Updated key to *Myrmecina* species of Sumatra is given.

Резюме. Два новых вида муравьев рода *Myrmecina* Curtis, 1829 (*M. andalas* **sp. nov.** и *M. nitidiuscula* **sp. nov.**) описаны по королеве и рабочим особям, собранным на Суматре (Индонезия). Каждый из видов обладает уникальными морфологическими признаками. *Myrmecina andalas* **sp. nov.** характеризуется комбинацией следующих признаков: голова сверху скульптирована, с гладкими и блестящими затылочными углами; шип проподеума короткий, треугольный, заостренный кверху и с широким основанием; покатая поверхность проподеума вертикальная, с постеродорсальным углом около 90°. *Myrmecina nitidiuscula* **sp. nov.** характеризуется комбинацией следующих признаков: дорсальная поверхность головы в значительной части гладкая и блестящая; шип проподеума треугольный и заостренный кзади, с очень широким основанием. Дан модифицированный ключ суматранских видов рода *Myrmecina*.

Key words: ants, taxonomy, Sumatra, Hymenoptera, Formicidae, Myrmicinae, *Myrmecina*, new species

Ключевые слова: муравьи, таксономия, Суматра, Hymenoptera, Formicidae, Myrmicinae, *Myrmecina*, новые виды

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Introduction

The ant genus *Myrmecina* Curtis, 1829 is currently assigned to the tribe Crematogastrini Forel, 1893 of the subfamily Myrmicinae Lepeletier de Saint-Fargeau, 1835 (Ward et al., 2015; Bolton, 2018). This genus is easily distinguished from the other myrmicine genera by the presence of a longitudinal ridge on each ventrolateral side of the head, and a rounded and barrel-shaped petiole that lacks an anterior peduncle. This genus contains 54 valid species (Bolton, 2018; AntWiki,

2018) and is distributed throughout the world except for Central and South Americas, Sub-Saharan Africa, and the Middle East (Antmaps, 2018).

The *Myrmecina* ants are generally uncommon. Foraging workers are usually collected from leaf-litter, and colonies are small-sized (consisting of 30 to 150 adults) and found under stones or from decayed wood (Buschinger & Schreiber, 2002). Some species are known for their specialized predation on oribatid mites (Masuko, 1994) or close association with peculiar mites (Aoki et al., 1994; Ito & Takaku, 1994; Ito & Aoki, 2003), but the information on the biology of most species is still scanty [for the mechanism of gyne type differentiation in the European *M. graminicola* (Latreille, 1802) see Seifert, 2018]. Despite difficulty in finding *Myrmecina* ants, however, local faunas of the genus are relatively well-studied in the Neartic region (Smith, 1948; Snelling, 1965; Brown, 1967; Deyrup, 2015), Australia (Shattuck, 2009), China and Taiwan (Huang et al., 2008; Zhou et al., 2008), and Japan (Terayama, 1996), but for Sundaland areas records are still very scattered (Emery, 1887; 1900; Forel, 1905; 1913; Wheeler, 1924; Wong & Guenard, 2016). The ant fauna of Sumatra has been poorly studied even for large-sized ants such as the genus *Odontomachus* Latreille, 1804 (Satria et al., 2015), and this is particularly true for small and rare ants like *Myrmecina*.

Since Emery (1900) described a species of *Myrmecina* from Sumatra so far only the following four species have been known from this island: *M. bandarensis* Forel, 1913; *M. butteli* Forel, 1913; *M. nesaea* Wheeler, 1924 (described based on the queen); and *M. undulata* Emery, 1900. Wong & Guénard (2016) described a species from Singapore, and updated the key to the Sundaland species. During our long-term project to study the Sumatran ants, we recognized more than ten species in this genus, of which two were confirmed to be new species based on our careful examination of their morphology. Therefore, the two species are herein described based on the worker and queen castes.

Materials and methods

Type materials and images examined. Images of the type material of the following species provided in AntWeb (2018) were examined to confirm our species recognition: *M. bandarensis*, worker (CASENT0908953, FoCol1945, FoCol1946, FoCol1947); *M. butteli*, worker (FoCol1943).

Abbreviations of the specimen depositories. Most of the specimens were collected by us under international collaborations with researchers working at universities and research institutions in Asian countries. Abbreviations of specimen depositories are as follows: MZB, Bogor Zoological Museum, Bogor, Indonesia; RSC, Collection managed by Rijal Satria, Padang, West Sumatra, Indonesia; SKYC, Collection managed by Seiki Yamane, Kagoshima, Japan.

Imaging. Multi-focused montage images were produced using Helicon Focus Pro. (Helicon Soft Ltd., http://www.heliconsoft.com/) from a series of source images taken by a Canon EOS KissX5 digital camera attached to a Nikon SMZ1270 stereomicroscope. Artifacts/ghosts and unnecessary parts (unfocused appendages, insect pin, etc.) surrounding or covering target objects were erased and cleaned up using the retouching function of Helicon Focus Pro, and the color balance, contrast and sharpness were adjusted using Adobe Photoshop CS6.

Measurements. The following parts of the bodies were measured using ImageJ 1.49m (National Institute of Mental Health, USA, available at http://imageJ.nih.gov/ij/) based on the photographs taken using a Canon EOS KissX5 digital camera attached to a Nikon SMZ1270 stereomicroscope under suitable magnifications. Measurements and morphological terminology follows Terayama (1996); Shattuck (2009); Wong & Guénard (2016); Satria et al. (2017). Abbreviations of measurements and indices are as follows: HL, maximum length of head in frontal view, measured from midpoint of line drawn across anteriormost points of clypeus to midpoint of a line drawn across posteriormost points of head; HW, maximum width of head in frontal view, including eyes; MDL, maximum length of mandible measured from mandibular insertion to apicalmost point of mandible; EL, length of major axis of eye measured in lateral view; OED, maximum distance between lateral ocellus and eye (queen only); SL, maximum length of antennal scape excluding basal condylar bulb; WL, maximum diagonal distance of mesosoma in lateral view (Weber's length), measured from anteriormost point of pronotal collar

to posteriormost point of propodeal lobe; PNW, maximum width of pronotum measured in dorsal view; PSL, maximum length of propodeal spine measured in profile view from tip of propodeal spine to closer outward margin of propodeal spiracle; PTH, maximum height of petiole measured from ventralmost point of subpetiolar process to imaginary line tangential to the apex as measured in lateral view; PTL, maximum length of petiole measured from anterodorsalmost point to posterodorsalmost point of petiolar base in lateral view; CI = HW/HLx100; MDI = MDL/HLx100; SI = SL/HWx100; PTHI = PTH/PTLx100.

Taxonomic part

Order **Hymenoptera**

Family **Formicidae**

Subfamily **Mymicinae**

Tribe **Crematogastrini**

Genus ***Myrmecina*** Curtis, 1829

***Myrmecina andalas* sp. nov.**
(Figs 1, 2, 3, 4)

Holotype. Worker, **Indonesia,** *Sumatra*, Aceh, Leuser Ecosystem, Putri Betung, Gunung Kemiri, N 3°49'521'', E 97°31'198'', alt. ca. 950–1200 m, 19.IX.2012, R. Satria leg., individual code: SEMUT20180326A (MZB).

Paratypes. One worker (SEMUT20180731A), same data as for holotype (RSC); 3 workers (SKYU-SI-FOR001–003), Leuser Ecosystem, Gunung Kemiri, alt. 1200 m, good forest, 20.IX.2012, Yamane & Syaukani leg. (SKYC); 1 ergatoid queen (SEMUT20180731B), same data as for holotype (RSC).

Worker measurements and indices. *Holotype* and *paratypes* (n = 3): HL 0.90 mm, HW 1.00–1.02 mm, MDL 0.50–0.52 mm, EL 0.24 mm, SL 0.94 mm, WL 1.19–1.20 mm, PNW 0.66–0.68 mm, PSL 0.12–0.13 mm, PTH 0.27–0.28 mm, PTL 0.26 mm, CI 111–113, MDI 55–57, SI 92–94, PTHI 103–107.

Worker description. Relatively large (HL 0.90 mm, HW 1.00–1.02 mm, WL 1.19–1.20 mm). Head in frontal view rectangular, slightly shorter than broad, with posterior margin almost straight (Fig. 3A); lateral sides of head shallowly convex. Clypeus consisting of flat dorsal disc and steep anterior face, laterally serrate; its anterior margin almost straight, with small median tooth and pair of lateral denticles. Labrum with pair of apical processes. Eye relatively large (EL 0.24 mm; 72–73 ommatidia), distinctly breaking lateral margin of head, in profile occupying almost 1/4 length of head. Mandible triangular; masticatory margin with large apical and smaller preapical teeth, followed by 6 denticles. Antenna 12-segmented, with 3-segmented club; apical segment slightly longer than segments 10 and 11 combined; scape relatively long, distinctly surpassing posterolateral corner of head. Mesosoma in lateral view short and stout, with dorsal outline evenly convex; anterior ventrolateral portion of pronotum forming distinct process; mesonotum completely fused with pronotum; lower portion of mesopleuron broadly concave anteriorly (red arrow in Fig. 3B); mesopleuron not differentiated from metapleuron. Propodeum in dorsal view weakly demarcated anteriorly, but metanotal groove indistinct; anterior pair of denticles present on propodeal dorsum, very small and short (difficult to distinguish

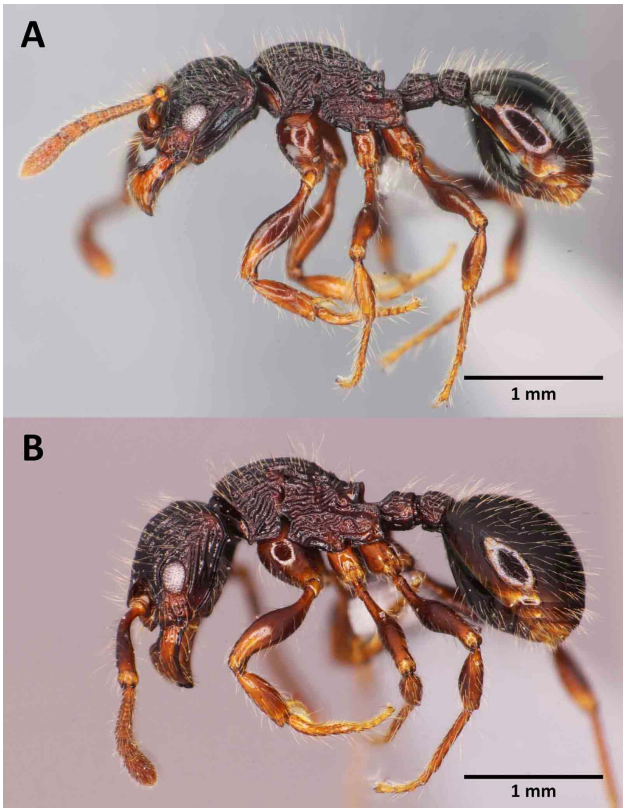

Fig. 1. *Myrmecina andalas* **sp. nov.**, body in lateral view: A, worker (holotype, SEMUT20180326A); B, ergatoid queen (paratype, SEMUT20180731B).

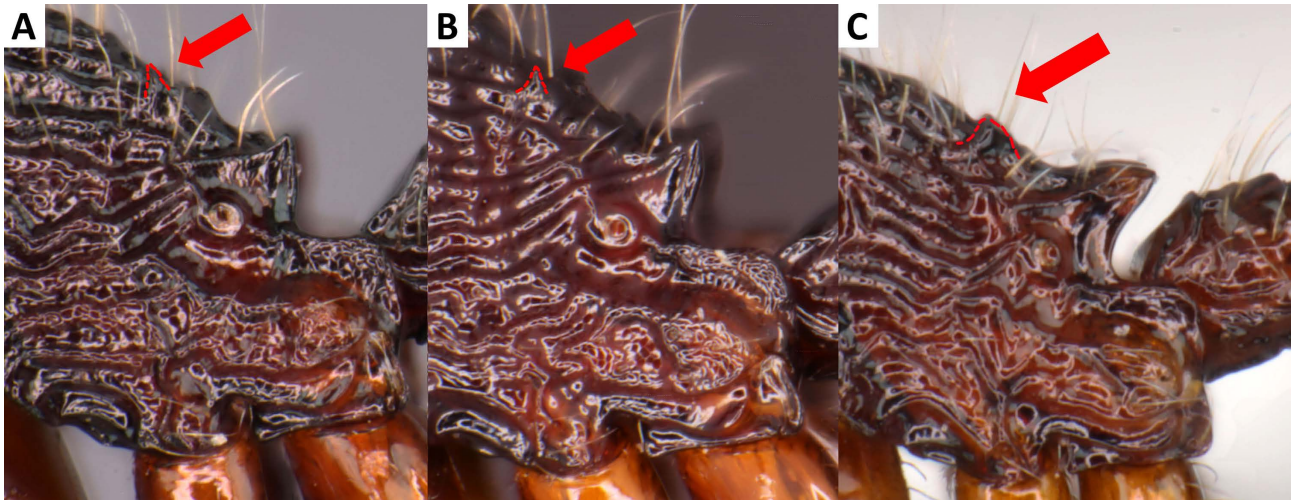

Fig. 2. *Myrmecina*, propodeum in lateral view: A, *M. andalas* **sp. nov.**, worker (holotype, SEMUT20180326A); B, *M. andalas*, ergatoid queen (paratype, SEMUT20180731B); C, *M. nitidiuscula* **sp. nov.**, worker (holotype, SEMUT20180326B) with red arrows indicating anterior denticles on propodeal dorsum.

them from longitudinal rugae on propodeum) (red arrow in Fig. 2A); propodeal spine triangular, much shorter than broad and pointing dorsally; propodeal declivity almost vertical with lateral carinae well developed, with posterodorsal angle about 90°; posteriormost portion of propodeum with high lateral walls (propodeal lobes) (Figs 3B, 3C, 3D). Petiole in dorsal view as broad as long, rectangular; its anterior slope in profile almost straight, dorsal face flat to weakly concave, and ventral outline straight with a small anterior denticle; postpetiole in dorsal view much broader than long, broader than petiole; sternopostpetiolar process absent. Gaster in dorsal view slightly elongate circular; anterior margin of first gastral tergite straight, with anterolateral corner very weakly angled. Mid- and hind tibiae broad and long, 3.5 times as long as broad.

Head dorsally with coarse longitudinal rugae; those on lateral part of head running posterolaterally toward posterolateral corner of head; interspaces between lateral rugae superficially sculptured and shiny; flat dorsal disc of clypeus smooth and shiny, with irregular punctures around anterolateral corner; ventrolateral area (temple + gena) of head smooth and shiny, with 1–2 longitudinal rugae (see Fig. 1A). Mesosoma, petiole and postpetiole with coarse irregular longitudinal rugae; declivity and posteriormost part of propodeun smooth and shiny. Gaster smooth and shiny.

Body covered with abundant long erect setae; clypeus with several long setae and a pair of long setae arising from median tooth of its anterior margin; scape with many suberect to erect setae that are longer than scape width (some of them as long as eye); all legs with numerous suberect to erect setae.

For color pattern see Figs 1–3; mesosoma, petiole and postpetiole dark reddish brown; head and gaster blackish brown, with apex of gaster orange. Mandible, clypeus, antenna and all legs reddish brown to brown, with antennal flagellum, tibiae and tarsi paler.

Ergatoid queen measurements and indices. Paratype (n = 1): HL 0.92 mm, HW 1.09 mm, MDL 0.54 mm, EL 0.27 mm, OED 0.39 mm, SL 0.97 mm, WL 1.30 mm, PNW 0.72 mm, PSL 0.16 mm, PTH 0.29 mm, PTL 0.26 mm, CI 118, MDI 58, SI 88, PTHI 111.

Ergatoid queen description. Very similar to worker including size, but differentiated from worker as follows: size of eye and number of ommatidia larger than in worker (EL 0.27 mm; 85 ommatidia); three ocelli present (Fig. 4A); dorsal outline of mesosoma in lateral view more convex than in worker; small hole present at forewing position on mesosoma (blue arrow in Fig. 4B) near small round pale area (red arrow in Fig. 4B).

Comparative remarks. Myrmecina andalas **sp. nov.** is morphologically most similar to *M. magnificens* Wong et Guénard, 2016 among the spe-

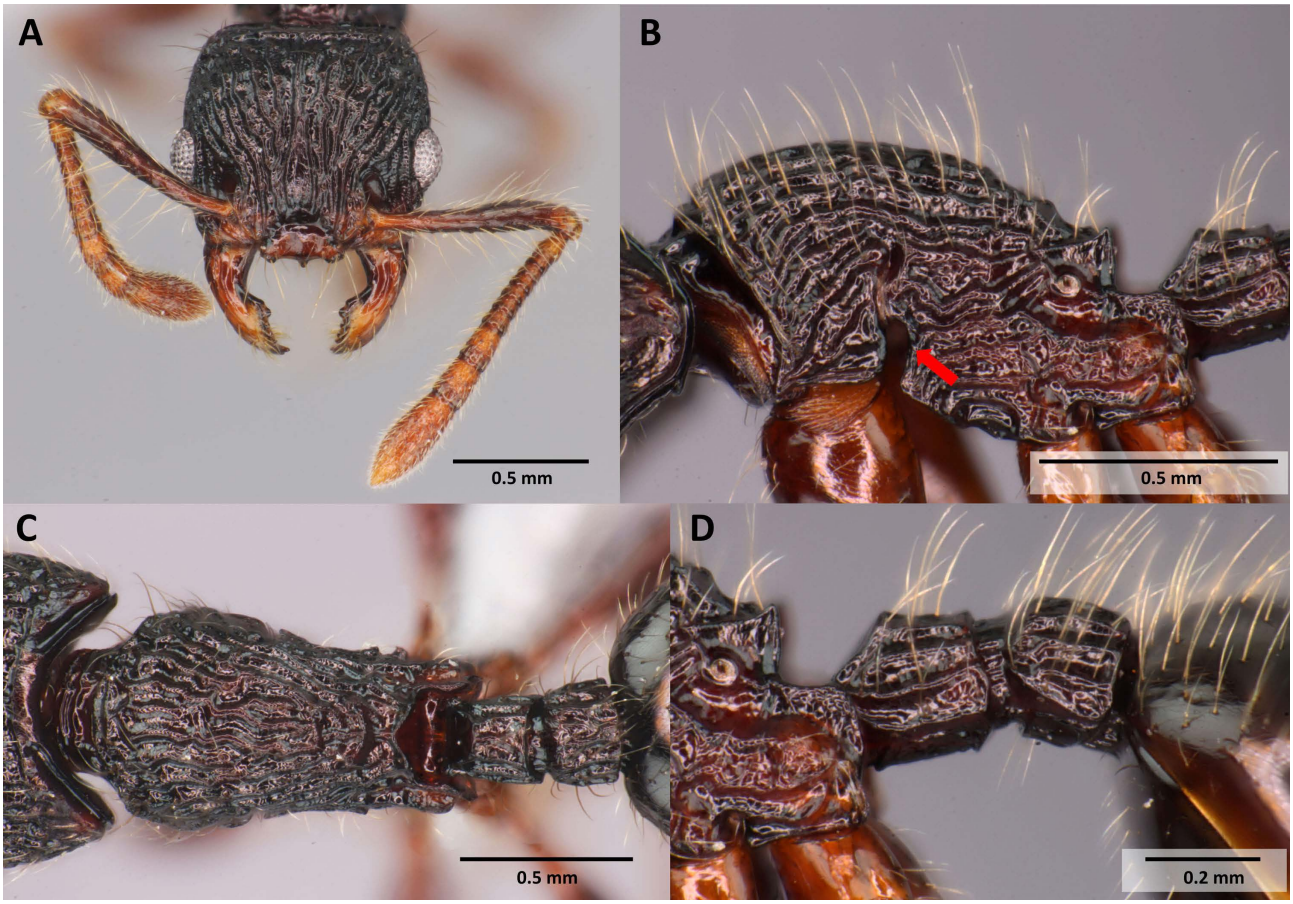

Fig. 3. *Myrmecina andalas* **sp. nov.**, worker (holotype, SEMUT20180326A): A, head in frontal view; B, mesosoma in lateral view, with red arrow indicating broad concavity of anterior outline of mesopleuron; C, mesosoma in dorsal view; D, petiole and postpetiole in lateral view.

cies known from Sundaland. However, it is distinguishable from the latter by the following characteristics of worker: ventrolateral area of head (temple + gena) smooth and shiny; anterior pair of denticles on propodeal dorsum very small and short (distinct in *M. magnificens*); propodeal spine triangular, much shorter than broad at base and pointing dorsad; propodeal declivity vertical, with posterodorsal angle almost 90°; sternopostpetiolar process absent. Worker of *M. andalas* **sp. nov.** also resembles that of *M. nipponica* Wheeler, 1906. However, it is easily separated from the latter by the much larger eye that is more than twice as long as the antennal pedicel (*vs.* eye small, as long as pedicel), long erect setae on scape, some of which are 1.5 times as long as scape width (*vs.* most erect setae very short, not longer than scape length), and the propodeal lobe dorsally roundly convex (*vs.* in shape of a narrow strip).

The ergatoid queen in Asian *Myrmecina* has also been found in *M. nipponica* (Ohkawara et al., 1993; Miyazaki et al., 2005; Peeters, 2012) and in undescribed species from Java (Ito, 1996). Despite the difficulty in recognizing the ergatoid queen among dead specimens, some morphological characters are used for the recognition of ergatoid queen, such as the presence of ocelli and vestiges of wing articulation on mesosoma (Fig. 4). The vestige of wing articulation was observed in the ergatoid queen of *M. andalas* as a small hole in place of the forewing near small round pale area on the mesosoma, and the same feature was also reported in ergatoid queens of *M. nipponica* which were determined by a direct observation of the ovaries and spermatheca (Ohkawara et al., 1993). The ergatoid queen has developed eyes as in the dealate queen, but smaller in body size with a smaller number of ommatidia than in the dealate

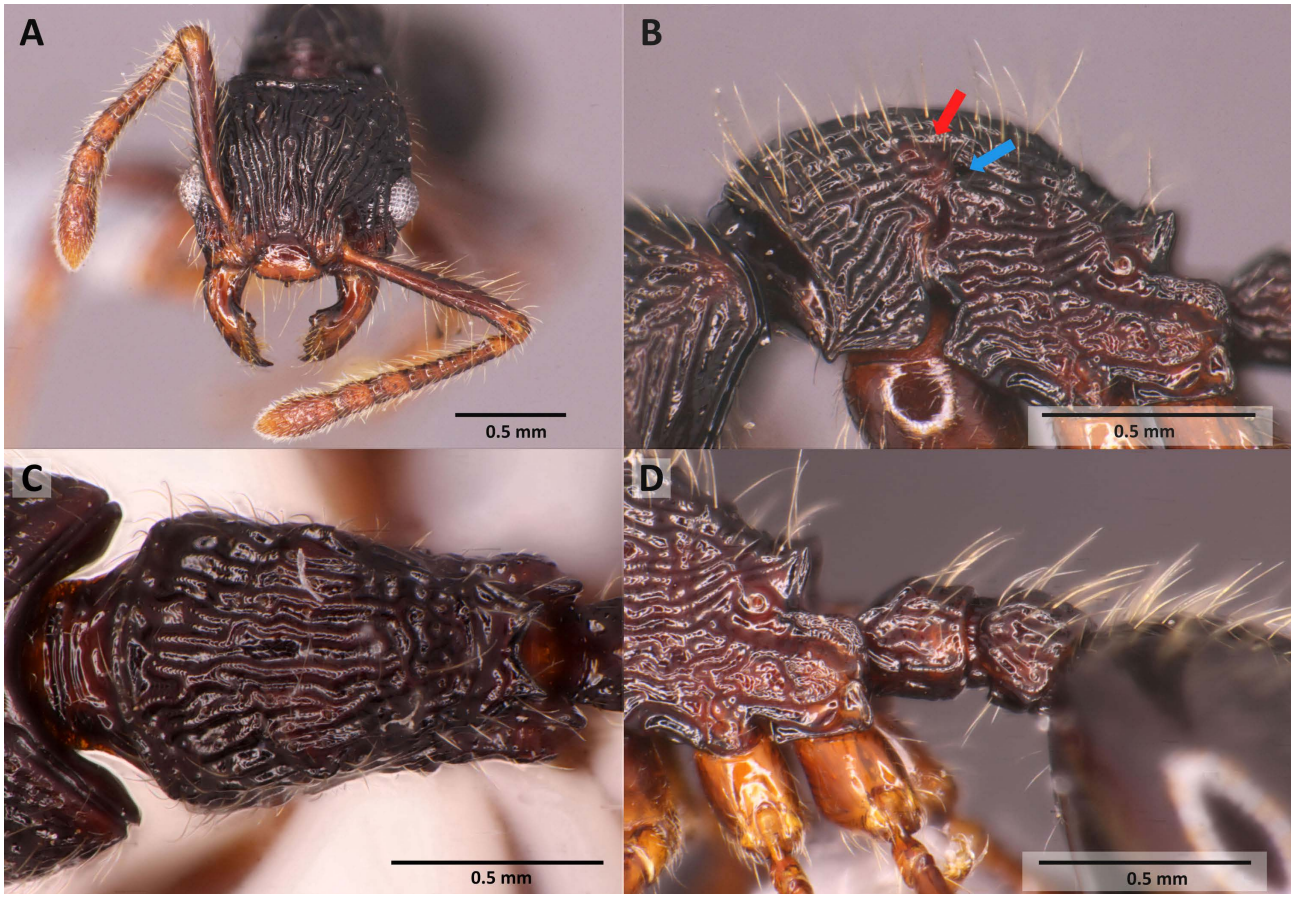

Fig. 4. *Myrmecina andalas* **sp. nov.**, ergatoid queen (paratype, SEMUT20180731B): A, head in frontal view; B, mesosoma in lateral view, with blue arrow indicating a small hole, and with red arrow indicating round pale area; C, mesosoma in dorsal view; D, petiole and postpetiole in lateral view.

queen. On the other hand, the worker has smallest eyes and number of ommatidia among the three castes, but ommatidia each being larger than those in both the dealate queen and ergatoid queen in *M. nipponica* (Miyazaki et al., 2015). Although in *M. andalas* the ergatoid queen has larger eyes and number of ommatidia than in the worker, the size of each ommatidium was similar in both castes.

Etymology. The specific epithet is a previous name of Sumatra Island.

Distribution. So far known only from Sumatra.

Bionomics. No information about the biology of this species is available, except that specimens were collected from leaf litter in secondary forests.

Myrmecina nitidiuscula sp. nov.
(Figs 2C, 5, 6)

Holotype. Worker, **Indonesia,** *Sumatra*, Aceh, Leuser Ecosystem, Putri Betung, 21.IX.2012, R. Satria Leg., individual code: SEMUT20180326B (MZB).

Paratypes. Two workers (SEMUT20180808A, SEMUT20180808B), same data as for holotype (RSC); 2 workers (SKYUSI-FOR004–005), same locality, but alt. >1100 m, good forest, 20.IX.2012, Yamane & Syaukani leg. (SKYC); 1 dealate queen (SEMUT20181112), same locality, but alt. 850 m, plantation, 19.IX.2012, Yamane & Syaukani (RSC).

Worker measurements and indices. Holotype and *paratypes* (n = 4): HL 0.65–0.67 mm, HW 0.72–0.74 mm, MDL 0.35–0.38 mm, EL 0.15–0.16 mm, SL 0.58–0.59 mm, WL 0.87–0.93 mm, PNW 0.50–0.52 mm, PSL 0.14–0.15 mm, PTH 0.21 mm, PTL 0.18–0.22 mm, CI 110, MDI 53–56, SI 78–80, PTHI 116.

Worker description. Relatively small (HL 0.65–0.68 mm, HW 0.72–0.75 mm, WL 0.87–0.93 mm). Head in frontal view rectangular, slightly shorter than broad, with posterior margin

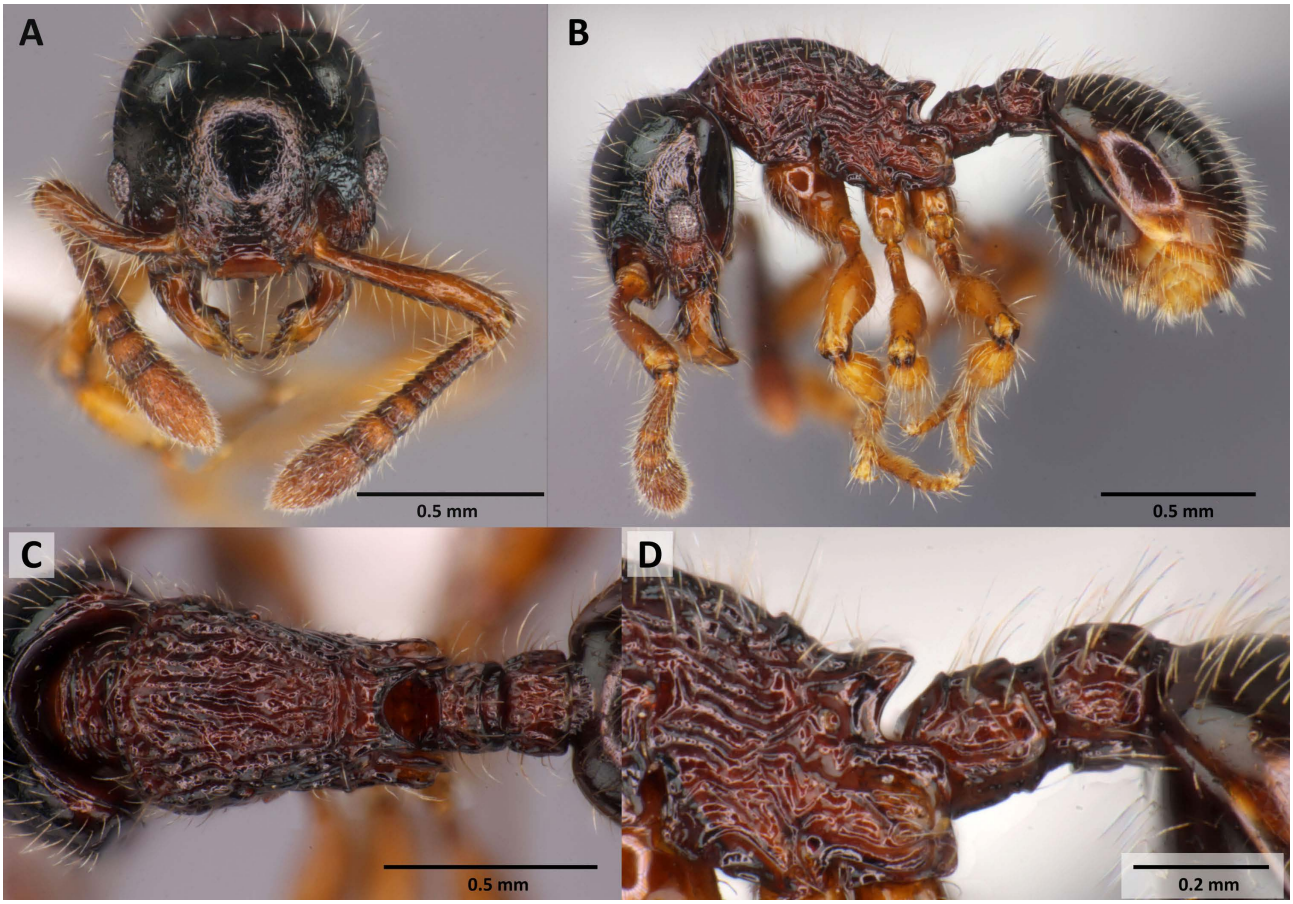

Fig. 5. *Myrmecina nitidiuscula* **sp. nov.**, worker (holotype, SEMUT20180326B): A, head in frontal view; B, body in lateral view; C, mesosoma in dorsal view; D, petiole and postpetiole in lateral view.

slightly concave (Fig. 5A); lateral sides of head evenly convex. Clypeus consisting of short dorsal disc and steep anterior slope; its anterior margin almost straight, with small median tooth and a pair of weak lateral processes. Eye relatively large (EL 0.15–0.16 mm; 34–35 ommatidia), breaking outer margin of head by 1/5 length of eye in profile. Mandible triangular; masticatory margin with large apical tooth, followed by two relatively large teeth, 3–4 small denticles, diastema and low but broad basal tooth. Antenna 12-segmented, with 3-segmented club; apical segment slightly longer than segments 10 and 11 combined; scape relatively short, not surpassing posterolateral corner of head. Mesosoma in lateral view short and stout, with dorsal outline roundly convex; anterior ventrolateral portion of pronotum weakly angulate, without anterior process; mesonotum completely fused with pronotum; anteroventral corner of mesopleuron angulate; mesopleuron not differentiated from metapleuron. Propodeum in dorsal view weakly separated from mesonotum but without distinct metanotal groove; propodeal spine in profile triangular, apically blunt but pointing posteriad, with very broad base; dorsum with a pair of barely recognized denticles anteriorly (Fig. 2C); declivity steep, with transverse carina connecting propodeal spines; flat posteriormost portion of propodeum laterally margined by wall (part of propodeal lobe) (Figs 5B, 5C, 5D). Petiole in dorsal view as broad as long, in lateral view consisting of flat to weakly concave dorsal face and gently sloping anterior face; ventral outline of petiole straight, with longitudinal median keel that is posteriorly angulate; postpetiole in dorsal view much broader than long, shorter but broader than petiole, in profile dorsally shallowly convex, with ventral margin almost straight; sternopostpetiolar process absent. Gaster in dorsal view almost circular; first gastral tergite without distinct antero-

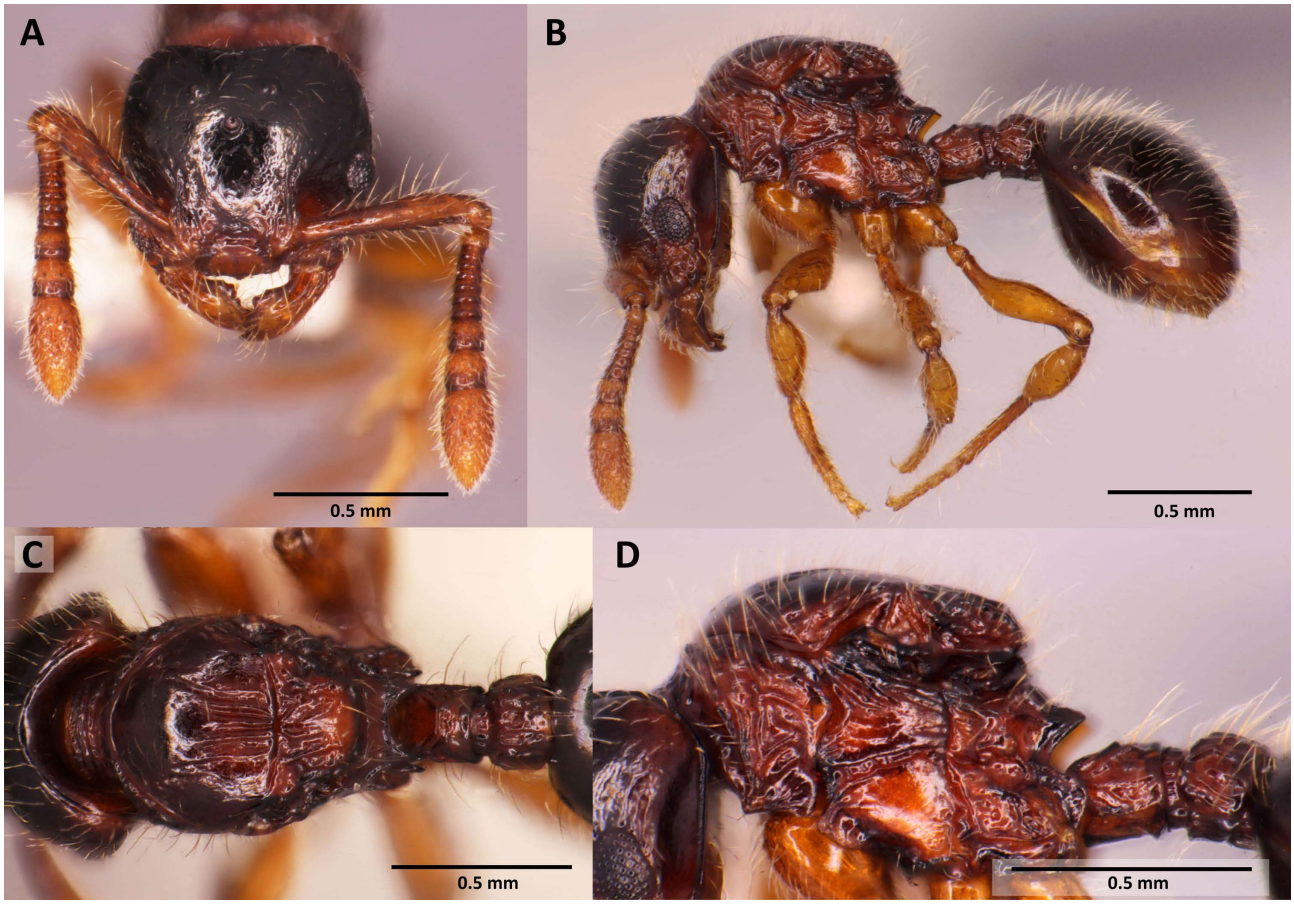

Fig. 6. *Myrmecina nitidiuscula* **sp. nov.**, dealate queen (paratype, SEMUT20181112): A, head in frontal view; B, body in lateral view; C, mesosoma in dorsal view; D, mesosoma, petiole and postpetiole in lateral view.

lateral angle. Mid- and hind tibiae very broad and short, 2.5 as long as broad.

Head superficially sculptured with scattered shallow punctures but generally smooth and shiny; frontal lobe, area between eye and frontal lobe, and area close to mandible more strongly sculptured; ventrolateral surface of head (temple + gena) smooth and shiny; mandible smooth, with dorsobasal portion irregularly sculptured; antennal scape superficially sculptured and shiny. Mesosoma, petiole and postpetiole with coarse irregular longitudinal sculpture; anterior protruding portion (neck) of pronotum transversely rugose. Gaster smooth and shiny.

Body including legs covered with abundant long erect setae; clypeus with a pair of very long setae and a few short setae on disc and a pair of long setae arising around base of anterior tooth; antennal scape with suberect to erect setae, some of which are longer than scape width.

For color pattern see Fig. 5; mesosoma reddish brown; head and gaster blackish brown with apex of gaster orange. Clypeus, mandible, and antenna pale reddish brown. All legs yellowish brown.

Queen measurements and indices. Paratype (n = 1): HL 0.68 mm, HW 0.75 mm, MDL 0.37 mm, EL 0.19 mm, OED 0.28 mm, SL 0.58 mm, WL 0.97 mm, PNW 0.60 mm, PSL 0.16 mm, PTH 0.21 mm, PTL 0.20 mm, CI 110, MDI 54, SI 77, PTHI 105.

Queen description. Differing from worker only in structure of eye and in structure and surface texture of mesosoma as follows: size of eye and number of ommatidia greater than in worker (EL 0.19 mm; 67 ommatidia), but each ommatidium similar in size in both; mesosoma in dorsal view with mesoscutum large, broad and roundly convex anteriorly; notaular lines absent; parapsidal lines weakly impressed, shorter than half of mesoscutum length; metanotum medially produced ante-

riad, dividing mesoscutellum into two triangular sections; propodeum separated from metanotum by deep groove; mesosoma in profile forming single dome; mesonotum and metanotum higher than pronotum and propodeum; mesopleuron demarcated from pronotum and metapleuron, divided into dorsal and ventral sections by deep groove; separation of metapleuron from lateral face of propodeum incomplete; dorsum of pronotum transversely striate; mesoscutelum smooth and shiny, with posteromedian portion coarsely longitudinally rugose; ventral section of mesopleuron smooth and shiny; other parts rugose to irregularly sculptured.

Comparative remarks. Myrmecina nitidiuscula **sp. nov**. is easily distinguished from other named species of *Myrmecina* known from Sundaland by the combination of the following characteristics: rather smooth and shiny head with ventrolateral area (temple + gena) of head smooth, triangular propodeal spine pointing posteriad and with very broad base, and short and broad mid- and hind-tibiae.

Etymology. The species epithet relates to the extensively shiny dorsum of the head.

Distribution. So far known only from Sumatra.

Bionomics. This species was collected from leaf litter in the secondary forest.

Key to Sumatran species of *Myrmecina* based on the worker caste

1. Large size (HW ≥1.00 mm); mesosoma in lateral view with propodeal spines pointing anteriorly or dorsally (Figs 2A, 2B) ..... ***M. andalas* sp. nov.**
– Small size (HW <1.00 mm); mesosoma in lateral view with propodeal spines pointing posteriorly (Figs 5D) 2
2. Mesosoma in profile having propodeal spine small, shorter than basal width or equal to it 3
– Mesosoma in profile having propodeal spine distinct, with length exceeding basal width 5
3. Dorsum of head only superficially sculptured, generally smooth and shiny; frontal lobe, area between eye and frontal lobe, and area close to mandibular base strongly sculptured ..... ***M. nitidiuscula* sp. nov.**
– Head in frontal view entirely distinctly sculptured and mat. 4
4. In profile, pro-mesonotum weakly to moderately convex. In frontal view, anterior margin of clypeus straight. Eye large; its length approximately 1/4 of HL ..... ***M. bandarensis***
– In profile, pro-mesonotum strongly convex. In frontal view, anterior margin of clypeus slightly concave. Eye smaller; its length less than 1/4 of HL .. .. ***M. butteli***
5. In frontal view, clypeus with distinctly concave anterior margin ..... ***M. undulata***
– In frontal view, clypeus with straight anterior margin ..... ***M. nesaea***

Discussion

Two new species are added to the *Myrmecina* fauna of Sumatra in the present study. In total, six named species of *Myrmecina* are currently known in Sumatra. Both these new species were collected from secondary forests in Leuser Ecosystem, Aceh, located in northern part of Sumatra. We have more species from Sumatra in our ant collections, but most of them have not yet been identified to species. Considering our field experience that generally in Sumatra different localities have different species compositions for ants, the total number of *Myrmecina* species would increase with more extensive exploration in the future.

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