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Taxonomic revision of the ant genus *Myrmecina* in Southeast Asia (Hymenoptera: Formicidae)

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Abstract: The ant genus *Myrmecina* occurring in Southeast Asia is systematically revised. Fifty-three species of this genus are recognized from these areas. The following 40 species are described as new to science: *M. arcuata, M. asiatica, M. aspera, M. asthena, M. boltoni, M. breviata, M. celebebsis, M. dasynota, M. dechai, M. dolichothrix, M. elegans, M. glabra, M. gopa, M. gracilis, M. grandis, M. gymnocephala, M. inflata, M. insulana, M. inthanonensis, M. itoi, M. lambirensis, M. lombokensis, M. longiseta, M. macrops, M. mahuana, M. maryatiae, M. monticola, M. muluensis, M. nigra, M. nomurai, M. padangensis, M. parallela, M. poringensis, M. sabahna, M. spinosa, M. sulawesiana, M. sundanica, M. tridentata, M. vieti* and *M. yamanei*. A key to the species based on the workers is provided. Of all species examined, 16 species are classified into four species complexes, though the remainings are not assigned to any species groups.

Key Word: Myrmicinae, Crematogastrini, taxonomy, new species

Introduction

The ant genus *Myrmecina* of the subfamily Myrmicinae was established by Curtis (1829) based on *Myrmecina latreillii* Curtis. This genus is assigned to the tribe Crematogastrini Forel, 1893 (Ward et al. 2015; Bolton, 2020). This genus consists of 56 valid species at present (Bolton, 2020) and is distributed in all the geographical regions except for the Ethiopian region. Members of this genus are medium-sized, characterized by a pair of longitudinal carina on the ventrolateral margin of the head, and cylindrical petiole without an anterior peduncle.

Of the 56 nominal species, 28 were described from Asia (Bolton, 2020). This figure shows that *Myrmecina* species are the richest in Asia. The previous studies, however, were fragmental and treated with only local faunas based on limited materials i.e., Japan (Ogata & Terayama, 1992; Terayama & Kihara, 1994), China and Taiwan (Lin & Wu, 1998; Zhou, 2001; Huang et al. 2008; Zhou et al. 2008), India (Tiwari, 1994), Thailand (Jaitrong et al. 2019), Singapore (Wong & Guénard, 2016), Borneo (Wheeler, 1919), Sumatra (Forel, 1913; Satria & Yamane, 2019).

Biology of the genus *Myrmecina* has been studied in only a few species. Masuko (1994) reported the predatory habits of *M. nipponica* and *M. flava*, and showed that the ants are specialized predators on oribatid mites. He concluded that the peculiarly elongate head of the larvae is associated with a feeding habit in which they insert the head into the hard oribatid body to consume the contents. The association of oribatid mites with *Myrmecina* was also observed in tropical Asia (Ito & Takaku, 1994; Aoki & Ito, 1997) where they show symbiosis. The colony size of the ants has been recorded in the limited number of species. Wilson (1959) noted 50 adults in a colony of *M. transversa*. Ohkawara *et al*. (1993) counted 27.4±SD 16.1 adults per colony from 108 samples of *M.*

nipponica. Ito (1996) recorded 66±SD 24 workers and 8±SD 8.4 ergatogynes per colony from 41 samples of *Myrmecina* species of Java. Ergatogynes are found in other species. Emery (1916), Ohkawara *et al.* (1993) and Ito (1996) reported that *M. graminicola, M. nipponica* and undescribed species of Java have ergatogynes.

Members of the genus *Myrmecina* live in rotten wood (Wilson, 1959), soil and litter, or under stones (Ogata & Terayama, 1992). The ants are relatively rare, but have a potential value as a bioindicator especially in tropical Asia, because they occur well conserved forests. The taxonomy of the genus is, however, far from complete. Up to the present, no comprehensive reviews have been made, which causes practical difficulties in identification of the group. It is necessary to study its taxonomy for the inventory of this area.

The purpose of the present study is to establish a classification system of the genus *Myrmecina* in Southeast Asia. The study area includes the entire Oriental region, and the Austro-Malayan subregion of the Australian region.

Material and methods

'Southeast Asia' in the present paper refers to the Oriental region and Australian region excluding Australia, Papua New Guinea, the Solomon Islands, Vanuatu, Fiji and the islands in the Pacific Ocean.

Specimens examined

Type specimens were examined and/or deposited in the collectioons below. Other specimen depositories are also listed (Some of abbreviations of these institutions follow those of Brandão, 2000).

AMNH American Museum of Natural History, New York, U. S. A.
BMNH The Natural History Museum, London, United Kingdom.
BZM Bogor Zoological Museum, Bogor, Indonesia.
EUMJ Entomological Laboratory, Ehime University, Matsuyama, Japan.
HNHM Hungarian Natural History Museum, Budapest, Hungary.
IEBR Institute of Ecology and Biological Resources, Hanoi, Vietnam.
KUEC Entomological Laboratory and Institute of Tropical Agriculture, Kyushu University, Fukuoka, Japan.
KUFA Faculty of Agriculture, Kagawa University, Miki, Japan.
KUFF Department of Forest Biology, Faculty of Forestry, Kasetsart University, Bangkok, Thailand.
KUIC Department of Earth and Environmental Sciences, Faculty of Science, Kagoshima University, Kagoshima, Japan.
LKCNHM Lee Kong Chian Natural History Museum, Singapore.
MCSN Museo Civico di Storia Naturale "Giacomo Doria", Genoa, Italy.
MCZC Museum of Comparative Zoology, Harvard University, Massachusetts, U. S. A.
MHNG Museum d'Histoire Naturelle, Geneva, Switzerland.
MNHA Museum of Nature and Human Activities, Hyogo, Japan.
MTPC Mamoru Terayama, Private Collection, Tokyo, Japan.
MZB Bogor Zoological Museum, Bogor, Indonesia.
NHMW Naturhistorisches Museum Wien, Vienna, Austria.
NIAES National Institute for Agro-Environmental Sciences, Tsukuba, Japan.
NSMT National Science Museum, Tokyo, Japan.
NMNS National Museum of Natural Science, Taichung, Taiwan.
NTU Department of Plant Pathology and Entomology, National Taiwan University, Taipei, Taiwan.

NZSI National Zoological Collection, Zoological Survey of India, Calcutta, India.

OMNH Osaka Museum of Natural History, Osaka, Japan.

RSC Rijal Satria Collection, Padang, West Sumatra, Indonesia.

SBSHKU Insect Biodiversity and Biogeography Laboratory, School of Biological Sciences, The University of Hong Kong, Hong Kong SAR.

SKYC Seiki Yamane Collection, Kagoshima, Japan.

TARI Taiwan Agricultural Research Institute, Taichung, Taiwan.

THNHM Thailand Natural History Museum, Technopolis, Khlong Luang, Pathum Thani Thailand.

UMS Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Kota Kinabalu, Malaysia.

USNM United States National Museum of Natural History, Washington, D. C., U. S. A.

The specimens used in this study were collected mainly from the following Asian countries:
Brunei, China, Indonesia (Sumatra, Java, Sebesi, Sulawesi), Malaysia, Myanmar, Philippines, Thailand, Vietnam. The material collected by a colony sampling method was shown with colony code in various ways.

Observation of morphological features

Observations were made under stereoscopic microscopes (Nikon, SMZ-2T; Olympus, SD-STB3) and a scanning electron microscope (SEM: JEOL, JSM-5600LV) at voltage 15 kV. In the later case, some specimens were sputter-coated with gold for 12 min (4 min × 3 times), but the others not.

Measurements and indices

Measurements, indices and their abbreviations follow those of Bolton (2000).

Total Length (TL): The total length of the ant from the mandibular apex to the gastral apex; when measured in profile the sum of mandible length + HL + ML + lengths of waist segments (petiole and postpetiole) + length of gaster.

Head Length (HL): The length of the head capsule excluding the mandibles, measured in full-face view along mid-dorsal longitudinal axis from the mid-point of the anterior clypeal margin to the mid-point of the occipital margin. In species where one or both of these margins are concave, the measurement is taken from the mid-point of a transverse line that spans the apices of the projecting portions.

Head Width (HW): The maximum width of the head in full-face view, measured behind the eyes.

Cephalic Index (CI): HW*100 divided by HL.

Scape Length (SL): The maximum straight-line length of the antennal scape, excluding the basal constriction or neck close to the condylar bulb.

Scape Index (SI): SL*100 divided by HW.

Pronotal Width (PW): The maximum width of the pronotum in dorsal view.

Mesosoma Length (ML) (=Weber's length, alitrunk length): The diagonal length of the mesosoma in profile from the point at which the pronotum meets the cervical shield to the posterior basal angle of the metapleuron.

Measurements were made by means of a stereoscopic microscope (SMZ-2T) with an ocular graticule and expressed in millimeters (mm). The scale bars in the digital photographs by SEM were expressed in micrometers (μm).

Morphology and terminology

Note on the terminology concerning the castes in Myrmecina

In the present study, taxonomy of the genus *Myrmecina* is based on the morphological characters of the workers. But in some species there are individuals morphologically intermediate between the queen and worker, and wingless as workers. It is sometimes difficult to distinguish workers from them. Therefore, it is appropriate to state about the wingless females and its terms.

These wingless females have been called "**ergatogynes**" (Ohkawara *et al*., 1993). Peeters (1991) suggested that there are two distinct categories in the term ergatogynes: ergatoid queens and intercastes. The ergatoid queens are a persistently wingless reproductive caste which has derived from normal queens, while the intercastes are morphologically continuous series of reproductive females. Here, these categories are not recognized, and "ergatogyne" is used only when the wingless females can be morphologically distinguished from workers. Because morphological difference between ergatoid queen and intercaste is not clear, and their ontogenetic process is not known.

Morphological differences between worker and ergatogyne are observed mainly in total body length, head width, eye length, shape, width and sutures of mesosoma, and width of gaster. Among 53 species examined in this study, ergatogynes are found in six species: *M. gopa* sp. nov., *M. grandis* sp. nov., *M. guangxiensis* Zhou, *M. magnificens* Wong & Guénard, *M. raviwonghei* Jaitrong et al., *M. sundanica* sp. nov. (see the remarks under each species). In addition, Forel (1915) and Emery (1916) reported the occurrence of ergatogyne in the European species, *M. graminicola* (Latreille, 1802).

Morphology of worker

Head

The head is usually rectangular with rounded occipital corners (Figs. 3d), but in some species, the corners are projected posteriorly (Fig. 42e). The ratio of the length to width of the head varies among species. The occipital margin is straight or concave at the median portion; the occipital carina is present. The ventrolateral margin is delineated by a sharp longitudinal carina on each side, which arises close to inner-ventral mandibular base, running along the length of the head immediately below the eye and ascending to the occipital surface posteriorly. This character is unique to the genus *Myrmecina*. The lobate area partly covering an antennal socket is called the frontal lobe, and the longitudinal ridge following the frontal lobe is called the frontal carina. In many species of the genus, the frontal lobe is more or less distinct, but the frontal carina is short, weak and almost indistinguishable from the surface sculptures. The median portion of the clypeus projects with or without small processes on the anterior margin (Fig. 1a); the number of the small processes ranges from 1 to 4; the lateral portions are usually simple, but in the *M. vieti* complex with sharp ridges of **shield walls** in front of the antennal insertions. Eyes are variable in size and the number of ommatidia, obscure in some some species complexes but distinct in others. The eye is usually located at the apical one third between the mandibular insertion and the occipital corner of the head in profile. Because of the variable size of the eye, the shortest distance between the base of the mandible and the anterior margin of the eye, or the **malar space**, varies among species.

The antenna is 12-segmented, forming a club of apical 3 segments. The basal portion of the antennal scape bears a more or less developed flange (Fig. 1a), which encircles the area above the basal condylar bulb. This structure, the **antennal flange** (Moffett, 1986), is seen in the genera *Acanthomyrmex, Myrmecina, Perissomyrmex* and *Pristomyrmex*. The antennal flange is extremely well developed in *M. flava* Terayama, 1985, completely covering the condylar bulb. The third segment of the antenna lacks the girdle of hairs. Taylor (1980) noticed this character in *M. cacabau* (Mann, 1921) and thought it as a distinctive character of this species. This character was observed in all the species examined, and thus this is a diagnostic character of the genus.

The mandible is robust and strongly curved downwards. As the distal portion of each mandible in anterior view is suddenly broadened, this portion is distinguished easily from the proximal portion forming an arm. The shape of the mandible in the genus is

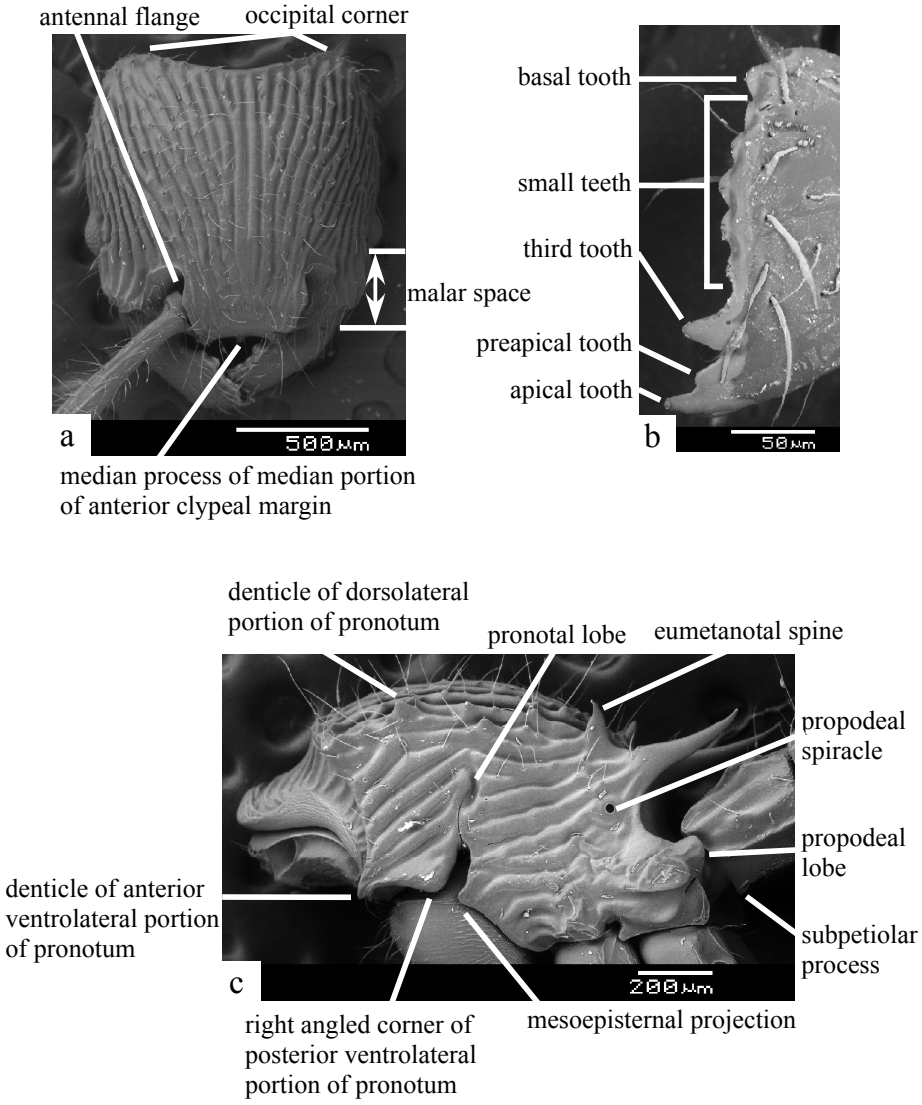


Fig. 1. Morphological terms. a, head of *M. spinosa* sp. nov. in full-face view; b, masticatory margin of mandible of *M. maryatiae* sp. nov. in anterior view; c, mesosoma and petiole of *M. spinosa* sp. nov. in profile.

subtriangular, having three margins: the outer-, basal- and masticatory one. The masticatory margin is usually bent at mid-length, but sometimes straight, and armed with a strong apical, the preapical and the third teeth distinctly. The preapical tooth is incomplete and fused with apical one, without isolated tip (Fig. 1b). These three teeth are followed by small teeth varying in number and a blunt basal tooth (Fig. 1b). The basal tooth is sometimes absent. The dorsal surface of the labrum bears projected structure in the genera *Acanthomyrmex, Myrmecina, Perissomyrmex* and *Pristomyrmex*. In the genus *Myrmecina*, paired denticles usually occur on the anteromedian portion, but sometimes the projections are fused with each other at the base. The number of segments of the maxillary and labial palpi, or palp formula, is consistently 4 and 3, respectively.

Mesosoma

In this study, the term '**mesosoma**' is used for calling the second tagma including pro-, meso-, metathorax and propodeum. The term is synonymus with 'trunk' and 'alitrunk' of myrmecology. The mesosoma of the genus *Myrmecina* is flattened to strongly convex on the dorsal margin in profile. The anterior portion of the pronotum is usually marginated and broadened (Fig. 3a). The anterior dorsolateral and ventrolateral portions are armed with or without denticles. Those denticles are well developed in *M. spinosa*,

and its allied species (Fig. 1c). Even when the denticles are not formed, the anterior ventrolateral portion is distinct and angulate. The posterior ventrolateral portion extends and forms a right angled corner. The upper most area of the free posterior margin of the pronotum forms a rounded lobe covering the mesothoracic spiracle, which is homologous with pronotal lobe in other hymenopterans.

The mesonotum is completely fused with the pronotum, lacking the promesonotal suture. The mesopleuron is fused with the mesonotum. Its border is probably originated from the area just posterior to the pronotal lobe. The anterior ventrolateral portion extends to form a projection partly covering the forecoxa, here termed the **mesoepisternal projection**. The posterior ventrolateral portion of the pronotum and the mesoepisternal projection form a cleavage. The oblique furrow on the mesoepisternum is absent, which is present in the male and female. The line was errorously interpreted as the suture dividing the anepisternum and the katepisternum in Bolton (1994).

In some cases of myrmicines there is a groove between the mesonotum and the propodeum. This represents a vestige of the metanotum, and thus called the metanotal groove. In the worker of *Myrmecina*, however, the metanotal groove is completely lost. The most species of *Myrmecina* have a pair of spines in front of the propodeal spines. The metanotum of the female has a pair of processes in some species. Comparing the worker with the conspecific female as shown in *M. spinosa* sp. nov. (Figs. 2a, 2b), the spines in front of the propodeal ones in the worker seem to be originated in the metanotal area. Thus, the spines in front of the

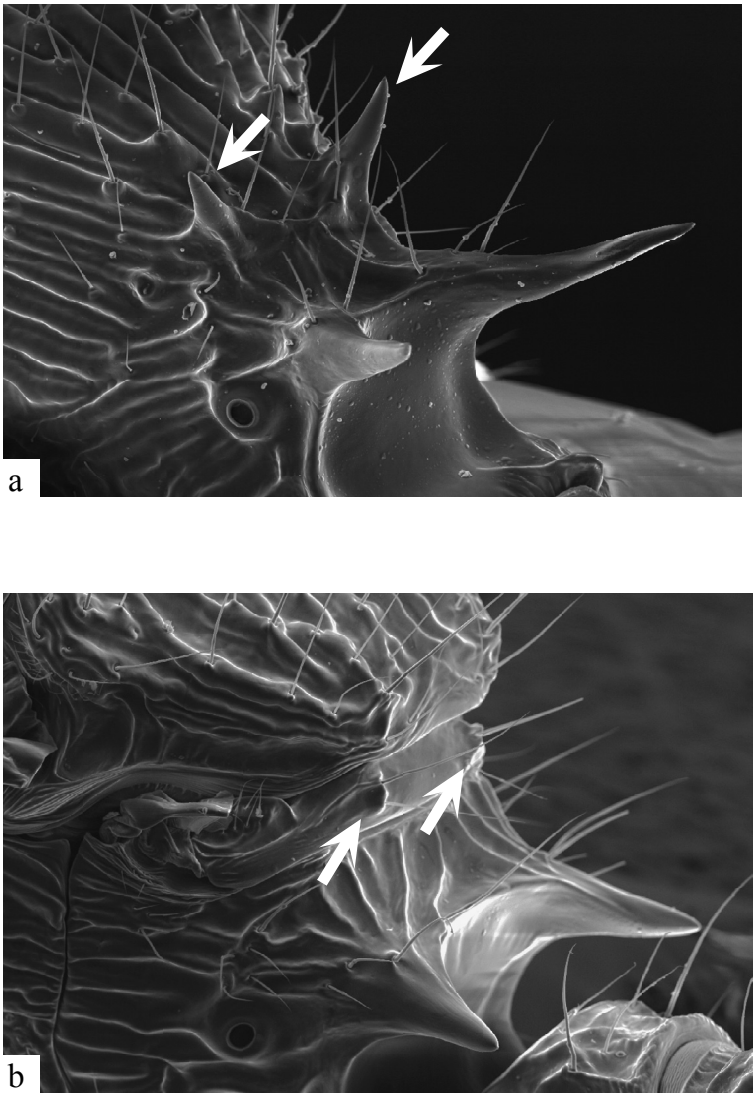


Fig. 2. Eumetanotal spines of *M. spinosa* sp. nov. in oblique view. a, worker; b, queen.

propodeal ones are “metanotal spines”. But the term “metanotal spines” was used incorrectly in the past literature of myrmecology (e.g., Bingham, 1903), here I newly introduce the term “**eumetanotal spines**” to this structure (Fig. 1c).

The propodeal spines are usually triangular to elongate, but only angulately projected (not spine-like) in *M. breviata* sp. nov. and *M. dasynota* sp. nov. The propodeal lobe (Fig. 1c) is a small process developed on the propodeal declivity. It varies among species from a low ridge to distinct projection. The propodeal spiracles are variable in size and its position among species, usually situated near the base of the propodeal spines; distance between the posterior margin of the spiracle and that of the propodeum is usually longer than the diameter of the spiracle.

The legs are relatively short. The middle and hind legs lack the tibial spurs.

Petiole, postpetiole and gaster

The petiole is the second abdominal segment morphologically. The tergum and the sternum are rigidly united; the former has spiracles anteroventrally; the sternum is reduced to form a simple longitudinal plate, often with a small anterior projection termed subpetiolar process. In almost all the myrmicine genera, the segment is petiolate, including an anterior peduncle and a posterior node. But in the genus *Myrmecina*, the petiole is sessile, somewhat cylindrical in overall shape, so that the peduncle and the node are indistinguishable; the anterior portion is truncated forming an oblique face, which is marginated by a curved ridge in profile; the highest portion, the dorsal crest, is located at the midlength of the petilole. The shape of the petiole and the proportion of the height and length are useful characters in distinguishing species. The height is defined as the minimum length taken from the dorsal crest to ventral edge of the petiole in profile. The length is defined as the minimum length taken from the anterior most point of the curved ridge to the posterior margin of the petiole in profile.

The postpetiole is subrectangular in dorsal view, with a transverse anterior margin and subparallel sides. The lateral margins are sometimes convergent. The proportion of the width to length is different by species. The anterior portion of the postpetiolar sternum is sharply marginated, sometimes forming a distinct projection in profile.

The gaster is usually oval in dorsal view. In dorsal view, the base of the first gastral tergum is simple in many species, but in some species the portion is concave behind the postpetiole and forming distinct anterolateral corners. The first gastral tergum is large, occupying about two thirds of the dorsal area of the gaster. The sting is present but small and weakly sclerotized. The morphology of the sting apparatus was studied by Kugler (1978, 1979). No stinging behavior has been observed (Maschwitz, 1964; Masuko, 1994).

Surface

The sculpture on the body surface in this genus is one of conspicuous characters distinguishing it from other genera easily. In the majority of species, the head and mesosoma have longitudinal or irregular rugae distinctly. In many cases, patterns of the sculpture of them are more or less different among species. Thus, this sculpturing character is used for recognizing species in the following key to the species, although the sculpture is variable in some species.

The dorsal portion of the head has longitudinal or irregular rugae with or without punctures. On the ventrolateral portion of the head, some species have sculptured surface and others have no sculpture. The scuplture of this portion is sometimes used for recognizing species. The ventral portion of the head has transverse and curved rugae in almost all speices.

The dorsal and the lateral portions of the mesosoma have usually longitudinal or irregular rugae with or without punctures, sometimes transverse and curved rugae or diverging rugae anteriorly. The sculpture of the head and mesosoma is variable between species, sometimes the sculpture is not observed and the surface of the head and mesosoma is smooth and shining in some species.

The petiole and postpetiole usually have longitudinal rugae on the dorsal and lateral portions. The first gastral segment is usually smooth and shining, sometimes shallow rugae or punctures are observed in a few species.

The body surface including the mandible, antenna and legs has erect pilosity. The pilosity is simple but variable in density and length among species. In particular, the ratio of its length on the pronotum to length of propodeal spine is sometimes useful for recognizing species.

Body color is usually black, but the color of the legs, the antenna and the posterior portion of the gaster is often reddish or yellowish brown. The color of the whole body is sometimes yellowish brown, or slightly darker in *M. dasynota* sp. nov.

Taxonomy

Genus *Myrmecina* Curtis

Myrmecina Curtis, 1829: 265. Type species: *Myrmecina latreillii* Curtis (junior synonym of *Myrmecina graminicola*) by monotypy.
Archaeomyrmex Mann, 1921: 448. Type species: *Archaeomyrmex cacabau* Mann, by original designation [synonymy by Brown, 1971: 1.].

Diagnosis of workers

Occipital corners rounded in profile but sometimes projected posteirorly. Ventrolateral margin delineated by a sharp longitudinal carina on each side, the carina arising close to inner-ventral mandibular base, running along length of head immediately below eye and ascending to occipital surface posteriorly. Frontal lobe present. Mandible robust and strongly down-curved with basal arm; anterior clypeal margin and basal margin of mandible forming a space when the mandibles are closed in full-face view; masticatory margin with a strong apical, low and blunt preapical and third teeth followed by 4-6 small teeth and a blunt basal tooth. Apical tooth always acute and distinct; preapical tooth fused with apical one, sometimes indistinct; third tooth well isolated from preapical one; basal tooth sometimes reduced in size and indistinguishable from median small teeth. Clypeus more or less projected anteriorly, with or without 1-4 processes on median portion of anterior margin. Labrum with a pair of denticles on median anterodorsal portion, each of which are distinct and well separated. Antenna 12-segmented, with apical 3 segments forming a club; third segment lacking the girdle of hairs; base of scape forming flange more or less covering condylar bulb. Palp formula 4, 3.

Pronotum with or without denticles on dorsolateral or ventrolateral portions. Mesoepisternal projection covering a part of forecoxa. Eumetanotal spines usually present but often small to absent.

Petiole cylindrical, without an anterior peduncle.

First gastral tergum large, occupying about two thirds of dorsal area of gaster, with or without sculptures dorsally, anterior margin sometimes concave.

Note

[Spelling]

There was a nomenclatural confusion on the type species. When Curtis (1829) established the genus *Myrmecina*, he originally described *M. latreillii* based on a male. In his catalogue, Bolton (1995) listed up this as a type species of *Myrmecina*. But he also used the same species as "*M. latreillei*" at the section of the species list. Latter spelling has been cited by Mayr (1855), Nylander (1856), Emery (1895), Wheeler (1911), Rigato (1999) and others. This is incorrect spelling according to the Article 32 and 33 of ICZN (ICZN, 1999).

[Synonymy]

Bolton (1995) showed that Mayr (1855) synonymized *latreillei* [sic] under *graminicola*. But the truth is that Mayr treated

latreillei as a senior synonym of *graminicola*. Indeed Emery (1895) used the species name *latreillei* when he described the subspecies *americana*. Mayr's treatment was wrong, because he based it on the incorrect authorship of *graminicola* as Foerster (1850). The name, *Myrmecina graminicola*, has been used as valid since Emery (1898) (see also Donisthorpe, 1915; Emery, 1922).

Checklist of the species of Southeast Asia

In the present study, 53 species are treated and listed here arranged by alphabetical order. In the list below, 40 species of them are new to science, and their specific names are followed by the boldface, "**sp. nov**.". Sixteen species of them could be categorized to 4 species complexes. These complexes are indicated by the abbreviations in the brackets following each specific name as follows: [gra], *gracilis* complex; [mac], *macrops* complex; [spi], *spinosa* complex; [vie], *vieti* complex. The other species are not assigned to any of these complexes. The distribution of species is indicated following each specific name.

1. *andalas* Satria & Yamane [spi]: INDONESIA: Sumatra
2. *arcuata* **sp. nov.** PHILIPPINES: Luzon.
3. *asiatica* **sp. nov.** CHINA: Yunnan Prov.; THAILAND: Nakhon Ratchasima Prov., Chanthaburi Prov., Phetchaburi Prov., Pattani Prov.; MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra, Rakata I.
4. *aspera* **sp. nov.** MALAYSIA: The Malay Pen.
5. *asthena* **sp. nov.** CHINA: Yunnan Prov.; VIETNAM: Lao Cai Prov.; MALAYSIA: The Malay Pen., Borneo (Sabah).
6. *bandarensis* Forel INDONESIA: Sumatra.
7. *boltoni* **sp. nov.** INDONESIA: Sulawesi.
8. *breviata* **sp. nov.** [mac] PHILIPPINES: Luzon.
9. *butteli* Forel INDONESIA: Sumatra.
10. *celebensis* **sp. nov.** INDONESIA: Sulawesi.
11. *curvispina* Zhou et al. [gra] CHINA; VIETNAM: Vinh Phuc Prov., Ninh Binh Prov.
12. *dasynota* **sp. nov.** MALAYSIA: Borneo (Sabah).
13. *dechai* **sp. nov.** THAILAND: Phetchaburi Prov.
14. *dolichothrix* **sp. nov.** PHILIPPINES: Mindanao.
15. *elegans* **sp. nov.** MALAYSIA: Borneo (Sabah).
16. *glabra* **sp. nov.** MALAYSIA: The Malay Pen.
17. *gopa* **sp. nov.** INDONESIA: Java.
18. *gracilis* **sp. nov.** [gra] MALAYSIA: Borneo (Sabah, Sarawak); INDONESIA: Borneo (Kalimantan).
19. *grandis* **sp. nov.** MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); BRUNEI: Tasek Merimbum; INDONESIA: Sumatra.
20. *guangxiensis* Zhou [vie] CHINA; VIETNAM: Ninh Binh Prov.
21. *gymnocephala* **sp. nov.** [mac] PHILIPPINES: Mindoro; INDONESIA: Seram.
22. *inflata* **sp. nov.** [spi] THAILAND: Phang Nga Prov.
23. *insulana* **sp. nov.** MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); INDONESIA: Sumatra, Borneo (Kalimantan), Java.
24. *inthanonensis* **sp. nov.** THAILAND: Chiang Mai Prov.
25. *itoi* **sp. nov.** MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra.
26. *lambirensis* **sp. nov.** MALAYSIA: Borneo (Sarawak).
27. *lombokensis* **sp. nov.** INDONESIA: Lombok.
28. *longiseta* **sp. nov.** INDONESIA: Sumatra.
29. *macrops* **sp. nov.** [mac] MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra, Java.

30. *magnificens* Wong & Guénard [spi] SINGAPORE; MALAYSIA: Tioman Is., The Malay Pen.; INDONESIA: Sumatra.
31. *mahuana* **sp. nov.** [spi] MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra.
32. *maryatiae* **sp. nov.** THAILAND: Phang Nga Prov.; MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); INDONESIA: Borneo (Kalimantan).
33. *monticola* **sp. nov.** MALAYSIA: The Malay Pen.
34. *muluensis* **sp. nov.** MALAYSIA: Borneo (Sarawak).
35. *nesaea* Wheeler INDONESIA: Sebesi I. (near Krakatau Is.)
36. *nigra* **sp. nov.** VIETNAM: Lao Cai Prov.
37. *nitidiuscula* Satria & Yamane [mac] INDONESIA: Sumatra.
38. *nomurai* **sp. nov.** [vie] VIETNAM: Cao Bang Prov., Vinh Phuc Prov.
39. *padangensis* **sp. nov.** INDONESIA: Sumatra.
40. *parallela* **sp. nov.** INDONESIA: Sumatra.
41. *poringensis* **sp. nov.** MALAYSIA: Borneo (Sabah).
42. *raviwonghei* Jaitrong et al. [gra] THAILAND: Chiang Mai Prov., Necornratchasima Prov.
43. *sabahna* **sp. nov.** MALAYSIA: Borneo (Sabah).
44. *semipolita* Forel INDONESIA: Java.
45. *spinosa* **sp. nov.** [spi] MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); BRUNEI: Tasek Merimbun; INDONESIA: Borneo (Kalimantan), Java.
46. *striata* Emery MYANMAR: Tenasserim.
47. *sulawesiana* **sp. nov.** INDONESIA: Sulawesi, Seram.
48. *sulcata* Emery INDONESIA: Sulawesi, Java.
49. *sundanica* **sp. nov.** MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Java, Bali.
50. *tridentata* **sp. nov.** [spi] MALAYSIA: Borneo (Sabah, Sarawak).
51. *undulata* Emery INDONESIA: Sumatra, Laut I. (SE of Borneo).
52. *vieti* **sp. nov.** [vie] VIETNAM: Ha Tai Prov.
53. *yamanei* **sp. nov.** MALAYSIA: The Malay Pen.

Myrmecina gracilis complex

The *M. gracilis* complex is characterized by the small eyes (< 0.12 mm), the flattened mesosoma, long and posteriorly directed propodeal spine, and first gastral tergum that is concave at the anterior margin in dorsal view and sculptured on the dorsum. The species complex comprises *M. curvispuna* Zhout et al., 2008 *M. gracilis* sp. nov. and *M. raviwonghei* Jaitrong et al., 2019, and is distributed in N. Vietnam, Thailand and Borneo.

The propodeal spine extends to the vertical posteriormost limit of the propodeum, and is at the almost same level of the flattened mesosoma. The apex of the spine is acute and directed posteriorly, though some variations occur with species. The long, acute and horizontal spine is apomorphic, but also observed in some species such as *M. spinosa* sp. nov. and *M. tridentata* sp. nov. The concave anterior margin of the gaster forms rounded lateral corner in each side. This state is apomorphic, but again observed in several species in other species grous such as *M. aspera* sp. nov., *M. elegans* sp. nov., *M. spinosa* sp. nov. and *M. tridentata* sp. nov. The species of this complex tend to be small in size.

Myrmecina macrops complex

The *M. macrops* complex is characterized by having the large eyes, the broadened head, and the smooth and shining, or foveolate

surface of the head. The species complex includes *M. breviata* sp. nov., *M. gymnocephala* sp. nov., *M. macrops* sp. nov. and *M. nitidiuscula* Satria & Yamane, 2019. The species complex is distributed in the Philippines, Sumatra, Malay Peninsula, Borneo, Java.

All these characters seemed to be derived states but each of them can be observed independently in different species complexes of the genus. *M. maryatiae* sp. nov. would be close to the complex in having the similar shape of the head, but the shape of the pronotum and the surface sculpture are different from those in the complex.

Myrmecina spinosa complex

The *M. spinosa* complex is characterized by the backwardly projected occipital corners of the head (Fig. 42e). The species complex includes *M. andalas* Stria & Yamane, 2019, *M. inflata* sp. nov., *M. magnificens* Wong & Guénard, 2016, *M. mahuana* sp. nov., *M. spinosa* sp. nov. and *M. tridentata* sp. nov. The species complex is distributed in Thailand, S. Malay Peninsula, Borneo, Sumatra and Java.

This unique shape of the head is an autapomorphy of the complex and somewhat similar to that of *Gnamptogenys* species of the Ectatomminae. Species of this complex are relatively larger than other species. Among 5 species of the complex, *M. spinosa* sp. nov. and *M. tridentata* sp. nov. share the distinct projections on the mesosoma including anterior dorsolateral and anterior ventrolateral denticles on the pronotum, the eumetanotal spines and the propodeal spines (Figs. 42b, 46b), the shape of the masticatory margin of the mandible, and the concave anterior margin of the first gastral tergum.

Myrmecina vieti complex

The *M. vieti* complex is well defined as having a sharp ridge of the shield wall on the lateral portion of the clypeus in front of the antennal insertions. The species complex includes *M. guangxiensis* Zhou, 2001, *M. nomurai* sp. nov. and *M. vieti* sp. nov. Distribution of the species complex is restricted to E. Asia.

The shield wall is unique and represents a derived state among the genus *Myrmecina*. In the tribe Crematogasterini, *Acanthomyrmex* has an incomplete ridge originated from the frontal lobe but low and indistinct in front of the antennal insertion. *Pristomyrmex* and *Perissomyrmex* have a distinct ridge surrounding the frontal area of the antennal insertion, but the anterior margin of the clypeus hides under this ridge. The shield wall in the *M. vieti* complex and its ridge have the same property judging from their position and the connection to the frontal lobe. At least the structure in the *M. vieti* complex would be homologous among the members, because the anterior margin of the clypeus does not hide but is visible. Another character demarcating the *M. vieti* complex is the shape of the propodeal lobe (Figs. 20b, 36b, 47b). The lobe is reduced and low in this complex, while is more or less distinct in others. The same state is also observed in several species including *M asthena* sp. nov., *M. breviata* sp. nov., *M. dasynota* sp. nov., *M. dechai* sp. nov., etc. This would be a secondary reduction. From these characters discussed above, the *M. vieti* complex would be a monophyletic group having these synapomorphies.

Key to species based on workers

The key presented below treats 48 species. The following 5 species are not examined and omitted from the key: *butteli* Forel, 1913 from Sumatra, *nesaea* Wheeler, 1924 from Sebesi I., *semipolita* Forel, 1905 from Java, *striata* Emery, 1889 from Myanmar, *undulata* Emery, 1900 from Sumatra.

1. Lateral portions of clypeus raised into a sharp ridge of shield wall in front of the antennal insertions.....2 (*M. vieti* complex)
- Lateral portions of clypeus not raised into a sharp ridge of shield wall in front of the antennal insertions.....4
2. Petiole longer than high; lateral surface smooth; ventral margin concave in profile (Fig. 47b) ..... *vieti* sp. nov.
- Petiole as long as high; lateral surface rugose; ventral margin not concave in profile (Fig. 36b) 3

3. Body color reddish brown. Anterior portion of postpetiole forming more or less distinct lateral expansion, broadest anteriorly and much broader than petiole. Mesosoma with more or less flattened dorsal margin in profile; dorsal surface with longitudinal and parallel rugae ..... *nomurai* sp. nov.
- Body color black. Anterior portion of postpetiole not expanded laterally, slightly broader than petiole. Mesosoma with convex dorsal margin in profile; dorsal surface with rugae diverging anteriorly ..... *guangxiensis* Zhou
4. Occipital corners of head projected posteriorly (Fig. 42e) ..... 5 (*M. spinosa* complex)
- Occipital corners of head not projected posteriorly (Fig. 7b) 10
5. First gastral tergum not concave in dorsal view (Fig. 31a) 6
- First gastral tergum concave in dorsal view (Figs. 22a, 46a) 7
6. Mesosoma in lateral view with dorsal outline evenly convex. Mesosoma with irregular longitudinal rugulae. Propodeal spine pointing dorsally ..... *andalas* Satria & Yamane
- Mesosoma in lateral view with dorsl outline highly convex. Mesosoma with irregular rugulae. Propodeal spine pointing posteriorly ..... *mahuana* sp. nov.
7. Masticatory margin of mandible straight (Fig. 22d) ..... *inflata* sp. nov.
- Masticatory margin of mandible bent at midlength (Fig. 1b) 8
8. Propodeal spine elevated, pointing dorsally; propodeal declivity almost vertical with posterodorsal angle about 90˚ ..... *magnificens* Wong & Guénard
- Propodeal spine extending backward and over vertical posteriormost limit of propodeum in profile; propodeal declivity steep with posterodorsal angle < 90˚ (Figs. 42b, 46b) 9
9. Head and mesosoma with straight and longitudinal rugae on dorsal surface (Figs. 42a, 42c). Postpetiole distinctly marginate, sometimes with projected lateral lobe on both sides in dorsal view; anterior dorsal margin angulately raised in profile ..... *spinosa* sp. nov.
– Head and mesosoma with wavy or irregular rugae on dorsal surface (Figs. 46a, 46c), sometimes the rugae on mesosoma transverse. Postpetiole not marginate on both sides in dorsal view; anterior dorsal margin not angulately raised, almost horizontal in profile ..... *tridentata* sp. nov.
10. Head smooth and shining (Fig. 21c), or sparsely foveate (Fig. 29c) on dorsal surface 11
- Head largely sculptured with rugae and sometimes dense punctures on dorsal surface (Figs. 3c, 5c, 6c, 40c) 15
11. Head longer than broad (Fig. 16c) ..... *glabra* sp. nov.
- Head as long as broad (Fig. 21c) ..... 12 (*M. macrops* complex)
12. Propodeal spine only angulately projected, not spine-like (Fig. 9b) ..... *breviata* sp. nov.
- Propodeal spine well developed, triangular to elongate (Fig. 29b) 13
13. Head sparsely foveate on dorsal surface ..... *macrops* sp. nov.
- Head smooth and shining, or mostly smooth and shining except for frontal carinae and few rugulae in front of eye 14
14. Mesosoma with straight rugulae in dorsal view; median longitudinal portion raised, forming arched surface ..... *gymnocephala* sp. nov.
- Mesosoma with wavy rugulae in dorsal view ..... *nitidiuscula* Satria & Yamane
15. Anterior margin of first gastral tergum more or less concave in dorsal view 16
- Anterior margin of first gastral tergum not concave in dorsal view 20
16. First gastral tergum sculptured ..... 17 (*M. gracilis* complex)
- First gastral tergum not sculptured 19
17. First gastral sternum not sculptured ..... *curvispina* Zhout et al.
- First gastral sternum sculptured 18

18. First gastral sternum with ridge at anterior median portion in ventral view. Anterior clypeal margin without single median process. Head longer than broad ..... *gracilis* sp. nov.
- First gastral sternum without ridge at anterior median portion in ventral view. Anterior clypeal margin with single median process. Head as long as broad..... *raviwonghei* Jaitrong et al.
19. Propodeal spine broad and triangular, 1.5 times as long as broad at base or shorter, just reaching vertical posteriormost limit of propodeum in profile. Pronotum with rugae on dorsal surface. Eye comprising 15 ommtidia or more ..... *aspera* sp. nov.
- Propodeal spine elongate, much longer than broad at base, extending over vertical posteriormost limit of propodeum in profile. Pronotum smooth and shining on dorsal surface. Eye comprising 10 ommatidia or less ..... *elegans* sp. nov.
20. Antennal scape long, extending beyond occipital corner in full-face view 21
- Antennal scape short, not or just reaching occipital corner in full-face view 31
21. Eumetanotal spine absent 22
- Eumetanotal spine present.....23
22. Anterior clypeal margin without processes ..... *dolichothrix* sp. nov.
- Anterior clypeal margin with three processes ..... *gopa* sp. nov.
23. Ventral portion of petiole simple, without subpetiolar process nor median longitudinal ridge (Figs. 28b, 33b).....24
- Ventral portion of petiole with subpetiolar process or median longitudinal ridge (Figs. 1c, 44b).....28
24. Anterior clypeal margin with median paired processes 25
Anterior clypeal margin with single median process or without processes 26
25. Head with straight and thick rugae on dorsal surface (Fig. 8c). Forecoxa with rugae..... *boltoni* sp. nov.
- Head with slightly waved and thin rugae, and punctures on dorsal surface (Fig. 33c). Forecoxa smooth and shining ..... *monticola* sp. nov.
26. Propodeal spine long, extending over vertical posteriormost limit of propodeum in profile..... *parallela* sp. nov.
- Propodeal spine short, not or just reaching vertical posteriormost limit of propodeum in profile (Figs. 28b, 33b) 27
27. Pronotal pilosity sparse and extremely long, almost three times as long as propodeal spine (Fig. 28b). Dorsal portion of propodeal lobe not raised, simple. Ventrolateral portion of head sculptured (Figs. 3d, 23d). Eye much shorter than malar space ..... *longiseta* sp. nov.
- Pronotal pilosity dense and short, twice as long as propodeal spine or shorter (Fig. 33b). Dorsal portion of propodeal lobe raised, forming rounded corner. Ventrolateral portion of head smooth and shining (Fig. 7b). Eye as long as malar space ..... *bandarensis* Forel
28. Ventrolateral portion of head sculptured (Figs. 3d, 23d).....29
- Ventrolateral portion of head smooth and shining (Fig. 7b).....30
29. Anterior clypeal margin with single median process. Mesosoma with straight and parallel rugae on dorsal surface (Fig. 24a). Eye comprising 20 ommatidia or more ..... *inthanonensis* sp. nov.
- Anterior clypeal margin with three processes. Mesosoma with wavy and diverging rugae on dorsal surface (Fig. 35a). Eye comprising 15 ommatidia or less ..... *nigra* sp. nov.
30. Eye small, comprising 15 ommatidia or less; the diameter much shorter than half of malar space. Head longer than broad (CI<90) (Fig. 34c) ..... *muluensis* sp. nov.
- Eye large, comprising 20 ommatidia or more; the diameter longer than half of malar space. Head as long as broad (CI≥98) ..... *sulcata* Emery (p. 118)
31. Pilosity extremely dense (Fig. 12b); number of hairs on petiole more than 20 ..... *dasynota* sp. nov.
- Pilosity sparse (Figs. 13b, 39b); number of hairs on petiole less than 15 32
32. Mesosoma with transverse rugae on dorsal surface 33

- Mesosoma with longitudinal or irregular rugae on dorsal surface 34
33. Propodeal spine long, pointed backward ..... *dechai* sp. nov.
- Propodeal spine short, pointed upward ..... *poringensis* sp. nov.
34. Dorsal median portion of mesosoma and lateral portion of pronotum not sculptured ..... *lambirensis* sp. nov.
- Dorsal median portion of mesosoma and lateral portion of pronotum sculptured 35
35. First gastral sternum sculptured ..... *celebensis* sp. nov.
- First gastral sternum not sculptured 36
36. First gastral tergum sculptured ..... *sundanica* sp. nov.
- First gastral tergum smooth and shining 37
37. Eye distinctly longer than half of malar space 38
- Eye as long as or shorter than half of malar space 40
38. Head broad posteriorly in full-face view (Fig. 37c). Petiole distinctly longer than high in profile. Rugae on dorsal surface of head running parallel and straight (Figs. 8c, 37c) ..... *padangensis* sp. nov.
- Head with lateral margins nearly parallel in full-face view, anterior width almost same as posterior one (Figs. 25c, 32c). Petiole almost as long as high in profile. Rugae on dorsal surface of head running wavy and irregularly (Figs. 25c, 32c) 39
39. Masticatory margin of mandible straight without basal tooth ..... *itoi* sp. nov.
- Masticatory margin of mandible bent at the midlength with basal tooth (Fig. 1b) ..... *maryatiae* sp. nov.
40. Masticatory margin of mandible straight (Fig. 19d) ..... *grandis* sp. nov.
- Masticatory margin of mandible bent at midlength (as in Fig. 1b) 41
41. Rugae on ventrolateral portion of head transverse (Fig. 23d) ..... *insulana* sp. nov.
- Rugae on ventrolateral portion of head longitudinal or absent (Figs. 3d, 7b) 42
42. Antennal scape not reaching occipital corner by scape width in full-face view (SI≤77) ..... *yamanei* sp. nov.
- Antennal scape just reaching occipital corner in full-face view (SI≥80) 43
43. Anterior clypeal margin with median paired processes ..... *sabahna* sp. nov.
- Anterior clypeal margin with single median process or without processes 44
44. Ventrolateral portion of head with punctures, without longitudinal rugae 45
- Ventrolateral portion of head without punctures, or with both punctures and longitudinal rugae (Fig. 7b) 46
45. Eye small and circular, comprising about 6 ommatidia; the diameter much shorter than half of malar space. Head longer than broad ..... *asthena* sp. nov.
- Eye medium-sized and oval, comprising about 14 ommatidia; the diameter as long as half of malar space. Head as long as broad ..... *lombokensis* sp. nov.
46. Eye small and circular, comprising about 9 ommatidia; its diameter much shorter than half of malar space ..... *asiatica* sp. nov.
- Eye medium-sized and oval, comprising 15 ommatidia or more; its diameter as long as half of malar space *sulawesiana* sp. nov.

Species accounts

Myrmecina andalas **Satria & Yamane**

Myrmecina andalas Satria & Yamane, 2019: 185: 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*) (SEMUT20180326A) (MZB). Paratypes. One worker (SEMUT20180731A), same data as holotype (RSC); 3 workers (SKYU-SI-FOR001–003), Leuser Ecosystem, Gunung

Kemiri, alt. 1200 m, good forest, 20.ix.2012 (*Yamane & Syaukani*) (SKYC); 1 ergatoid queen (SEMUT20180731B), same data as holotype (RSC). [one SKYC paratype worker examined].

Remarks. *M. andalas* belongs to the *M. spinosa* complex. Among those species, *M. andalas* can be distinguished from the remains by having the elevated propodeal spine and simple anterior margin of the first gastral tergum.

Distribution. INDONESIA: Sumatra.

***Myrmecina arcuata* sp. nov.**

(Fig. 3)

Holotype worker. TL 2.62, HL 0.66, HW 0.59, CI 90, SL 0.56, SI 95, PW 0.432, ML 0.72.

Worker. Head subrectangular, slightly longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal blunt tooth; small teeth unclear. Dorsal surface of clypeus not slightly concave; median portion of anterior margin projected with three median processes that are very small; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles very small. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex with maximum diameter 0.10 mm, with 6 ommatidia in the longest row; malar space slightly twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye. Antennal scape long, extending beyond posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection narrow. Eumetanotal spine absent. Propodeal spine elongate, 1.5 times as long as broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum slightly longer than diameter of spiracle. Petiole long, longer than high in profile, and longer than broad in dorsal view; dorsal crest absent; subpetiolar process absent. Postpetiole slightly broader than petiole in dorsal view; anterodorsal outline slightly convex in profile; ventral outline projected with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae on dorsum which are distinct and longitudinal; ventrolateral portion with deep straight rugae. Clypeus smooth and shining. Mesosoma with deep straight rugae longitudinally. Forecoxa smooth and shining. Petiole and postpetiole with a few distinct rugae. First gastral segment smooth and shining. Head with relatively sparse and long pilosity on dorsum. Mesosoma with relatively sparse and long pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 1-2 hairs on ventral surface. Body black or dark reddish brown, forecoxae reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, PHILIPPINES: Luzon, Lagunas, Mt. Banahaw, 24. xi. 1995, 700 m, (*I. Löbl*) (BMNH).

Remarks. *M. arcuata* does not belong to any species complex. But in terms of the relative length of the antennal scape, the shape of

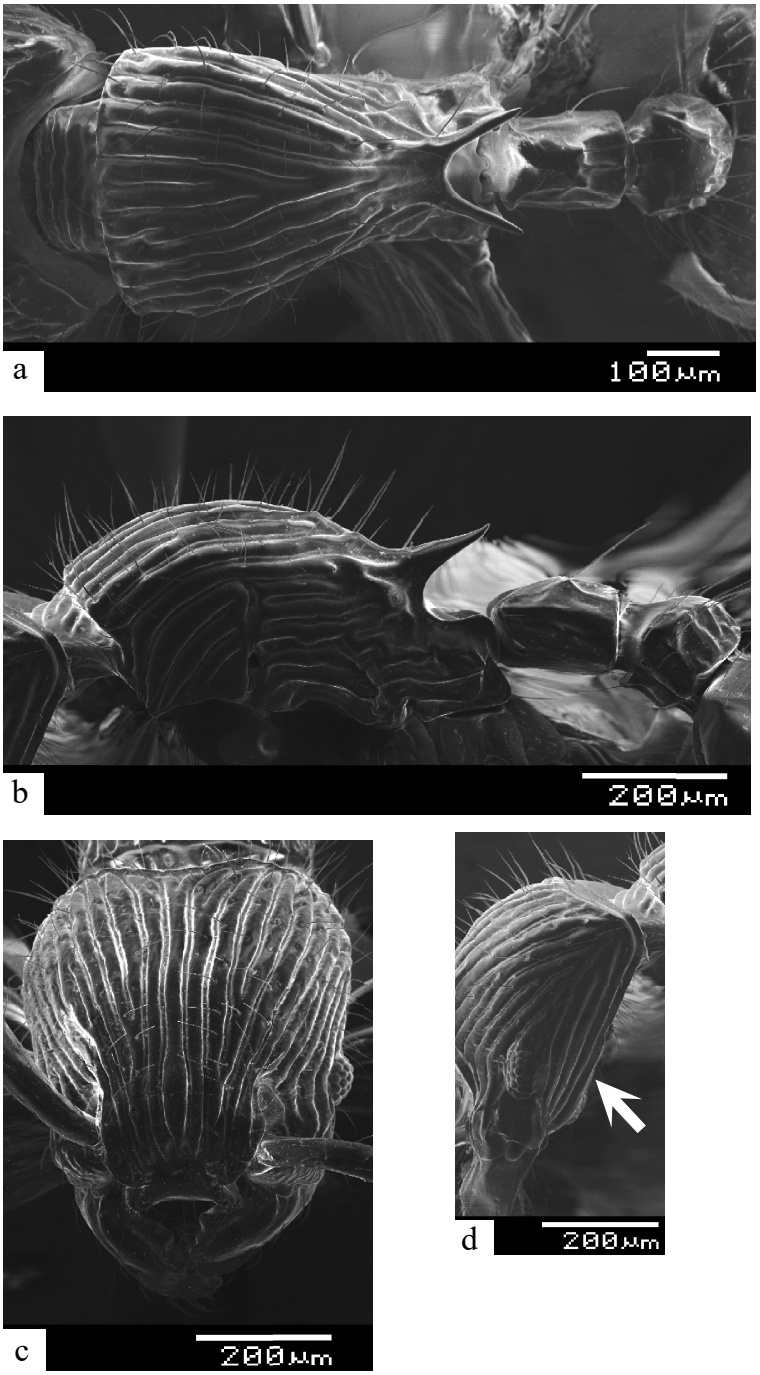


Fig. 3. ***Myrmecina arcuata*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, ventrolateral portion of head.**

the mesosoma without the eumetanotal spine, and the shape of the first gastral tergum, *M. arcuata* is similar to *M. modesta* Mann and *M. subarmata* Mann. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M. arcuata* can be distinguished from the remains by having the elongate propodeal spine.

Distribution. PHILIPPINES: Luzon.

***Myrmecina asiatica* sp. nov.**

(Fig. 4)

Holotype worker. TL 2.53, HL 0.59, HW 0.54, CI 92, SL 0.50, SI 91, PW 0.38, ML 0.64.

Paratype workers. TL 2.51-2.68, HL 0.59-0.61, HW 0.54-0.56, CI 91-95, SL 0.50, SI 89-91, PW 0.37-0.39, ML 0.66-0.70 (5

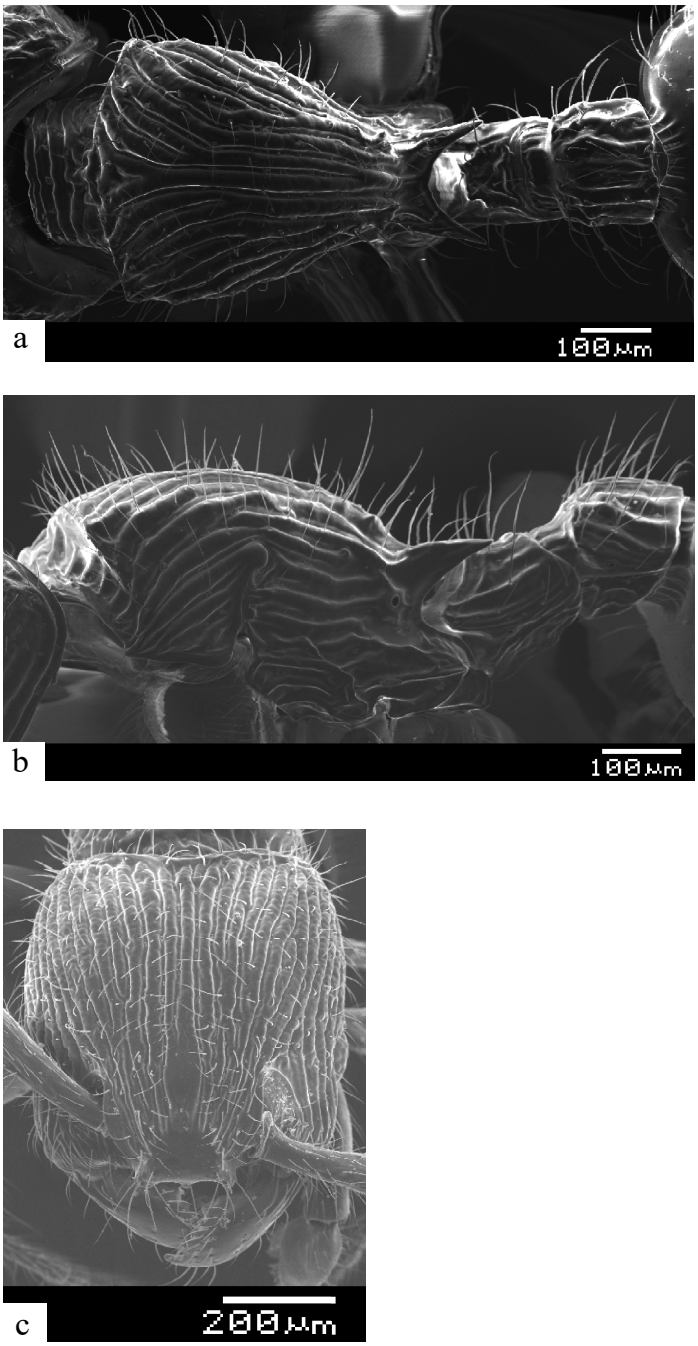


Fig. 4. ***Myrmecina asiatica*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

measured).

Worker. Head subrectangular, slightly longer than broad, sometimes as long as broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin feebly projected with or without a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, which are usually well separated. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes extremely small, varying in size with maximum diameter 0.06 mm and 7-11 ommatidia, circular, and moderately convex; malar space usually three times as long as diameter of eye or longer, but variable; distance between occipital margin and posterior margin of eye distinctly five times as long as diameter of eye or longer, but variable. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior portion incompletely marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small, sometimes unclear. Propodeal spine triangular, variable in length, usually extending beyond, sometimes just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, usually apart from margin by its diameter. Petiole short, as long as or slightly longer than high in profile, and slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process variously developed from weakly raised median longitudinal ridge to distinct projection. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline not or slightly projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view.

Head with slightly waved or straight rugae, sometimes also punctured; ventrolateral portion usually with longitudinal rugae and/or punctures, sometimes smooth and shining. Clypeus smooth and shining. Mesosoma with deep and longitudinal rugae with or without punctures. Forecoxa smooth and shining. Petiole and postpetiole usually with longitudinal rugae, sometimes with transverse or irregular rugae, or almost smooth and shining. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum usually shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole usually with 1-2 hairs on ventral surface. Head and mesosoma black, forecoxae reddish brown to yellowish brown, petiole, postpetiole and gaster black to reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, CHINA: Dahaoping, Gaoligongshan Mts., Tengchong Xian, Yunnan Prov., 10. x. 1996 (*S. Nomura*) (KUEC). Paratypes. 7 workers with same data as holotype (NSMT, KUEC, KUIC).

Other material examined. MALAYSIA: Malaya, Selangor, Gombak (*C. Betts*); Neg. Sembilan, Pasoh For. Res. (*M. Brendell, K. Jackson & L. Ficken*) (BMNH); Sabah, Kinabalu N. P., Poring Hot Springs, East Ridge (*C. Brühl*); Sabah, Kinabalu (*Burckhardt & Löbl*) (BMNH); Sabah, Crocker Range, KK-Tambunan, 1600 m (*Löbl & Burckhardt*) (BMNH); Sabah, Crocker Range, 1650 m (*Löbl & Burckhardt*) (BMNH); Sabah, KK-Tambunan, 1550 m-1650 m (*Löbl & Burckhardt*) (BMNH); Sabah, Crocker Range N. P., Gg. Emas Highland Res. (no collector's name). THAILAND: Sai Khao, Pattani Prov. (*H. Okido*); Kaeng Krachan NP. (*Löbl & Burckhardt*) (BMNH); Khao Soi Dao W. S., Chanthaburi Prov. (*H. Okido*); Kao Yai, Nakornratchasrima Prov. (Misspelling; Nakhon Ratchasima) (*W. Jaitrong; Löbl & Burckhardt*) (BMNH); Doi Chiang Dao, 500-600 m alt., nr. Chiang Mai (*H. Okido*); Doi Inthanon (*Löbl & Burckhardt*) (BMNH). INDONESIA: N. Sumatra, Brastagi, 1500 m (Rougemont); Sitiung, W. Sumatra (*F. Ito*); Sumatra, Padang (*no collector's name*) (BMNH); Rakata I., 150 m alt., Krakatau Is., S 06°09′xE 105°27′ (*H. Simbolon*); Rakata I., 50 m alt., Krakatau Is., S 06°09′xE 105°27′ (*K. Ogata*).

Remarks. *M. asiatica* does not belong to any species complex. But in terms of the body size, the masticatory margin of the mandible, relative length of the antennal scape, the shape of first gastral tergum, and the body sculpture, the species is similar to *M. sulawesiana* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Although differences between these two species are subtle, *M asiatica* can be distinguished from the latter by having small and circular eye comprising about 9 ommatidia. Some morphological characters of the species are variable, and the species is widely distributed in the Indo-Chinese and Indo-Malayan subregions. In the light of these facts, it may be possible that the species would be split into more than one species.

The species inhabits in soil and litter.

Distribution. CHINA: Yunnan Prov.; THAILAND: Nakhon Ratchasima Prov., Chanthaburi Prov., Phetchaburi Prov., Pattani Prov.; MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra, Rakata I. (Krakatau Is.).

***Myrmecina aspera* sp. nov.**

(Fig. 5)

Holotype worker. TL 3.14, HL 0.80, HW 0.77, CI 96, SL 0.77, SI 100, PW 0.54, ML 0.85.

Paratype worker. TL 3.06, HL 0.79, HW 0.75, CI 95, SL 0.72, SI 96, PW 0.51, ML 0.82 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin distinctly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible straight; apical tooth strong, third tooth robust, followed by unclear 4 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin projected, with or without three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles varies in size and shape, sometimes fused with each other at base. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex with maximum diameter 0.14 mm, with 7 ommatidia in the longest row; malar space slightly longer than diameter of eye in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye or shorter. Antennal scape long, extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum with denticles on dorsolateral portion, but small; anterior portion marginate; anterior ventrolateral portion projected directing downward. Furrow between pronotum and mesoepisternal projection narrow. Eumetanotal spine present but small. Propodeal spine broad and triangular, 1.5 times as long as broad at base or shorter, just reaching vertical posterior most limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle small, situated near the base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole short, slightly longer than high in profile, and longer than broad in dorsal view; dorsal crest located at mid-length in profile; subpetiolar process absent. Postpetiole as broad as petiole, and expanded posteriorly in dorsal view; dorsal outline flattened; ventral outline slightly projected rectangularly in profile.

Anterior margin of gaster concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with deep wavy rugae; ventrolateral portion with transverse, or vertical rugae posteriorly. Clypeus smooth and shining. Mesosoma with deep wavy rugae. Forecoxa almost smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively sparse and long pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum much longer than propodeal spine. Dorsal pilosity of petiole as long as that of mesosoma. Petiole without

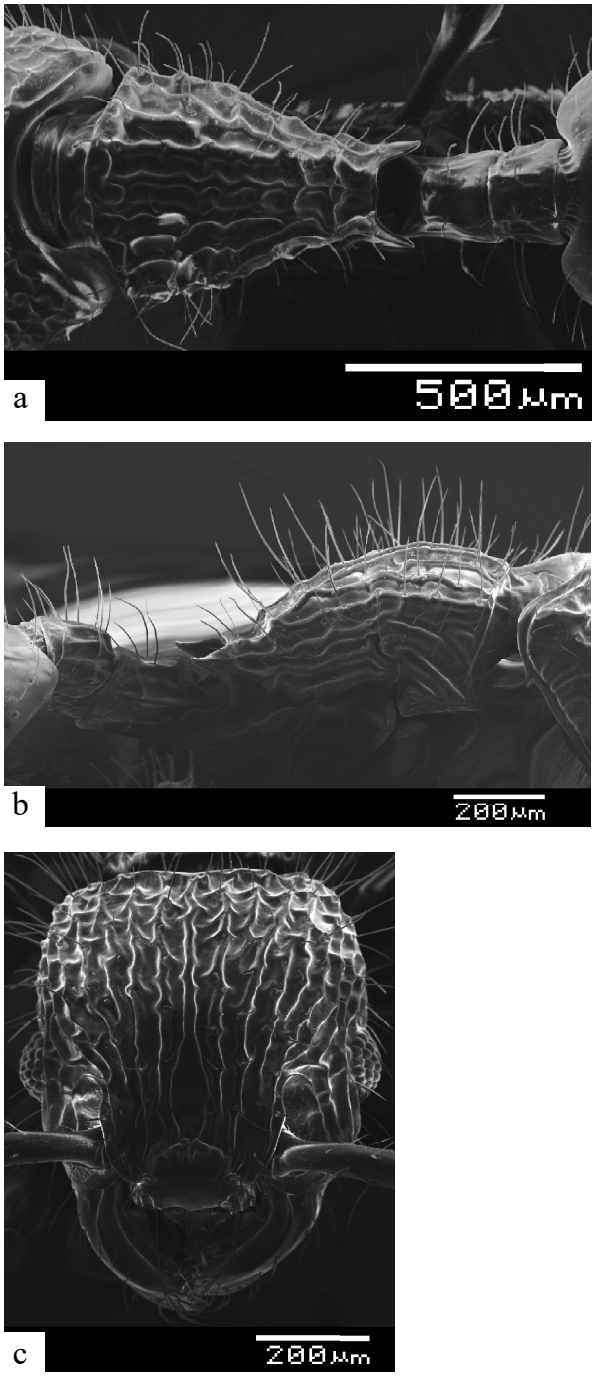


Fig. 5. ***Myrmecina aspera*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

hairs on ventral surface. Postpetiole with 4 hairs on ventral surface. Head and mesosoma black, petiole, postpetiole and gaster reddish brown, mandibles, antennae and legs yellowish brown to light reddish brown.

Holotype worker, MALAYSIA: Genting Highlands, 28. ix. 73 (*B. Bolton*) (BMNH). Paratype. 1 worker with same data as holotype (BMNH).

Other material examined. MALAYSIA: Fraser Hill, Pahang Prov., 1180 m (*Schillhammer*) (NHMW).

Remarks. *M. aspera* does not belong to any species complex. But in terms of the body size and the smooth and shining first gastral tergum with the concave anterior margin, *M. aspera* is similar to *M. elegans* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M. aspera* can be distinguished from the remains by having the broad and triangular propodeal spine, the sculptured dorsum of the pronotum, and the eye comprising 15 ommatidia or more.

Distribution. MALAYSIA: The Malay Pen.

***Myrmecina asthena* sp. nov.**

(Fig. 6)

Holotype worker. TL 3.07, HL 0.72, HW 0.62, CI 87, SL 0.54, SI 87, PW 0.43, ML 0.77.

Paratype workers. TL 2.86-2.98, HL 0.64-0.69, HW 0.56-0.61, CI 86-88, SL 0.51-0.56, SI 87-92, PW 0.38-0.42, ML 0.74-0.78 (5 measured).

Worker. Head subrectangular, longer than broad distinctly in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin feebly projected, with or without three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, which are well separated. Frontal carinae absent. Eyes extremely small circularly and not convex, varying in size with maximum diameter 0.05-0.06 mm and 5-8 ommatidia; malar space three times as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye distinctly five times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma convex to flattened in profile. Pronotum without denticles; anterior portion not marginate completely in dorsal view; anterior ventrolateral portion not angulate. Mesoepisternal projection reduced; cleavage between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, variable in length, usually extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, apart from margin by its diameter. Petiole long, longer than high in profile, and longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process with acute anterior apex, or median longitudinal ridge at ventral portion present. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened in profile; ventral outline clearly projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view.

Head densely punctured sometimes with unclear longitudinal rugae; ventrolateral portion usually punctured, rarely unclearly. Clypeus smooth and shining. Mesosoma with thin and straight rugae weakly. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 4 hairs on ventral surface. Body black to reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, CHINA: Dabei, 2440 m alt., Gaoligongshan Mts., Tengchong Xian, Yunnan Prov., 11. x. 1996 (*S. Nomura*)

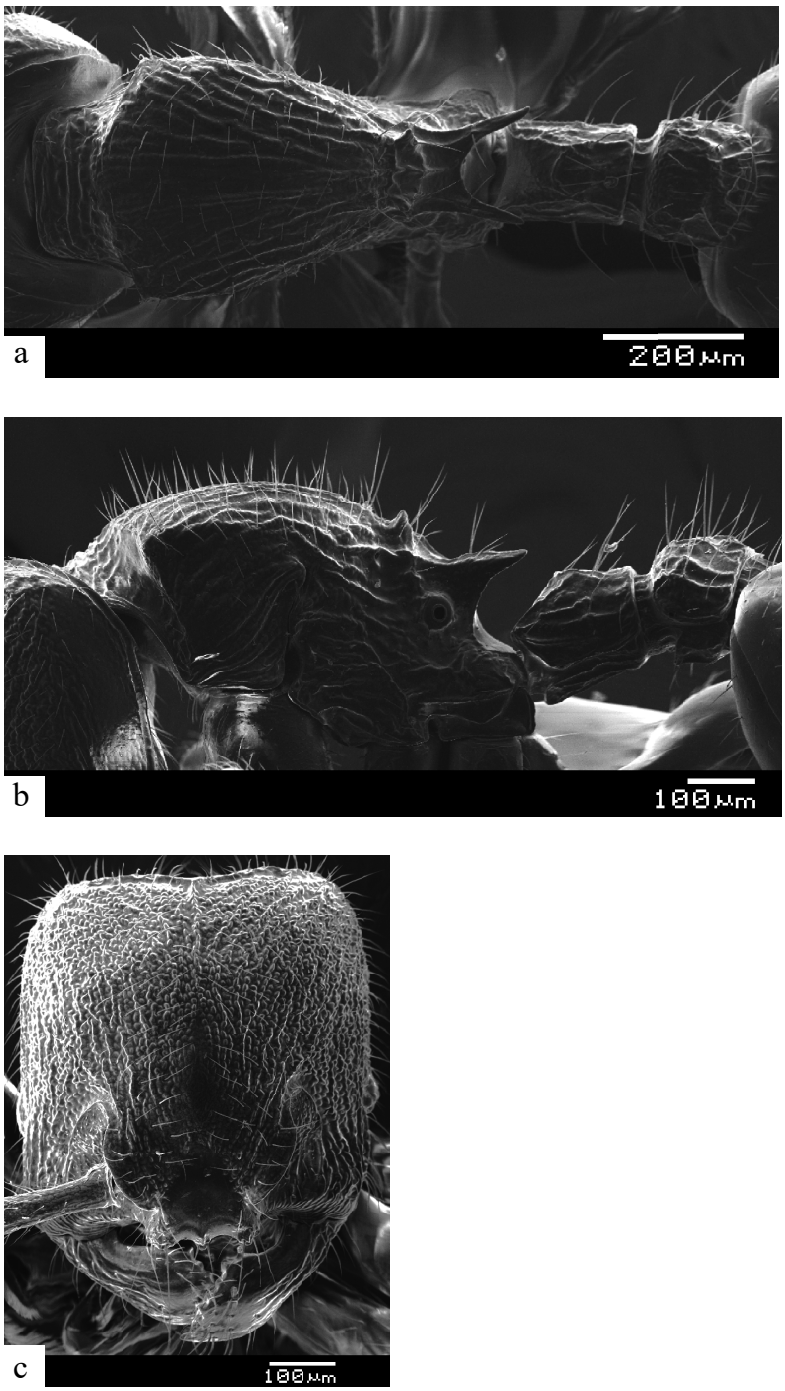


Fig. 6. *Myrmecina asthena* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

(KUEC).

Paratypes. 11 workers with same data as holotype. CHINA: 1 worker, Dahaoping Gaoligongshan Mts., Tengchong Xian, Yunnan Prov., 10. x. 1996 (*S. Nomura*); 1 worker, Huanxipo, Tengchong Xian, Yunnan Prov., 14. x. 1996 (*S. Nomura*) (KUEC, NSMT).

Other material examined. VIETNAM: Sin Chai, 1620 m alt., Sapa, Lao Cai Prov. (*B. T. Viet*); Thac Bac, 1820 m alt., Sapa, Lao Cai Prov. (*B. T. Viet*) (KUEC). MALAYSIA: Sabah, Crocker Range NP., Gg. Emas Highland Res., 1500-1700 m (no collector's name); Malaya, Gombak (*B. Bolton*) (BMNH).

Remarks. *M. asthena* does not belong to any species complex. But in terms of the head sculpture, relative length of the antennal scape, process of the clypeus, and shape and sculpture of the first gastral segment, *M. asthena* is similar to *M. lombokensis* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M asthena* can be distinguished from the remains by having the small and circular eye comprising about 6 ommatidia.

Distribution. CHINA: Yunnan Prov.; VIETNAM: Lao Cai Prov.; MALAYSIA: The Malay Pen., Borneo (Sabah).

***Myrmecina bandarensis* Forel**

(Fig. 7)

Myrmecina bandarensis Forel, 1913: 72. Syntype workers and queen, INDONESIA: Bandar Baroe, Sumatra, No. 598 (*V. Buttel*) (MHNG) [syntypes examined].

Worker. TL 2.48-2.60, HL 0.59-0.61, HW 0.60-0.62, CI 101-103, SL 0.51-0.56, SI 85-90, PW 0.37-0.38, ML 0.64-0.69 (3 measured).

Worker. Head subrectangular, shorter than broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles, fused with each other at base. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes extremely large and convex, and located at anterior portion near the mid point of head in profile, varying in size with maximum diameter 0.14-0.16 mm and 7-8 ommatidia; malar space as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye 1.5 times as long as diameter of eye. Antennal scape long, extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior portion not marginate; anterior ventrolateral portion more or less projected; anterior dorsolateral portion rounded. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, longer than broad at base, just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole short, as long as high in profile, and slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process absent. Postpetiole as broad as petiole in dorsal view; dorsal outline flattened in profile; ventral outline slightly projected rectangularly.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae which are thick and longitudinal; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with straight rugae which are thick and longitudinal. Forecoxa smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head and mesosoma with relatively sparse and long pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 4 hairs on ventral surface. Body brown to reddish brown, mandibles, antennae, and legs yellowish brown.

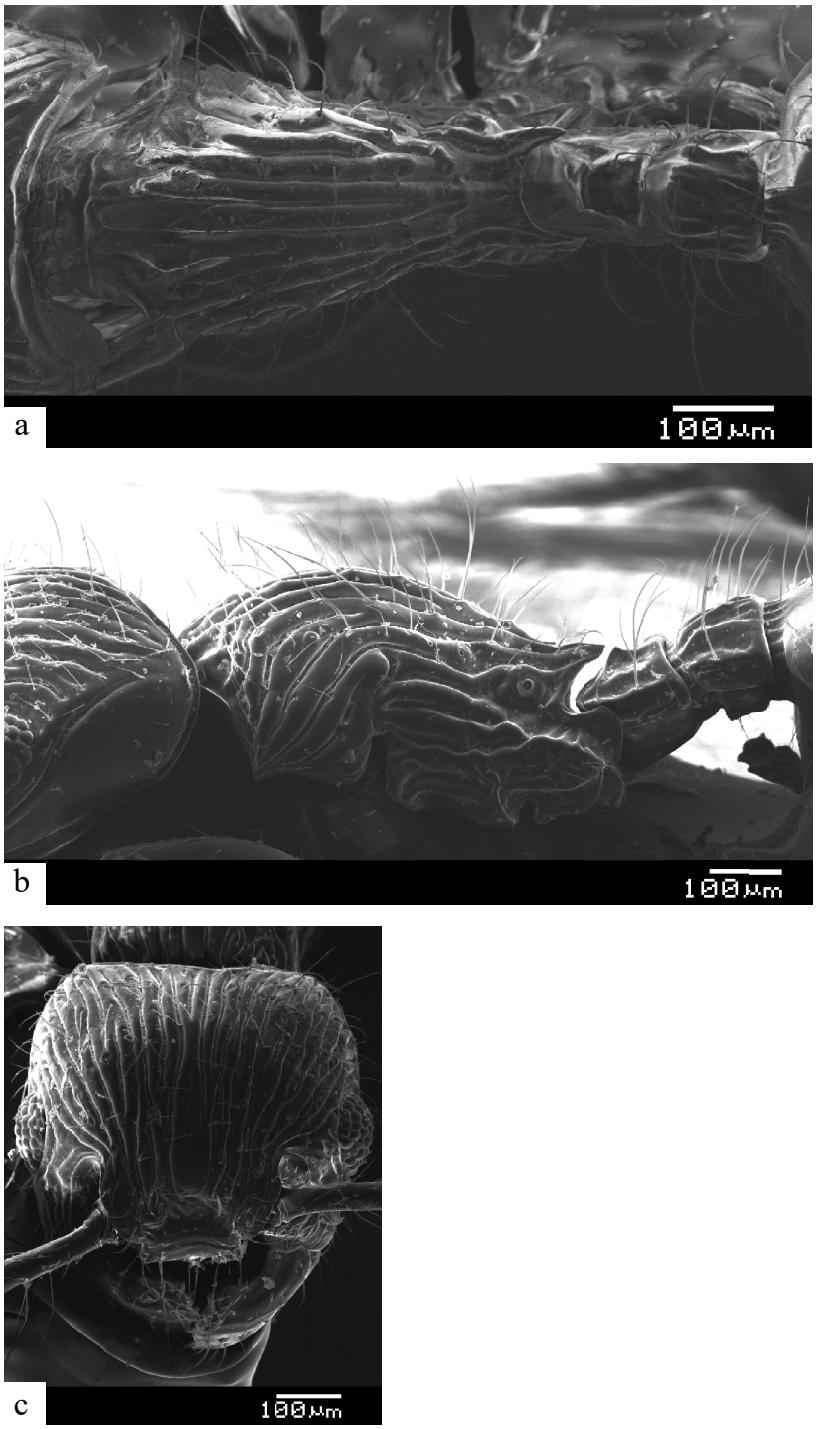


Fig. 7. *Myrmecina bandarensis* Forel. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Remarks. *M. bandarensis* does not belong to any species complex. But in terms of the large eye and the head shape, the species is similar to the species of the *macrops* complex and *M. maryatiae* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. *M bandarensis* can be distinguished from the latters by having the sculptured head and the long antennal scape.

Distribution. INDONESIA: Sumatra.

Myrmecina boltoni sp. nov.

(Fig. 8)

Holotype worker. TL 3.87, HL 0.91, HW 0.88, CI 96, SL 0.87, SI 99, PW 0.59, ML 1.09.

Paratype workers. TL 3.51-4.46, HL 0.84-1.08, HW 0.82-1.04, CI 93-100, SL 0.80-0.91, SI 88-100, PW 0.53-0.67, ML 1.04-1.22 (6 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin flattened or slightly concave;

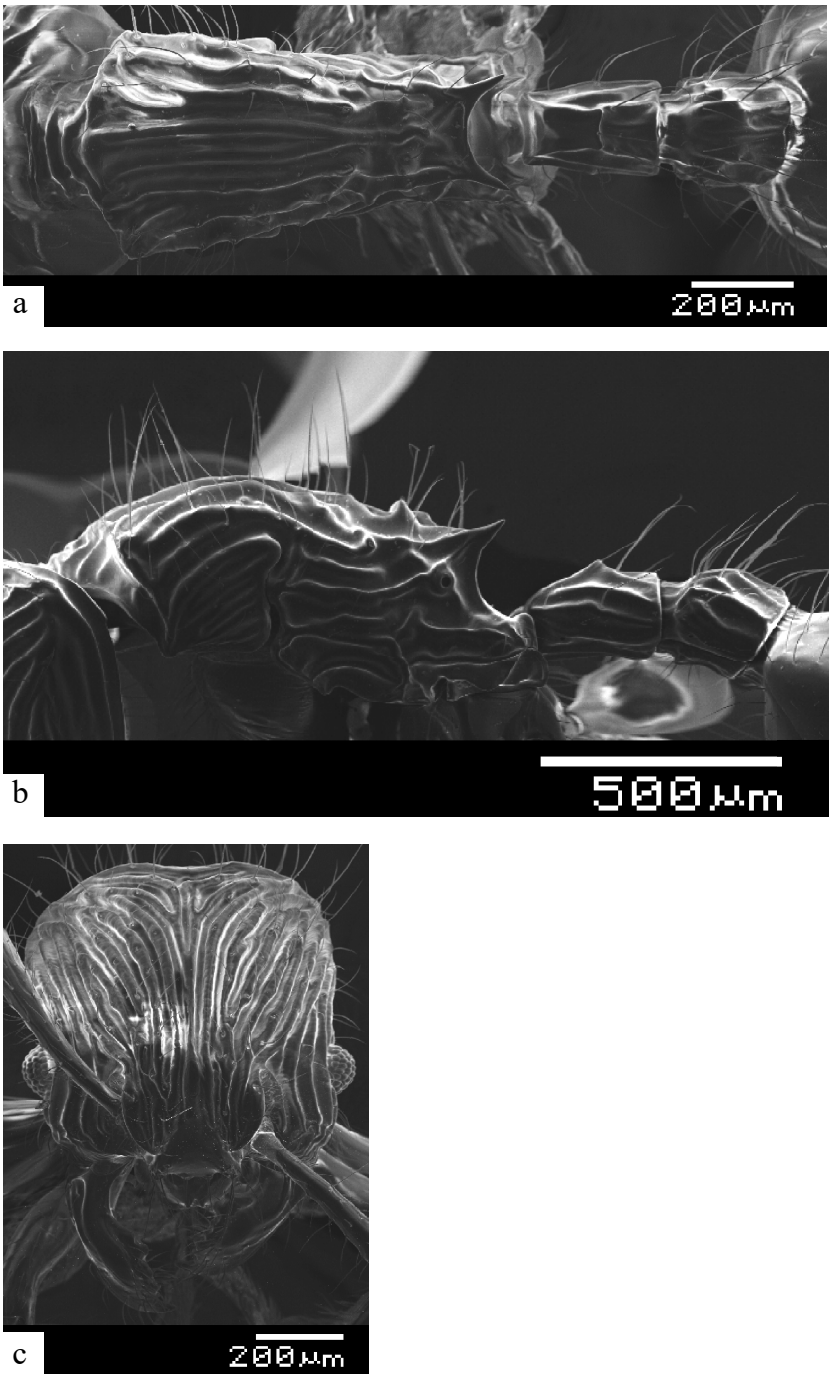


Fig. 8. *Myrmecina boltoni* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus concave; median portion of anterior margin slightly projected with two or four processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and distinctly convex, varying in size with maximum diameter 0.11-0.16 mm and 5-10 ommatidia; malar space longer than diameter of eye in profile; distance between occipital margin and posterior margin of eye twice as long as diameter of eye or longer. Antennal scape long, extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum with small denticles but unclearly; anterior portion not marginate; anterior ventrolateral portion usually angulate, sometimes not angulate. Furrow between pronotum and mesoepisternal projection narrow, sometimes relatively broad. Eumetanotal spine long. Propodeal spine triangular, variable in length, not or just reaching vertical posteriormost limit of propodeum in profile; as long as broad at base or longer. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole long, longer than high in profile, and slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process and median longitudinal ridge usually absent. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline slightly projected with two tops.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae distinctly; ventrolateral portion with also deep and straight rugae longitudinally but frequntly smooth and shining. Clypeus smooth and shining. Mesosoma with thick rugae longitudinally. Forecoxa with transverse rugae. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with sparse and long pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum longer than propodeal spine. Petiole with or without 1-4 hairs on ventral surface. Postpetiole with 2-8 hairs on ventral surface. Head, mesosoma, forecoxae, petiole and postpetiole black, gaster reddish brown, mandibles, antennae and legs yellowish brown to brown.

Holotype worker, INDONESIA: Sulawesi, Utara, G. Muajat, 1780 m, 16. ix. 1985 (*no collector's name*) (BMNH).
Paratypes. 4 workers and 1 male with same data as holotype; 3 workers with same data as holotype but 25. i. 1985; 2 workers with same data as holotype but Summint area, ca 1780 m, 24. v. 1985 (BMNH).

Other material examined. INDONESIA: Sulawesi, Utara, Dumoga-Bone N. P., 12?. ix. 1985 (*no collector's name*) (BMNH).

Remarks. *M. boltoni* does not belong to any species complex. But in terms of the simple petiole without the subpetiolar process nor median longitudinal ridge, relative length of the antennal scape, and the mesosoma with the eumetanotal spine, *M. boltoni* is similar to *M. monticola* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M boltoni* can be distinguished from the remains by having the anterior clypeal margin with median paired processes and the sculptured forecoxa.

Distribution. INDONESIA: Sulawesi.

***Myrmecina breviata* sp. nov.**
(Fig. 9)

Holotype worker. TL 2.60, HL 0.65, HW 0.61, CI 94, SL 0.61, SI 100, PW 0.42, ML 0.70.

Paratype worker. TL 2.59, HL 0.66, HW 0.64, CI 98, SL 0.59, SI 93, PW 0.42, ML 0.70 (1 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin flattened; occipital corners widely rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a stout basal tooth bearing blunt apex; small teeth unclear. Dorsal surface of clypeus slightly concave; median portion of anterior margin weakly projected with a median process but the process frequently unclear; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, closed to each other. Frontal carinae very short, frequently unclear, running to about mid point level

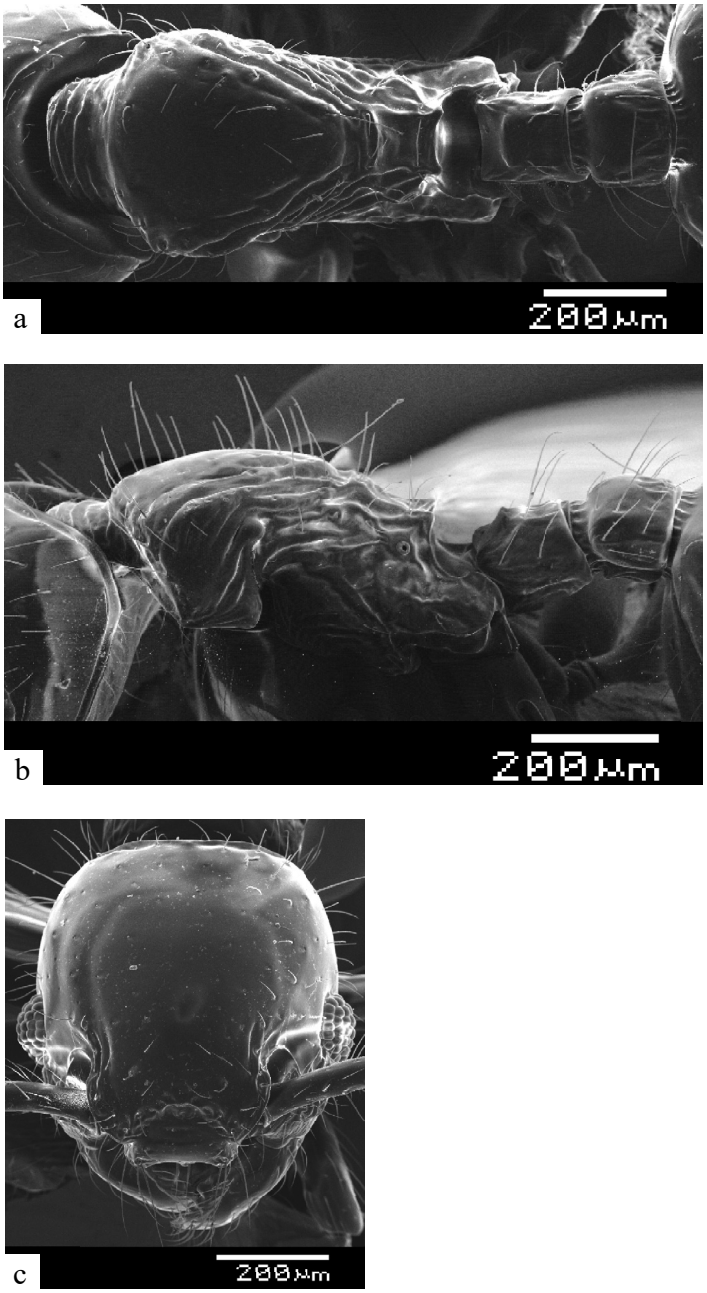


Fig. 9. *Myrmecina breviata* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

of eyes. Eyes extremely large and convex, varying in size with maximum diameter 0.15-0.16 mm and 7-8 ommatidia; malar space as long as diameter of eye in profile. Antennal scape long, extending beyond posterolateral corner of head distinctly; antennal flange weakly developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior ventrolateral portion not angulate. Eumetanotal spine absent. Propodeal spine only angulately projected, not spine-like. Propodeal lobe feebly raised. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum slightly longer than diameter of spiracle. Petiole long, longer than high in profile, and longer than broad in dorsal view; small but distinct dorsal crest located almost at midlength in profile; subpetiolar process absent or unclear; ventral outline flattened or slightly convex. Postpetiole broader than petiole in dorsal view; anterior side corners rounded; dorsal outline slightly convex or flattened in profile; ventral outline projected rectangularly.

Anterior margin of gaster not concave in dorsal view.

Head smooth and shining; ventrolateral portion smooth and shining. Mandibles smooth and shining, frequently yellow spots on dorsal surface. Clypeus smooth and shining. Mesosoma largely smooth and shining, lateral portion with a few longitudinal rugae on dorsum. Petiole with shallow rugae. Postpetiole smooth and shining on dorsum. Head with sparse pilosity on dorsum. Mesosoma with sparse pilosity on dorsum. Pilosity of pronotum slightly shorter than maximum diameter of eye. Pilosity of petiole and postpetiole as long as that of mesosoma. Petiole without hairs on ventral surface. Postpetiole with about 4 hairs on ventral surface. Head, mesosoma, petiole and postpetiole reddish brown, gaster slightly darker than head and mesosoma.

Holotype worker, PHILIPPINES: Luzon, Lagunas, Mt. Makiling, 21. xi. 1995 (*I. Löbl*) (BMNH).
Paratype. 1 worker with same data as holotype (BMNH).

Other material examined. PHILIPPINES: Luzon, Lagunas, Mt. Banahaw above Kinabuhayan, 600-700 m, trail to Crystalino (*J. Kodada & B. Rigová*) (NHMW).

Remarks. *M. breviata* forms the *macrops* complex comprising *M. breviata, M. gymnocephala* sp. nov. and *M. macrops* sp. nov. This species is different from the related species in having the angulately projected propodeal spine.

Distribution. PHILIPPINES: Luzon.

Myrmecina butteli Forel

Myrmecina butteli Forel, 1913: 71. Syntype worker, INDONESIA: Tandjong Slamat, Sumatra (*Buttel-Reepen*?) (depository unknown) [not seen].

Diagnosis of worker. The following description is based on Forel (1913). Mandible smooth and shining. Masticatory margin of mandible with 6-7 teeth. Anterior margin of clypeus slightly concave. Mid point of head length as long as broad. Sides of head convex strongly. Occipital margin slightly concave. Eyes small and much convex. Antennal scape reaching occipital margin. Mesosoma convex strongly without suture. Anterodorsal portion of pronotum marginated. Propodeal spine triangular, slightly longer than broad at base. Petiole slightly longer than broad. Postpetiole slightly broader than length, and slightly broader than petiole. Head with thick and diverging rugae. Mesosoma with thick rugae. Constricted anterior portion of pronotum with transverse rugae

posteriorly. Petiole with longitudinal rugae. Body black, mandibles, antennal scapes, femora and tibiae brown, funiculus, and tarsi reddish brown.

Remarks. We have not been able to examine type material of *M. butteli*.

Distribution. INDONESIA: Sumatra.

***Myrmecina celebensis* sp. nov.**

(Fig. 10)

Holotype worker. TL 2.18, HL 0.53, HW 0.48, CI 91, SL 0.42, SI 87, PW 0.33, ML 0.56.

Paratype worker. TL 2.31, HL 0.54, HW 0.50, CI 93, SL 0.40, SI 81, PW 0.34, ML 0.59 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin feebly projected without a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes small circularly and moderately convex, varying in size with maximum diameter 0.05-0.06 mm and 6-9 ommatidia; malar space twice as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape short, not reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma more or less flattened in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection relatively broad. Eumetanotal spine present. Propodeal spine triangular, longer than broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, apart from margin by its diameter. Petiole short, slightly longer than high in profile, longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process variously developed from weakly raised median longitudinal ridge to distinct projection. Postpetiole broader than petiole, 1.5 times as broad as its length except for helcium in dorsal view; anterolateral portion rounded; dorsal outline flattened in profile; ventral outline projected rectangularly with two tops.

Anterior margin of gaster not concave.

Head with thin and weakly waved rugae; ventrolateral portion with longitudinal or oblique rugae weakly. Clypeus smooth and shining. Mesosoma with thin and longitudinal rugae. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral tergum punctured distinctly dorsally. First gastral sternum rugulose at anterior and lateral portion. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole and postpetiole without hairs on ventral surface. Head and mesosoma black to dark reddish brown, petiole and postpetiole reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Sulawesi, Tengah, nr. Morowali, Ranu River Area, 27. i-20. iv. 1980 (*M. J. D. Brendell*) (BMNH). Paratype. 1 worker with same data as holotype (BMNH).

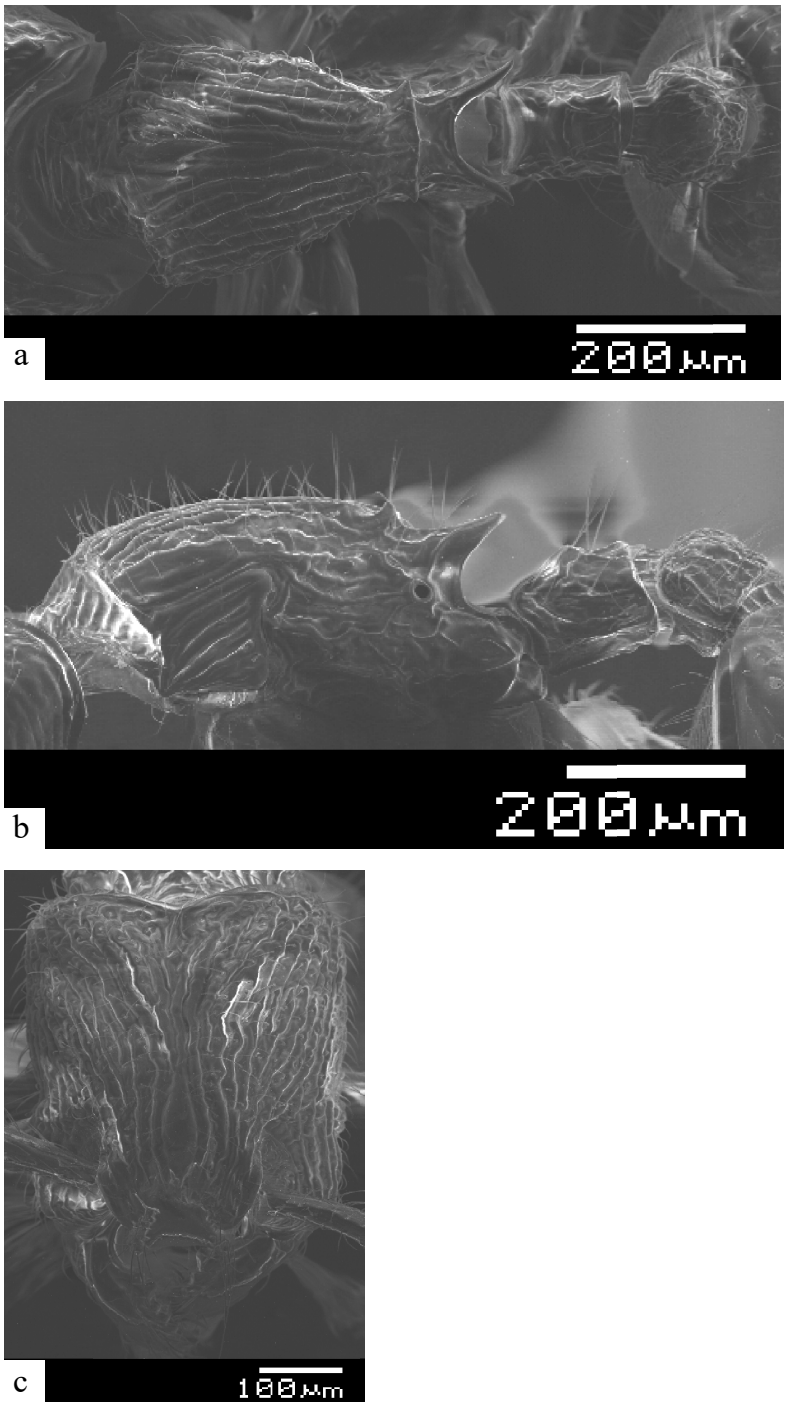


Fig. 10. ***Myrmecina celebensis*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

Remarks. *M. celebensis* does not belong to any species complex. Among those species, *M. celebensis* can be distinguished from the remains by having the anterior clypeal margin without processes and the propodeal spine longer than broad at base.

Distribution. INDONESIA: Sulawesi.

***Myrmecina curvispina* Zhou, Huang & Ma**

(Fig. 11)

Myrmecina curvispina Zhou, Huang & Ma, 2008: 286. Holotype worker, CHINA: Maoershan Natural Reserve, Xing'an County, Guangxi Province (25°54' N, 110°30' E), August 22, 1998 (*Shanyi Zhou*). [Insect Collection, College of Life Sciences, Guangxi Normal University, Guilin, China]. [not examined].

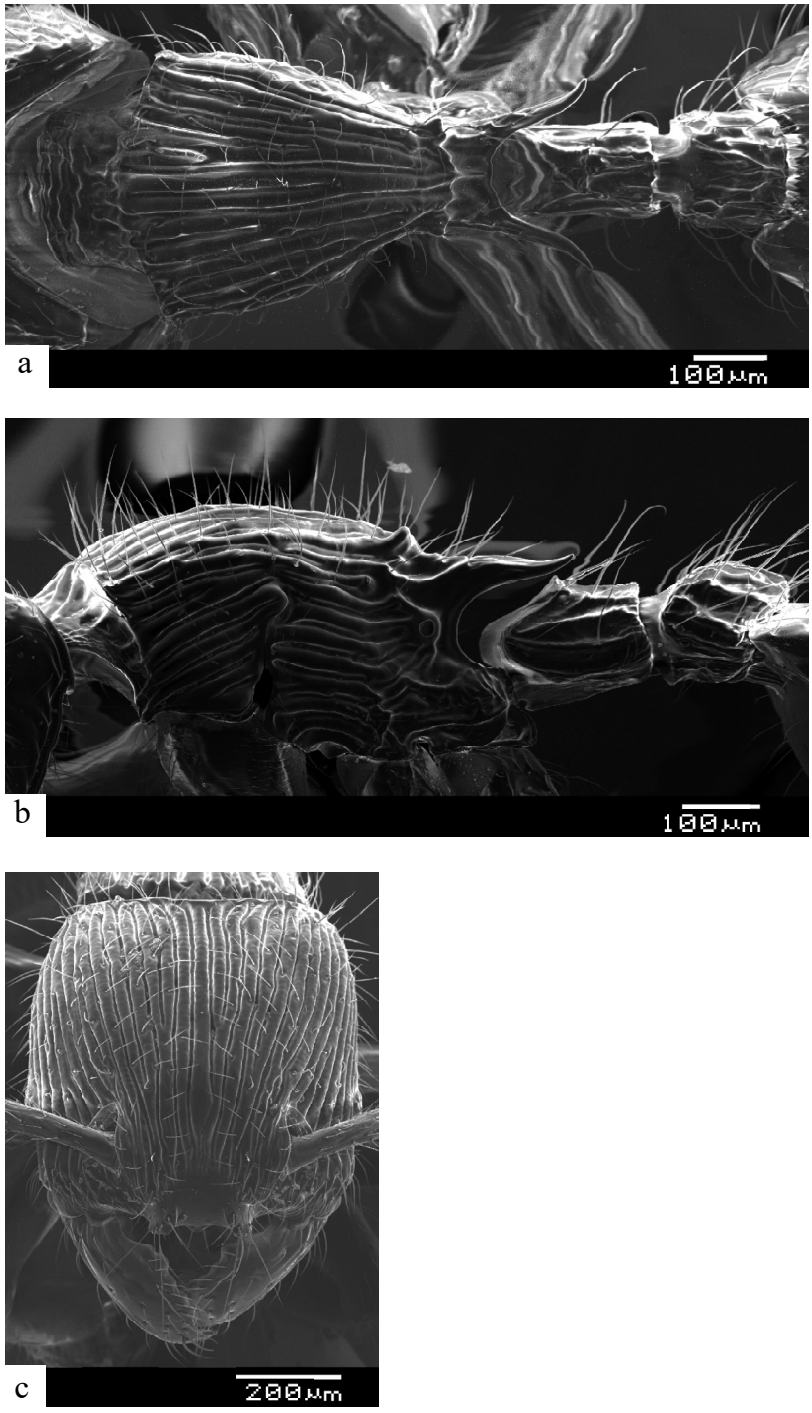


Fig. 11. *Myrmecina curvispina* Zhou, Huang & Ma. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Workers. TL 2.82-3.25, HL 0.67-0.77, HW 0.66-0.77, CI 98-102, SL 0.52-0.61, SI 77-83, PW 0.43-0.54, ML 0.70-0.83 (11 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin concave or straight; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal blunt tooth; small teeth frequently unclear; apical tooth completely fused with preapical tooth; apical tooth about twice as long as preapical tooth. Dorsal surface of clypeus strongly concave; median portion of anterior margin projected and concave with distinct three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired distinct denticles. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes small and not convex, varying in size with maximum diameter 0.06-0.11 mm and 4-6 ommatidia. Antennal scape short, just reaching posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticle on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion with denticle directing forward and downward. Furrow between pronotum and mesoepisternal projection more or less broad. Eumetanotal spine present but small. Propodeal spine elongate, directing backward, extending over vertical posteriormost limit of propodeum in profile; apex of spines curved upward distinctly. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole short, slightly longer than high in profile, and slightly longer than broad in dorsal view; small but distinct dorsal crest located at midlength in profile; subpetiolar process small, usually forming acute anterior apex. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline distinctly projected with acute anterior apex.

Anterior margin of gaster concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with thin rugae longitudinally; ventrolateral portion smooth and shining. Dorsal surface of mandible sometimes appears paired yellow spots. Clypeus smooth and shining. Mesosoma with thin rugae longitudinally on dorsal and lateral portion. Forecoxa smooth and shining. Petiole and postpetiole with a few distinct rugae. First gastral tergum punctured or rugulose weakly dorsally. First gastral sternum smooth and shining. Head with sparse and long pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum slightly shorter than propodeal spine. Dorsal pilosity of petiole as long as that of mesosoma. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body black, mandibles, antennae and legs yellowish brown, forecoxae reddish brown.

Other material examined. VIETNAM: Cuc Phuong N. P., Nho Quan Dist., Ninh Binh Prov., 11. viii. 1998, VN98-HO-022 (*H. Okido*) (IEBR); Cuc Phuong N. P., Nho Quan Dist., Ninh Binh Prov., 11. viii. 1998, VN98-HO-021 (IEBR, KUEC, KUIC); Tam Dao, 900-1240 m alt., Vinh Phuc Prov. (*Sk. Yamane*).

Remarks. *M. curvispina* forms to the *M. gracilis* complex comprising *M. cuvispina, M. gracilis* sp. nov. and *M. raviwonghei*. The definition and the distribution of the *M. gracilis* complex are given in the latter section. Among those species, *M. curvispina* can be distinguished from the remains by having the smooth and shining first gastral sternum.

Distribution. VIETNAM: Vinh Phuc Prov., Ninh Binh Prov.

***Myrmecina dasynota* sp. nov.**

(Fig. 12)

Holotype worker. TL 2.31, HL 0.56, HW 0.51, CI 91, SL 0.45, SI 88, PW 0.35, ML 0.59.

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin flattened; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin feebly projected without a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other. Frontal carinae present but very short,

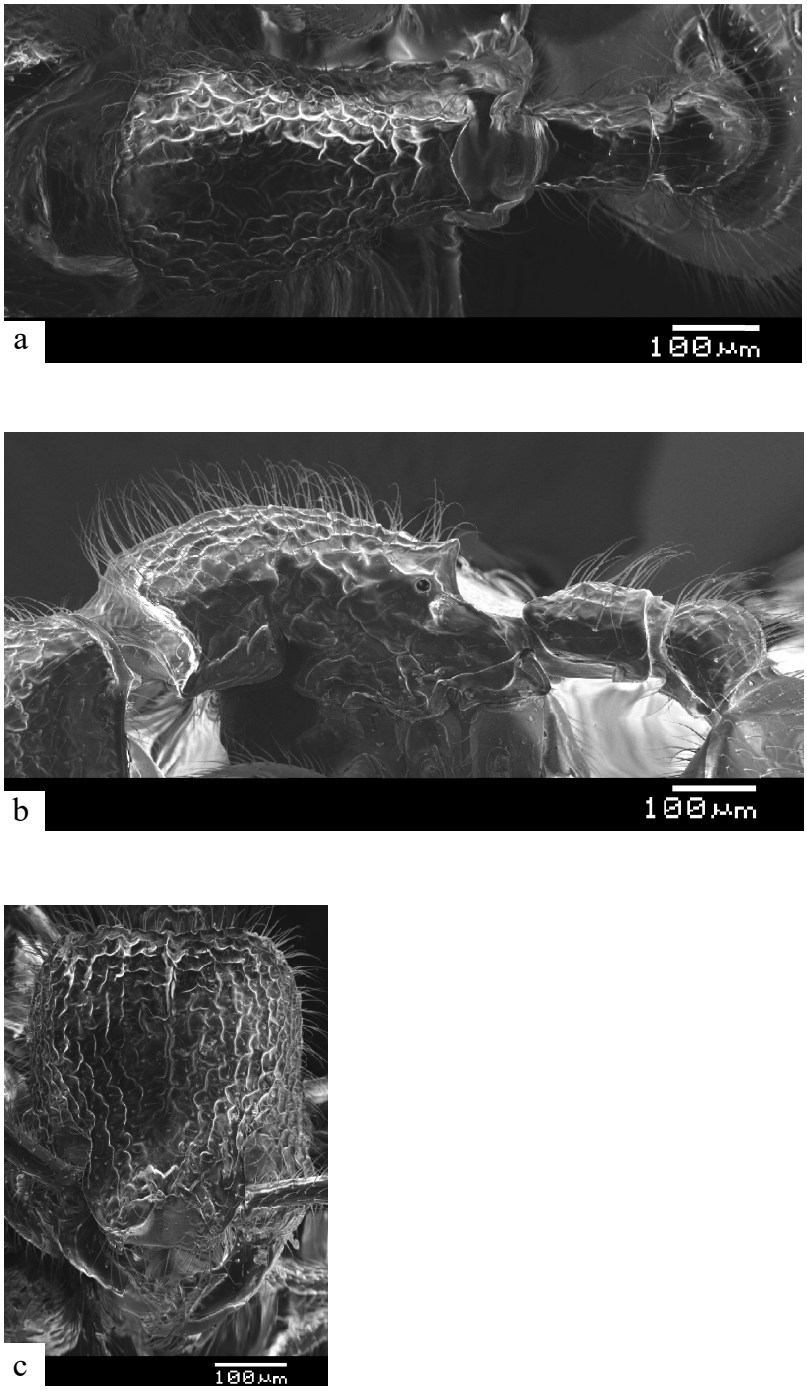


Fig. 12. *Myrmecina dasynota* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

running back to the level of the posterior margin of the eyes. Eyes extremely small circularly and moderately convex with maximum diameter 0.05 mm, with 6 ommatidia; malar space twice as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but much reduced and unclear. Propodeal spine only angulately projected, not spine-like in profile. Propodeal lobe low. Propodeal spiracle very large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum shorter than diameter of spiracle. Petiole long, longer than high in profile, and longer than broad in dorsal view; dorsal crest absent; subpetiolar process absent. Postpetiole slightly broader than petiole in dorsal view; dorsal outline largely convex in profile; ventral outline slightly projected with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with irregular rugae which are thin; ventrolateral portion feebly sculptured but shining. Clypeus smooth and shining. Mesosoma with waved rugae which are thin and longitudinal. Forecoxa smooth and shining. Petiole and postpetiole weakly sculptured. First gastral segment smooth and shining. Head with extremely dense, and relatively long pilosity on dorsum. Mesosoma with extremely dense, and relatively long pilosity on dorsum, hairs of pronotum much longer than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 8 hairs on ventral surface. Body yellow.

Holotype worker, MALAYSIA: Sabah, Gn. Silam, 620 m, 1983 (*R. Leakey*) (BMNH).

Remarks. *M. dasynota* does not belong to any species complex. The species is a distinctive species in having the yellow body color, the extremely dense pilosity and the small eye comprising about 10 ommatidia.

Distribution. MALAYSIA: Borneo (Sabah).

***Myrmecina dechai* sp. nov.**

(Fig. 13)

Holotype worker. TL 2.62, HL 0.59, HW 0.62, CI 105, SL 0.46, SI 74, PW 0.43, ML 0.67.

Paratype workers. TL 2.68-2.69, HL 0.61-0.62, HW 0.62, CI 100-103, SL 0.46-0.48, SI 74-77, PW 0.42, ML 0.59-0.67 (2 measured).

Worker. Head subrectangular, as long as or slightly longer than broad in full-face view; median portion of occipital margin flattened; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with a small median process or three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, which are relatively well separated. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes small and usually convex moderately, varying in size with maximum diameter 0.07-0.08 mm and 12-13 ommatidia; malar space twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye. Anten-

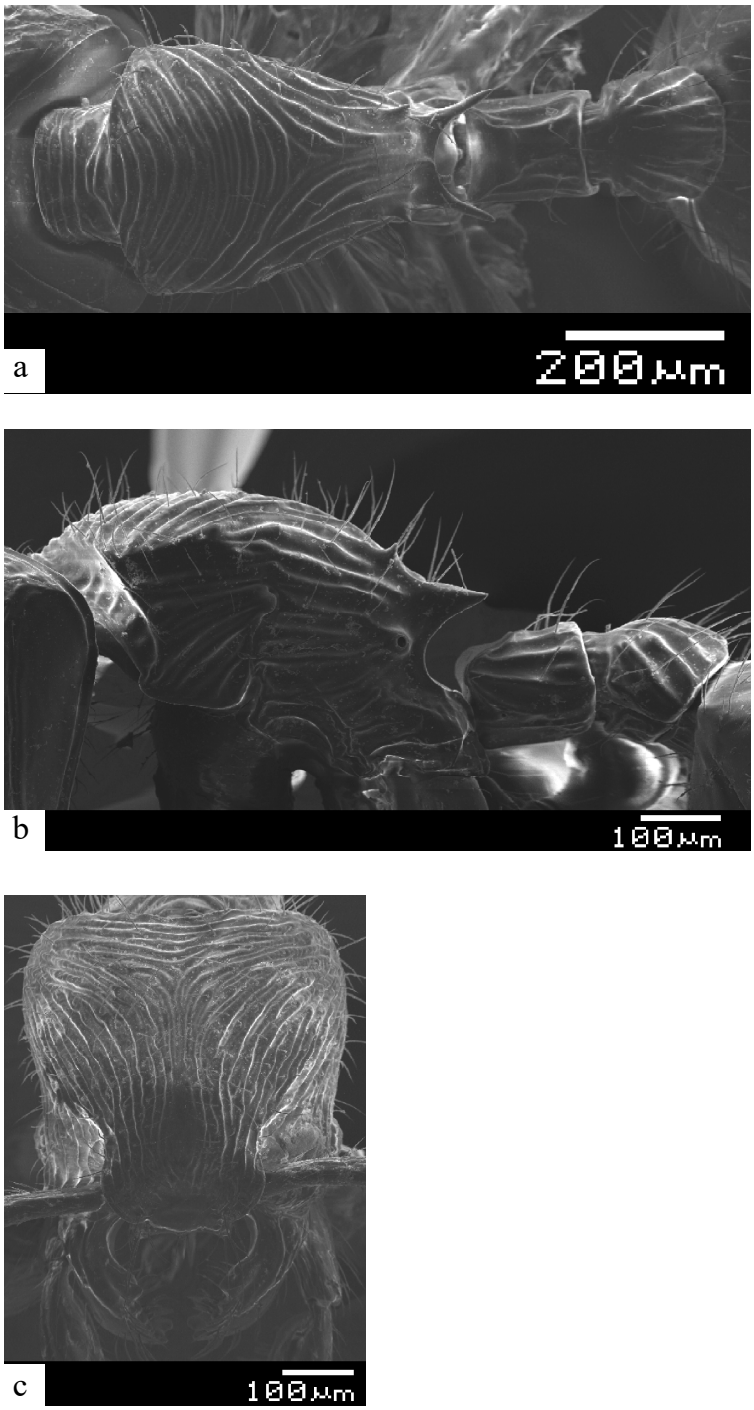


Fig. 13. *Myrmecina dechai* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

nal scape short, not reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection usually broad sometimes narrow. Eumetanotal spine present but small. Propodeal spine triangular, as long as broad at base, feebly extending over vertical posteriormost limit of propodeum in profile; tips directing outward in dorsal view. Propodeal lobe low. Propodeal spiracle small, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum variable, as long as diameter of spiracle or longer. Petiole short, as long as high in profile, slightly longer than broad in dorsal view; dorsal crest absent;

subpetiolar process absent. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened in profile; ventral outline slightly projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head weakly punctured with longitudinal rugae diverging posteriorly on occipital portion, and transverse rugae running along occipital carina; ventrolateral portion with longitudinal rugae weakly, but shining. Clypeus smooth and shining. Mesosoma weakly punctured with transverse rugae on anterior portion, and longitudinal rugae on posterior portion. Forecoxa almost smooth and shining. Petiole and postpetiole with distinct longitudinal rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2 hairs on ventral surface. Body and forecoxae black to reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, THAILAND: Kaeng Krachan N. P., 17. xi. 85 (*I. Löbl & D. Burckhardt*) (BMNH).
Paratypes. 2 workers with same data as holotype; 2 workers with same data as holotype but 19. xi. 85 (BMNH).

Remarks. *M. dechai* does not belong to any species complex. But in terms of the mesosoma with transverse rugae and relative length of the antennal scape, *M. dechai* is similar to *M. poringensis* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M. dechai* can be distinguished from the remains by having the triangular propodeal spine pointing backward.

Distribution. THAILAND: Phetchaburi Prov.

***Myrmecina dolichothrix* sp. nov.**
(Fig. 14)

Holotype worker. TL 2.74, HL 0.62, HW 0.61, CI 97, SL 0.58, SI 95, PW 0.44, ML 0.72.
Paratype workers. TL 2.60-2.75, HL 0.58-0.63, HW 0.58-0.61, CI 96-101, SL 0.54-0.61, SI 93-100, PW 0.42-0.45, ML 0.69-0.72 (5 measured).

Worker. Head subrectangular, slightly longer than broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4 small teeth and a small basal tooth; small teeth frequently unclear. Dorsal surface of clypeus not concave; median portion of anterior margin projected and flattened without a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles very small but distinct. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex, varying in size with maximum diameter 0.10-0.11 mm and 6-7 ommatidia; malar space much twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye or shorter. Antennal scape long, extending beyond posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion angulate. Mesoepisternal projection not developed; furrow between pronotum and mesoepisternal projection relatively broad. Eumetanotal spine absent. Propodeal spine elongate, 1.5 times as long as broad at base, extending over vertical posteriormost limit

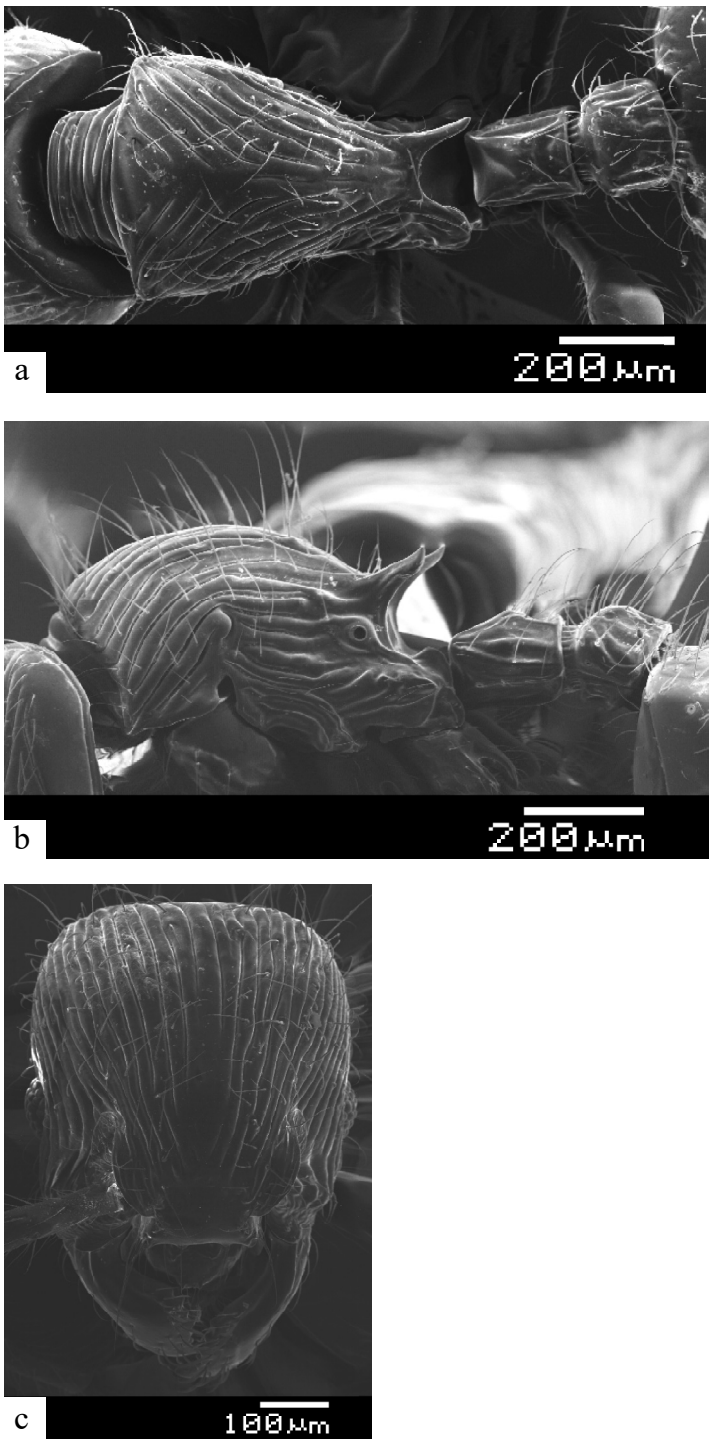


Fig. 14. *Myrmecina dolichothrix* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

of propodeum in profile. Propodeal lobe usually low, but sometimes raised. Propodeal spiracle large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum shorter than diameter of spiracle. Petiole long, slightly longer than high in profile, and longer than broad in dorsal view; very small dorsal crest located at midlength in profile; subpetiolar process absent, but median longitudinal ridge at ventral portion present. Postpetiole slightly broader than petiole in dorsal view; lateral margin straight; dorsal outline flattened in profile; ventral outline projected rectangularly.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with oblique rugae on dorsum. Forecoxa smooth and shining. Petiole and postpetiole with a few distinct rugae. First gastral segment smooth and shining. Head with sparse and long pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum slightly longer than propodeal spine. Dorsal pilosity of petiole as long as that of mesosoma. Petiole without hairs on ventral surface. Postpetiole usually without hairs on ventral surface. Body black or dark reddish brown, mandibles, antennae and legs yellowish brown to reddish brown.

Holotype worker, PHILIPPINES: Surigao del N, SW Bacuag, Payapag, Little Baguio Waterfall, 6. ii. 2000 (*S. Schödl*) (NHMW). Paratypes. 5 workers with same data as holotype (NHMW).

Remarks. *M. dolichothrix* does not belong to any species complex. But in terms of the body size, head shape, body sclupture, and the shape of the propodeal spine, *M. dolichothrix* is similar to *M. gopa* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M. dolichothrix* can be distinguished from the remains by having the long pilosity and the anterior clypeal margin without processes.

Distribution. PHILIPPINES: Mindanao.

***Myrmecina elegans* sp. nov.**

(Fig. 15)

Holotype worker. TL 3.42, HL 0.84, HW 0.72, CI 86, SL 0.69, SI 96, PW 0.48, ML 0.94.

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth. Dorsal surface of clypeus concave; median portion of anterior margin slightly projected with a median process or three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, which are relatively well separated. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes extremely small circularly and moderately convex with maximum diameter 0.06 mm, with 8 ommatidia; malar space distinctly twice as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye distinctly four times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Mesosoma slender in profile. Pronotum without denticles on anterior dorsolateral portion; anterior portion not marginate; anterior ventrolateral portion not angulate. Mesoepisternal projection much reduced; furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present. Propodeal spine elongate, much longer than broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole long, longer than high in profile, and much longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process present, bearing acute anterior apex. Postpetiole expanded posteriorly as broad as petiole in dorsal view; dorsal outline flattened in profile; ventral outline slightly projected rectangularly without acute anterior apex.

Anterior margin of gaster slightly concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

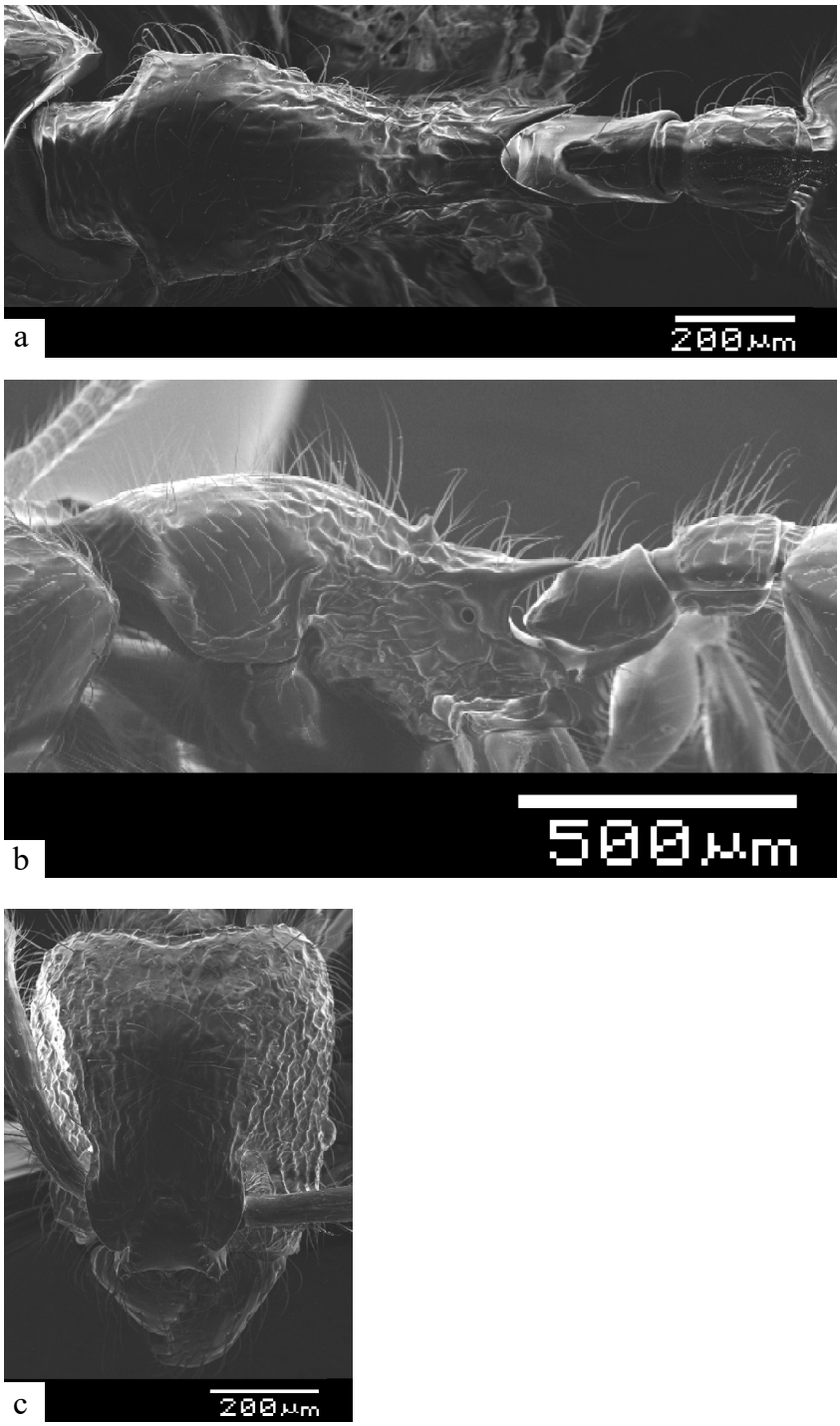


Fig. 15. *Myrmecina elegans* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Head with irregular rugae which are thin; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma feebly sculptured, but almost smooth and shining. Forecoxa smooth and shining. Petiole and postpetiole smooth and shining. First gastral segment smooth and shining. Head with dense and long pilosity on dorsum. Mesosoma with dense and long pilosity on dorsum, hairs of pronotum slightly shorter than propodeal spine. Petiole with 2 hairs on ventral surface. Postpetiole with 8 hairs on ventral surface. Body yellowish brown.

Holotype worker, MALAYSIA: Sabah, Kinabalu, 1880 m, 26. iv. 87 (*Burckhardt & Löbl*) (BMNH).

Remarks. *M. elegans* does not belong to any species complex. But *M. elegans* is similar to *M. aspera* sp. nov. on the basis of some characters (see the remarks of *M. aspera*). Among those species, *M. elegans* can be distinguished from the remains by having the elongate propodeal spine, the smooth and shining dorsum of the pronotum, and the eye comprising 10 ommatidia or less.

Distribution. MALAYSIA: Borneo (Sabah).

***Myrmecina glabra* sp. nov.**

(Fig. 16)

Holotype worker. TL 2.06, HL 0.50, HW 0.46, CI 94, SL 0.38, SI 83, PW 0.34, ML 0.53.

Paratype worker. TL 2.04, HL 0.50, HW 0.48, CI 95, SL 0.38, SI 80, PW 0.34, ML 0.51 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected and concave; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles small and blunt, close to each other. Frontal carinae present but very short and unclearly, running back to the level of the posterior margin of the eyes. Eyes very small and moderately convex, varying in size with maximum diameter 0.06-0.08 mm and 11-13 ommatidia; malar space two times as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye. Antennal scape short, not reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion not marginate; anterior ventrolateral portion slightly projected. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, as long as broad at base, feebly extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole short, slightly longer than high in profile, and longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process much reduced; ventral outline slightly concave. Postpetiole broader than petiole in dorsal view; lateral margin almost straight; dorsal outline flattened in profile; ventral outline projected with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head completely smooth and shining on dorsum and ventrolateral portion. Clypeus smooth and shining. Mesosoma completely smooth and shining. Forecoxa smooth and shining. Petiole and postpetiole with weak irregular rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum as long as or slightly shorter than propodeal spine. Petiole and postpetiole without hairs on ventral surface. Body black to reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, MALAYSIA: Neg. Sembilan, Pasoh For. Res., xi. 1994 (*M. Brendell, K. Jackson & S. Lewis*) (BMNH).

Paratype. 1 worker with same data as holotype (BMNH).

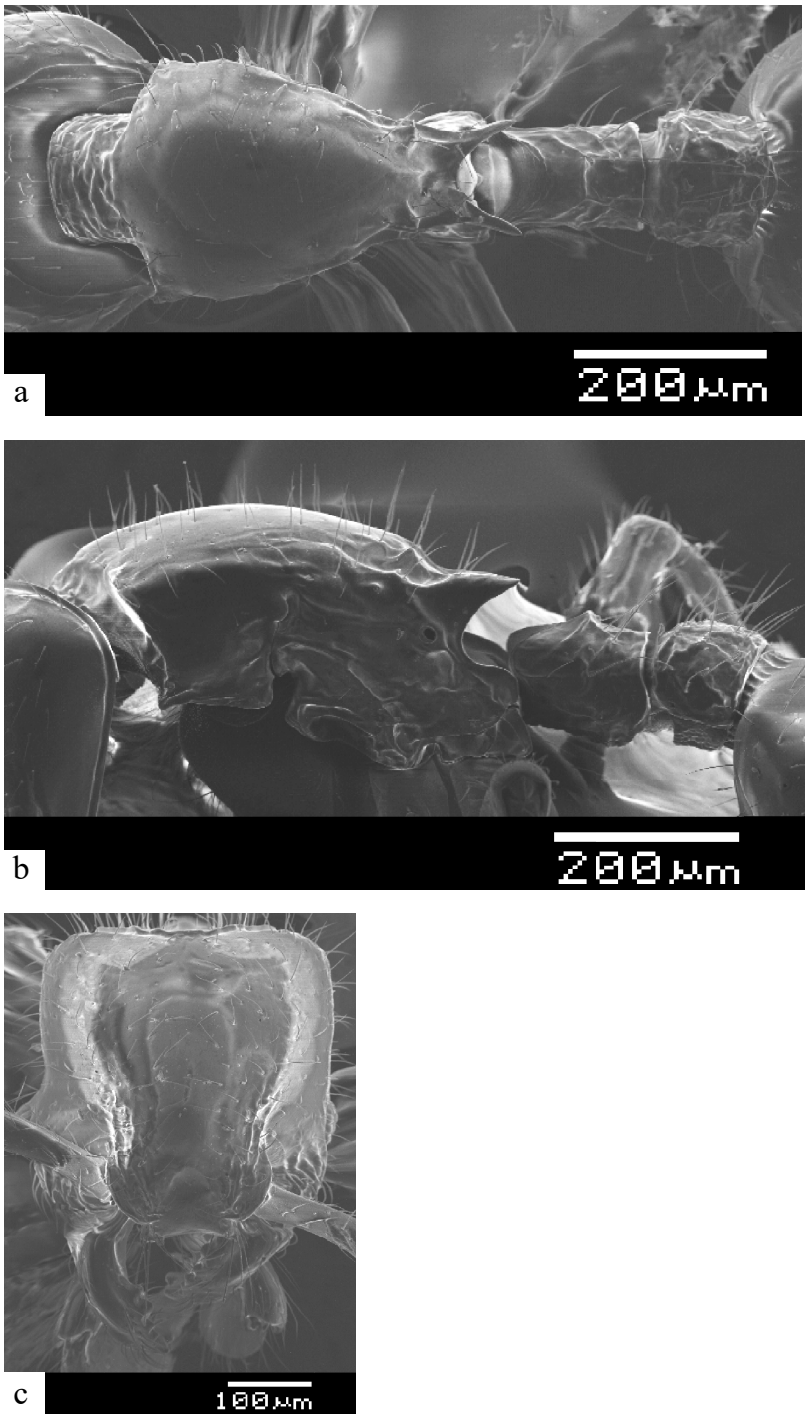


Fig. 16. *Myrmecina glabra* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Remarks. *M. glabra* does not belong to any species complex. This species is easily distinguished from the other species by the completely smooth, shining mesosoma in dorsal view.

The species inhabits in litter.

Distribution. MALAYSIA: The Malay Pen.

***Myrmecina gopa* sp. nov.**

(Fig. 17)

Holotype worker. TL 2.61, HL 0.61, HW 0.58, CI 95, SL 0.53, SI 92, PW 0.41, ML 0.67.

Paratype workers. TL 2.54-2.90, HL 0.57-0.65, HW 0.54-0.62, CI 91-97, SL 0.50-0.56, SI 88-96, PW 0.37-0.44, ML 0.64-0.75 (25 measured).

Worker. Head subrectangular, slightly longer than broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4-5 small teeth and a small basal tooth; small teeth frequently unclear. Dorsal surface of clypeus slightly concave; median portion of anterior margin projected with three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles very small. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and moderately convex, varying in size with maximum diameter 0.08-0.11 mm and 5-6 ommatidia; malar space twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye. Antennal scape long, extending beyond posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior portion usually marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection more or less broad. Eumetanotal spine absent. Propodeal spine elongate, 1.5 times as long as broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum shorter than diameter of spiracle. Petiole short, as long as or slightly longer than high in profile, and longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process present at anterior portion, usually bearing acute anterior apex, but varied in shape, sometimes triangular or lobed with a hole. Postpetiole broader than petiole in dorsal view; lateral margin usually straight; anterior portion sharply raised; ventral outline projected with two acute points.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae distinctly; ventrolateral portion usually smooth and shining. Clypeus smooth and shining. Mesosoma with straight rugae distinctly. Forecoxa smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively dense and long pilosity on dorsum. Mesosoma with dense and long pilosity on dorsum, hairs of pronotum slightly shorter than propodeal spine. Dorsal pilosity of petiole slightly longer than that of mesosoma. Petiole without hairs on ventral surface. Postpetiole usually without hairs on ventral surface. Head and mesosoma black, petiole, postpetiole and gaster reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Kebun Raya, Bogor, W. Java, 11. ix. 1996, FI96-375 (*F. Ito*) (BZM).

Paratypes. numerous workers, ergatogynes and males with same data as holotype; numerous workers, ergatogynes and males with same data as holotype but 17-20. ii. 1993, FI93-157; numerous workers and ergatogynes, and 1 male with same data as holotype but 17-20. ii. 1993, FI93-159; numerous workers, ergatogynes and males with same data as holotype but 17-20. ii. 1993, FI93-162; numerous workers, ergatogynes and males with same data as holotype but 17-20. ii. 1993, FI93-163 (BZM, KUEC, KUIC).

Remarks. *M. gopa* does not belong to any species complex. But *M. gopa* is similar to *M. dolichothrix* sp. nov. on the basis of some characters (see the remarks of *M. dolichothrix*). Among those species, *M. gopa* can be distinguished from the remains by having the short pilosity and the anterior clypeal margin with three processes. This species corresponds to "*Myrmecina* sp. A" of Ito (1996),

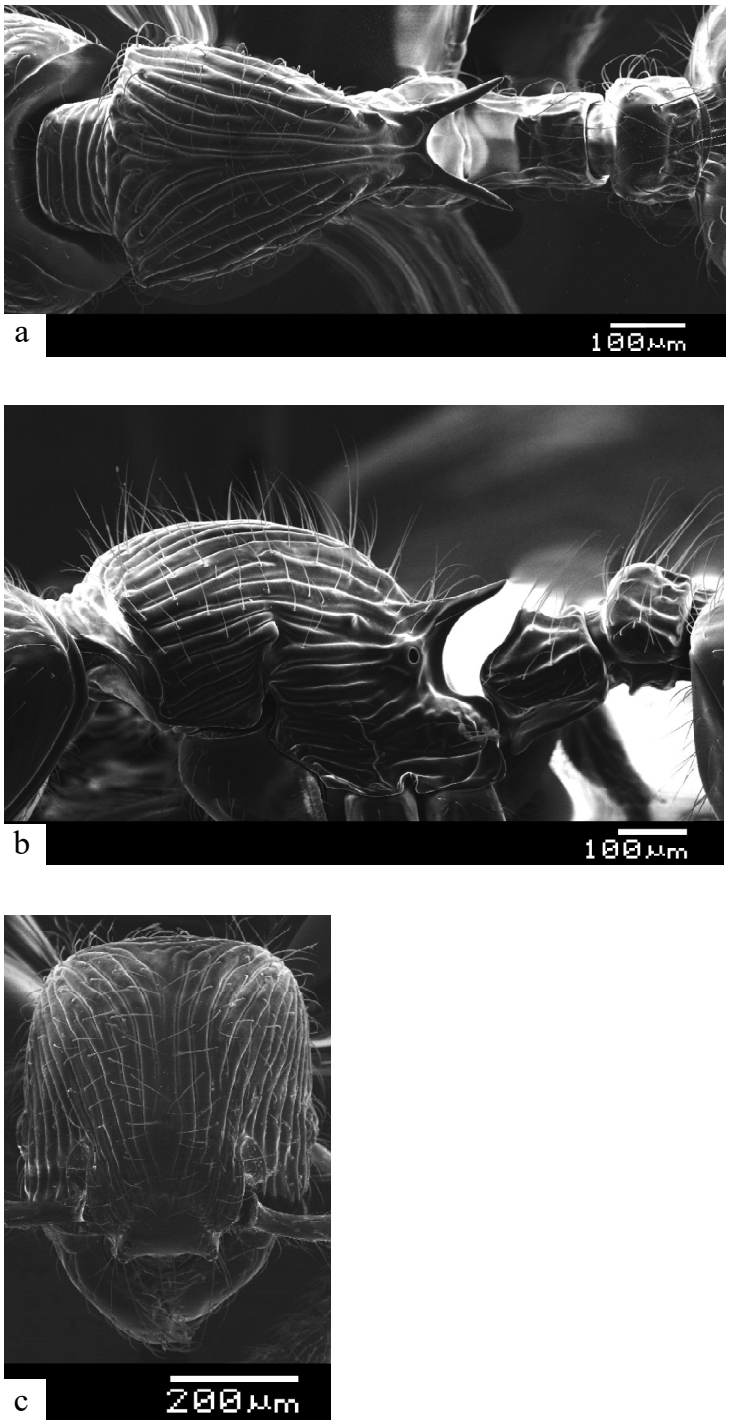


Fig. 17. *Myrmecina gopa* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Aoki & Ito (1997), Ito *et al.* (2001) and Tsuji *et al*. (2001).

Colony of this species is unicolonial, because their nest are contiguously rather than uniformly distributed, and conspecific nonnestmates are easily incorporated into alien nests (Tsuji *et al*., 2001). Ito (1996) reported that this species, which has a specialized myrmecophilous oribatid mite *Aribates javensis* Aoki, Takaku & Ito (Ito & Takaku, 1994; Aoki *et al*., 1994), had no queen, but ergatogyne as a reproductive caste. Ergatogyne distinguish from worker only in width and length of first gastral tergum. Colonies of this species are polygynous, having 8 ergatogynes on average per colony, and all mated ergatogynes reproduce without aggressive interactions.

Distribution. INDONESIA: Java.

***Myrmecina gracilis* sp. nov.**

(Fig. 18)

Holotype worker. TL 2.53 (excluding mandible length), HL 0.66, HW 0.56, CI 85, SL 0.50, SI 89, PW 0.43, ML 0.66.
Paratype workers. TL 2.30-2.90, HL 0.55-0.70, HW 0.50-0.62, CI 86-95, SL 0.38-0.51, SI 75-88, PW 0.37-0.48, ML 0.59-0.75 (9 measured).

Worker. Head subrectangular, longer than broad in full-face view; lateral margin more or less straight; median portion of occipital margin distinctly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal blunt tooth; small teeth and a basal tooth unclear. Dorsal surface of clypeus distinctly concave; median portion of anterior margin slightly projected and concave without median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly. Frontal carinae present, running to near occipital corners; frequently indistinguishable from rugae on dorsum of head. Eyes very small and moderately convex, varying in size with maximum diameter 0.05-0.06 mm and 4-7 ommatidia. Antennal scape short, not reaching posterolateral corner of head; antennal flange not developed.

Dorsal outline of mesosoma flattened or slightly convex in profile. Pronotum with very small denticles in dorsolateral portion; anterior portion not marginate; anterior ventrolateral portion usually not angulate, but sometimes angulate. Eumetanotal spine present but small. Propodeal spine elongate and weakly curved upward, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle usually large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum shorter than diameter of spiracle. Petiole slightly long, slightly longer than high in profile, and longer than broad in dorsal view; midpoint of both lateral margins concave in dorsal view, but varying; small but distinct dorsal crest located at midlength in profile; anterior portion of subpetiolar process much developed with acute anterior apex. Postpetiole broader than petiole in dorsal view; anterior portion sometimes sharply raised in profile; ventral outline slightly projected.

Anterior margin of gaster concave in dorsal view; first gastral sternum forming a median longitudinal ridge distinctly on anterior central surface.

Head punctured with thin rugae longitudinally; ventrolateral portion punctured with thin rugae. Clypeus smooth and shining. Mesosoma punctured with thin rugae parallely. Forecoxa smooth and shining. Petiole and postpetiole punctured with unclear irregular rugae. First gastral tergum punctured distinctly. First gastral sternum feebly rugulose or punctured. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Longest dorsal pilosity of petiole as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole without hairs on ventral surface. Body black or dark reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, MALAYSIA: Sayap Kinabalu, ca. 1000 m alt., Sabah, Borneo (*K. Eguchi*) (UMS).
Paratypes. 4 workers, MALAYSIA: Sarawak, 4th Division, Gn. Mulu NP., 8. ii. 78 or ii. 78 or v-vii. 1978 (*N. M. Collins; P. M. Hammond & J. E. Marshall*); 1 worker, Sabah, Kinabalu, 1500 m, 25. iv. 87 (*Burckhardt & Löbl*); 2 workers, Sabah, Crocker Ra. NP., KK-Tambunan, 1270 m, 17. v. 87 (*Burckhardt & Löbl*); 1 worker, Sabah, Kibongol Valley, 7 km N. Tambunan (*Löbl & Burckhardt*); 2 workers, Sabah, Gn. Silam, 620 m, 1983 (*R. Leakey*) (BMNH).

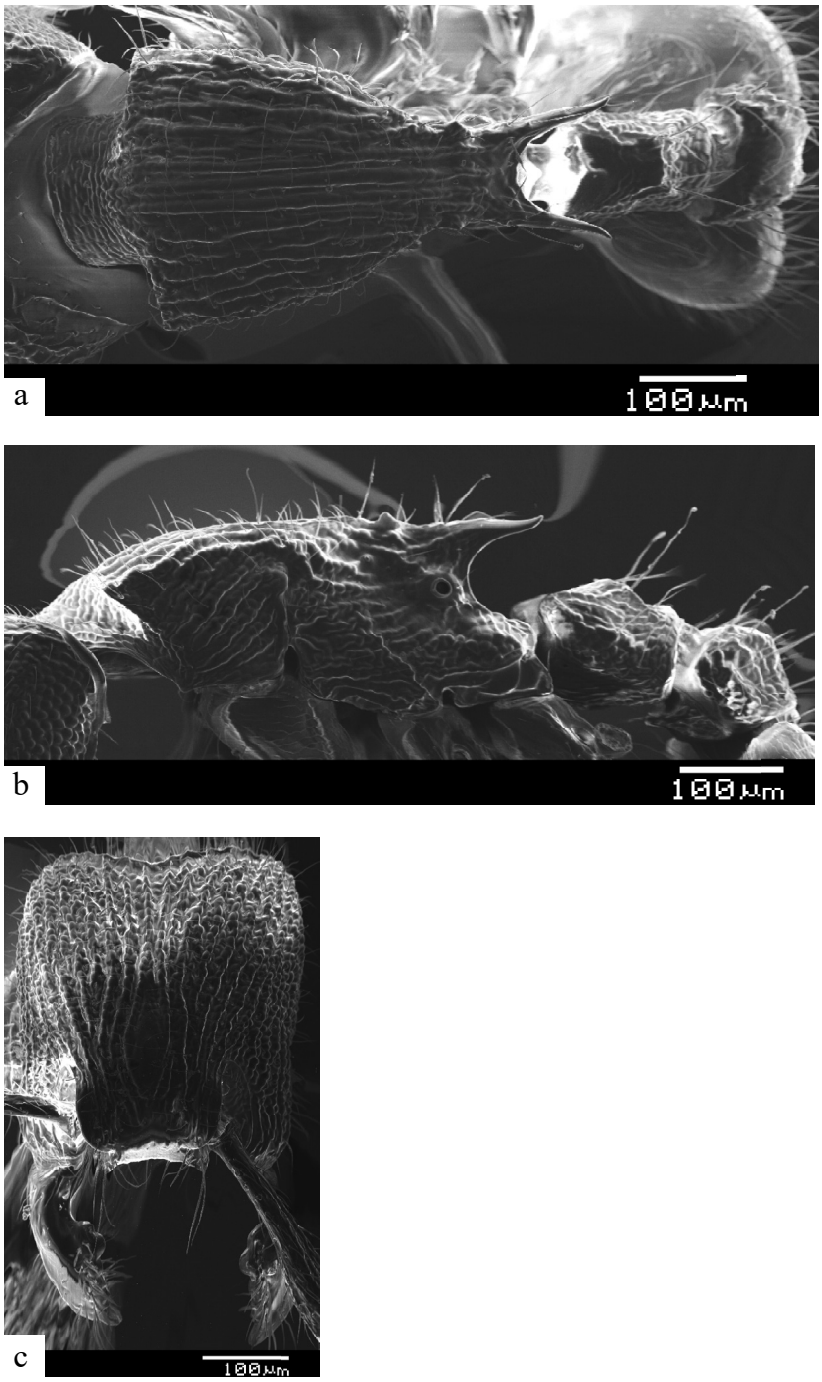


Fig. 18. *Myrmecina gracilis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Other material examined. INDONESIA: Teluk Kabah, Kutai N. P., E. Kalimantan (*Sk. Yamane*) (KUIC).

Remarks. *M. gracilis* belongs to the *M. gracilis* complex comprising *M. curvispina, M. gracilis* and *M. raviwonghei*. The definition and the distribution of the *gracilis* complex are given in the latter section. Among those species, *M. gracilis* can be distinguished from the remains by having the sculptured first gastral sternum with ridge at anterior median portion, and the long head. The species inhabits in soil.

Distribution. MALAYSIA: Borneo (Sabah, Sarawak); INDONESIA: Borneo (Kalimantan).

***Myrmecina grandis* sp. nov.**

(Fig. 19)

Holotype worker. TL 3.47, HL 0.86, HW 0.75, CI 87, SL 0.70, SI 94, PW 0.50, ML 0.91.

Paratype workers. TL 3.30-3.60, HL 0.79-0.90, HW 0.74-0.82, CI 88-93, SL 0.70-0.75, SI 91-98, PW 0.47-0.51, ML 0.90-0.96 (11 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible straight; apical tooth strong, third tooth robust, followed by 6 small teeth. Dorsal surface of clypeus not concave; median portion of anterior margin much projected with distinct three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes medium-sized and moderately convex, varying in size with maximum diameter 0.11-0.13 mm and 7-8 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma convex in profile. Pronotum with denticles on dorsolateral portion, but variable, sometimes reduced; anterior portion marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection narrow. Eumetanotal spine present. Propodeal spine triangular, slightly longer than broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum much longer than diameter of spiracle. Petiole short, as long as or slightly longer than high in profile, and longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process usually present, bearing acute anterior apex. Postpetiole broader than petiole and expanded anteriorly in dorsal view; anterior portion sharply raised in profile; ventral outline slightly projected rectangularly.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head usually with straight rugae distinctly, sometimes weakly waved; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with straight rugae longitudinally. Forecoxa smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively dense and long pilosity on dorsum. Mesosoma with dense and long pilosity on dorsum, hairs of pronotum slightly shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 4-8 hairs on ventral surface. Head and mesosoma black, antennal scape, petiole, postpetiole and gaster reddish brown, mandibles, antennal funiculus and legs yellowish brown to brown.

Holotype worker, INDONESIA: Ulu Gadut, Padang, W-Sumatra, 17. viii. 1996, 19. ii. 1997 fixed, FI96-379 (*K. Ohkawara*) (BZM). Paratypes. numerous workers and ergatogynes with same data as holotype (BZM, KUEC, KUIC, UMS).

Other material examined. INDONESIA: Ulu Gadut nr Padang, W. Sumatra (*Sk. Yamane*) (KUIC). MALAYSIA: Sepilok Forest, Sabah, Borneo, (*K. Eguchi*) (KUEC); Poring, Sabah, Borneo, (*T. Kikuta*) (KUEC); Poring Hot Springs, Sabah (*Burckhardt & Löbl*) (BMNH); 4th Division Gn. Mulu NP., Sarawak (*P. M. Hammond & J. E. Marshall*) (BMNH); Ulu Gombak, ca. 250 m alt., Serangor Prov., Malay Pen. (*Sk. Yamane*) (KUIC). Brunei: Tasek Merimbum, (*K. Eguchi*) (KUEC).

Remarks. *M. grandis* does not belong to any species complex. The species can be distinguished from other species by having the straight masticatory margin of the mandible, simple anterior margin of the smooth and shining first gastral tergum, the short antennal

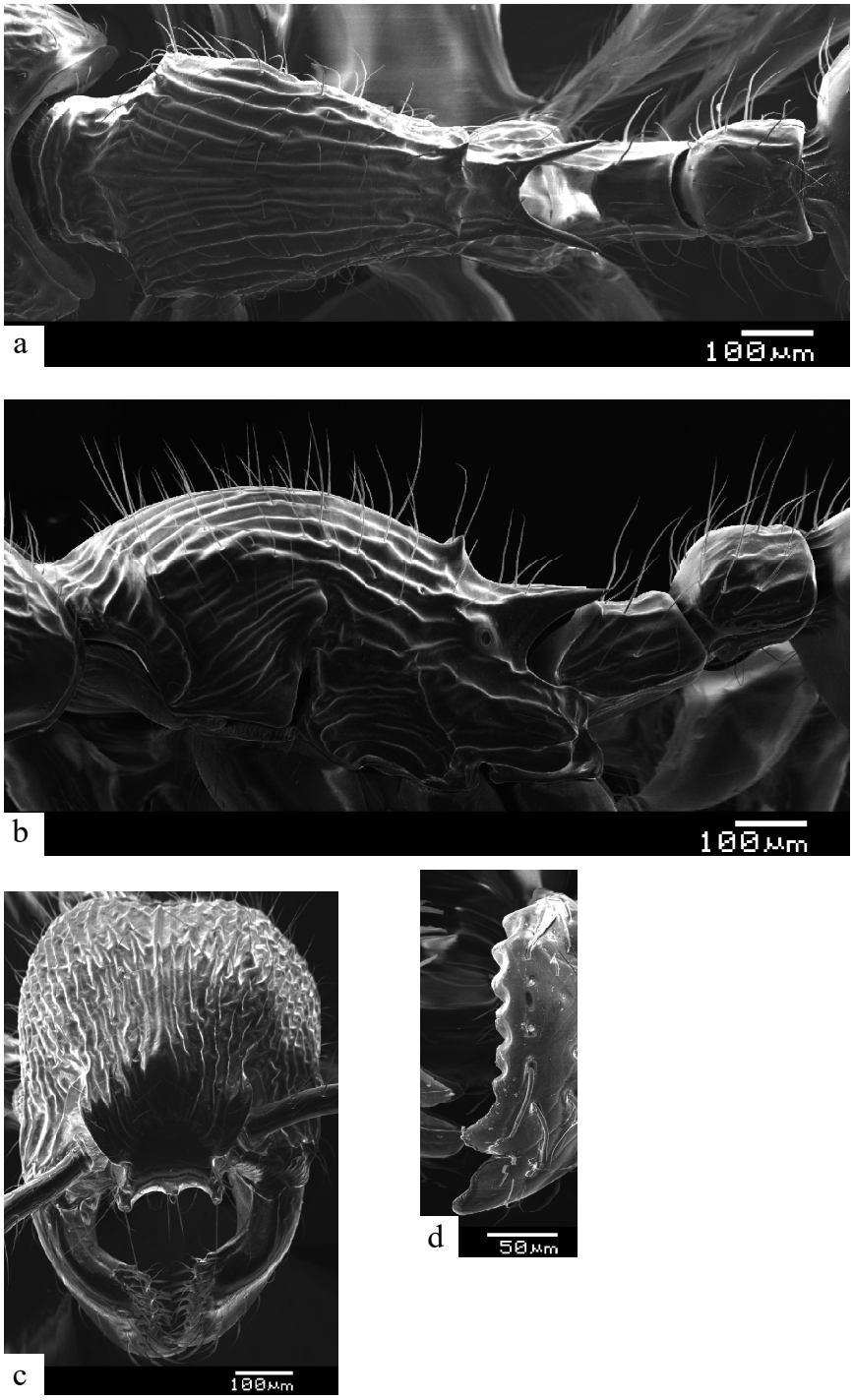


Fig. 19. *Myrmecina grandis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, masticatory margin of mandible.

scape just reaching occipital corner, the much projected anterior clypeal margin with distinct three processes, and the medium-sized eye. This species corresponds to "*Myrmecina* sp. E" of Aoki & Ito (1997). Aoki & Ito (1997) reported that this species had a myrmecophilous oribatid mite *Protoribates myrmecophilus* Aoki & Ito, which was also found in the nest of *M. maryatiae* sp. nov. (=*Myrmecina* sp. B). Ergatogynes are present in this species.

Distribution. MALAYSIA: Borneo (Sabah, Sarawak), The Malay Pen.; BRUNEI: Tasek Merimbum; INDONESIA: Sumatra.

***Myrmecina guangxiensis* Zhou**

(Fig. 20)

Myrmecina guangxiensis Zhou, 2001: 139, 237. Holotype worker, CHINA: Huashuichong Natural Reserve, Hezhou City, Guangxi, 1.ix.1998 (Shanyi Zhou). Paratype worker, Da Ping Shan Natural Reserve, 18.ix.1998 (John Fellowes). [not seen].

Worker. TL 2.22, HL 0.56, HW 0.54, CI 97, SL 0.48, SI 88, PW 0.38, ML 0.59.
ergatogyne. TL 2.72, HL 0.61, HW 0.61, CI 100, SL 0.53, SI 87, PW 0.45, ML 0.67.

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin almost flattened; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4-5 small teeth and a stout basal tooth bearing blunt apex. Dorsal surface of clypeus concave; median portion of anterior margin weakly projected without a median process; lateral portion raised into a sharp ridge of shield wall on each side, in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles, fused with each other at base. Frontal carinae present, running back to or beyond the level of the posterior margin of the eyes. Eyes very small, varying in size with maximum diameter 0.06 mm and 4-5 ommatidia. Antennal scape long, extending beyond posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior ventrolateral portion not angulate. Eumetanotal spine present but small. Propodeal spine triangular, directing upward and backward, not reaching vertical posteriormost limit of propodeum in profile; tips directing outward in dorsal view. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, apart from margin by its diameter. Petiole short; small dorsal crest located slightly at anterior portion in profile; subpetiolar process projecting forward with acute apex. Postpetiole slightly broader than petiole in dorsal view; lateral margin straight and not marginated; dorsal outline flattened in profile; ventral outline projecting forward with small but distinct apex.

Anterior margin of gaster concave in dorsal view.

Head with thin and irregular rugae and punctures weakly, but variable; ventrolateral portion smooth and shining, without rugae. Mandibles with large yellow spots on dorsal surface. Clypeus weakly punctured or smooth and shining. Mesosoma with thick rugae irregularly in profile. Mesosoma with thick rugae wavy and divergent anteriorly (forming “Y”-shape). Petiole and postpetiole with a few longitudinal rugae. First gastral tergum smooth and shining dorsally. Head with sparse pilosity on dorsum. Mesosoma with sparce pilosity on dorsum. Pilosity of pronotum more or less longer than propodeal spines. Pilosity of petiole and postpetiole relatively longer than that of mesosoma. Postpetiole with hairs on ventral surface. Head, mesosoma, petiole and postpetiole varying from reddish brown to black, legs yellowish, forecoxae yellowish brown, gaster reddish brown.

Other material examined. VIETNAM: Cuc Phuong, 320 m alt., Ninh Binh Prov., 2. vi. 1998 (*S. Nomura*) (KUEC); Cuc Phuong, 340 m alt., Ninh Binh Prov., 1. vi. 1998 (KUEC); Dong Dong Bai, 170 m alt., Cuc Phuong, Ninh Binh Prov. (S. Nomura).

Remarks. *M. guangxiensis* forms the *M. vieti* complex. The other members of the complex are: *M. nomurai* sp. nov. and *M. vieti* sp. nov. Among those species, *M. guangxiensis* can be distinguished from the remains by having the short and sculptured petiole which is not expanded laterally at the anterior portion in dorsal view, and the mesosoma with the rugae diverging anteriorly. Some morphological variations, such as the smooth and shining clypeus and the more strongly punctured mesosoma, are found in this species. Ergatogynes are present in this species.

The species inhabits in soil.

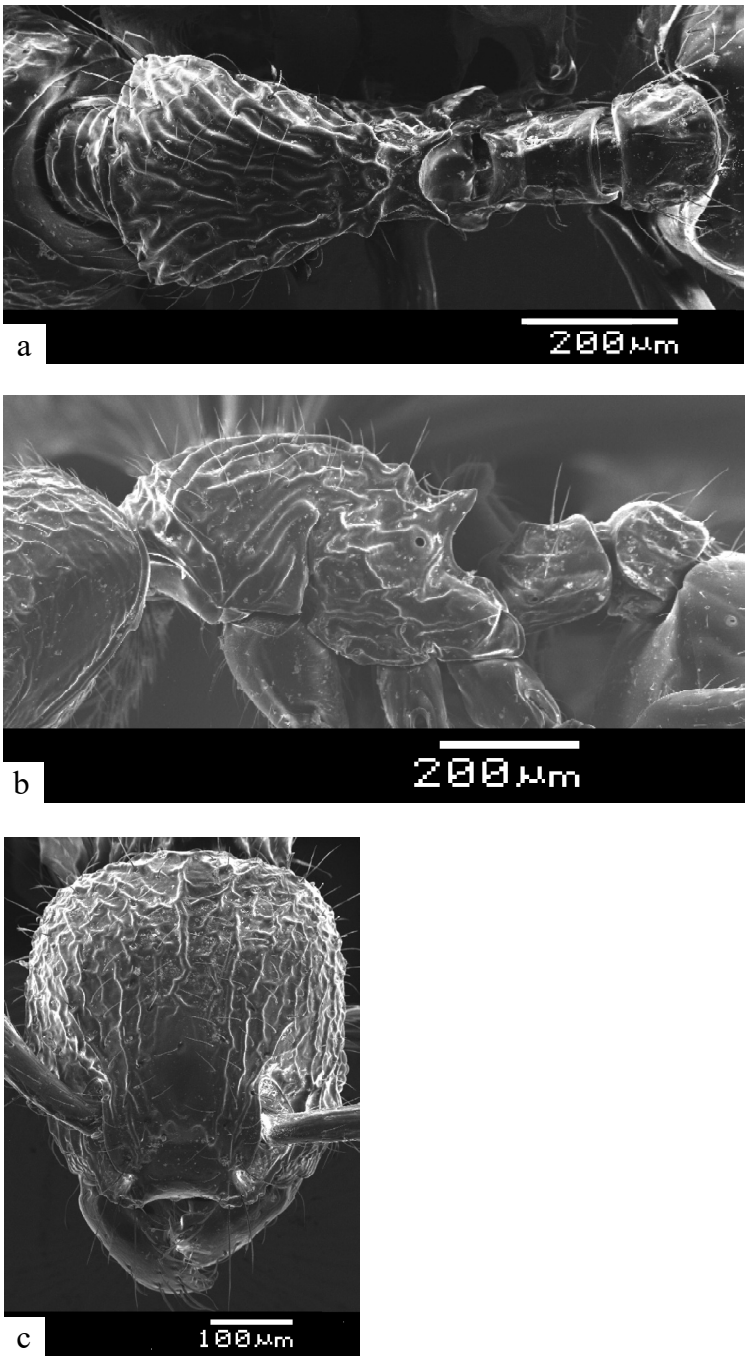


Fig. 20. ***Myrmecina guangxiensis*** **Zhou. a, dorsal view of mesosoma, petiole and post-petiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

Distribution. VIETNAM: Ninh Binh Prov.

Myrmecina gymnocephala **sp. nov.**

(Fig. 21)

Holotype worker. TL 2.78, HL 0.67, HW 0.66, CI 99, SL 0.62, SI 93, PW 0.43, ML 0.74.

Paratype workers. TL 2.71-2.93, HL 0.66-0.67, HW 0.66-0.68, CI 100-104, SL 0.61-0.63, SI 90-93, PW 0.42-0.45, ML 0.70-0.80 (5

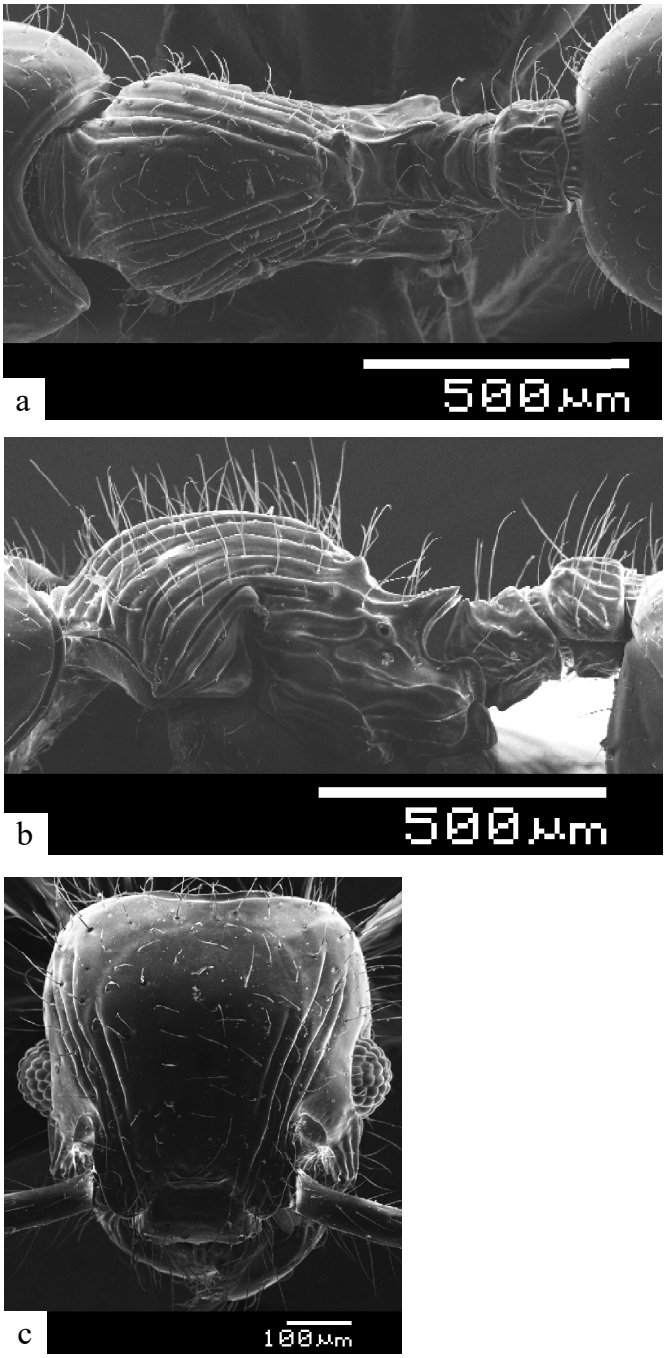


Fig. 21. ***Myrmecina gymnocephala*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin flattened or slightly concave; occipital corners widely rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4-5 small teeth and a stout basal tooth bearing blunt apex; small teeth frequently unclear. Dorsal surface of clypeus slightly concave; median portion of anterior margin weakly projected with a median process but the process frequently unclear; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, closed to each other. Frontal carinae present but variable in length; running

back to or beyond the level of the posterior margin of the eyes. Eyes extremely large and convex, varying in size with maximum diameter 0.14-0.16 mm and 7-8 ommatidia; malar space as long as diameter of eye in profile. Antennal scape long, extending beyond posterolateral corner of head distinctly; antennal flange weakly developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior ventrolateral portion not angulate. Eumetanotal spine absent. Propodeal spine triangular and very small, not reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe slightly raised. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum slightly longer than diameter of spiracle. Petiole long, longer than high in profile, and longer than broad in dorsal view; small but distinct dorsal crest located almost at midlength in profile; subpetiolar process absent or unclear; ventral outline flattened or slightly convex. Postpetiole broader than petiole in dorsal view; anterolateral margin rounded; dorsal outline slightly convex or flattened in profile; ventral outline projected rectangularly at anterior and posterior portion.

Anterior margin of gaster not concave in dorsal view.

Head smooth and shining, completely absent any sculpture except for frontal carinae and a few rugae in front of eyes; ventrolateral portion smooth and shining. Mandibles smooth and shining, frequently with yellow spots on dorsal surface. Clypeus smooth and shining. Mesosoma with with longitudinal rugae which are thick, sometimes median portion smooth and shining in dorsal view. Petiole and postpetiole with weak rugae. Head with sparse pilosity on dorsum. Mesosoma with sparse pilosity on dorsum. Pilosity of pronotum slightly shorter than maximum diameter of eye. Pilosity of petiole and postpetiole as long as that of mesosoma. Petiole without hairs on ventral surface. Postpetiole with about 4 hairs on ventral surface. Head, mesosoma, petiole and postpetiole reddish brown.

Holotype worker, INDONESIA: N. C. Seram, Manusela N. P., Wae Mual Plain, 25. vii-9. xi. 1987 (*M. J. D. Brendell*) (BMNH). Paratypes. 7 workers with same data as holotype (BMNH).

Other material examined. PHILIPPINES: 28 km S Calapan, Balete, Mindoro, (*Schillhammer*); 10 km W Puerto Galera, Mindoro (*Schillhammer*) (NHMW).

Remarks. *M. gymnocephala* belongs to the *M. macrops* complex comprising *M. breviata* sp. nov., *M. gymnocephala* and *M. macrops* sp. nov. This species is different from the related species in having the developed propodeal spine, and the pronotum and mesonotum with straight rugae. Dorsal surface of the mesosoma of the workers distributed in Seram is sculptured only on the lateral portion, while that of the workers distributed in Mindoro is sculptured on the entire surface.

Distribution. PHILIPPINES: Mindoro; INDONESIA: Seram.

Myrmecina inflata sp. nov.

(Fig. 22)

Holotype worker. TL 3.18, HL 0.79, HW 0.75, CI 95, SL 0.67, SI 89, PW 0.42, ML 0.80.
Paratype workers. TL 3.12-3.26, HL 0.74-0.84, HW 0.74-0.80, CI 92-101, SL 0.66-0.72, SI 83-98, PW 0.46-0.51, ML 0.78-0.86 (7 measured).

Worker. Occipital margin of head strongly concave in full-face view; lateral margin strongly convex; dorsal outline strongly convex

in profile; occipital corners projected posteriorly. Masticatory margin of mandible straight; apical tooth strong, third tooth weakly developed, followed by 6 small teeth; small teeth frequently unclear. Dorsal surface of clypeus not concave; median portion of anterior margin weakly projected; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, which are well separated. Frontal carinae present, running back to occipital corners, but very obscure, difficult to distinguish from rugae on dorsum of head. Eyes large and convex, varying in size with maximum diameter 0.14-0.18 mm and 6-8 ommatidia. Antennal scape short, just reaching posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles on dorsolateral portion; anterior ventrolateral

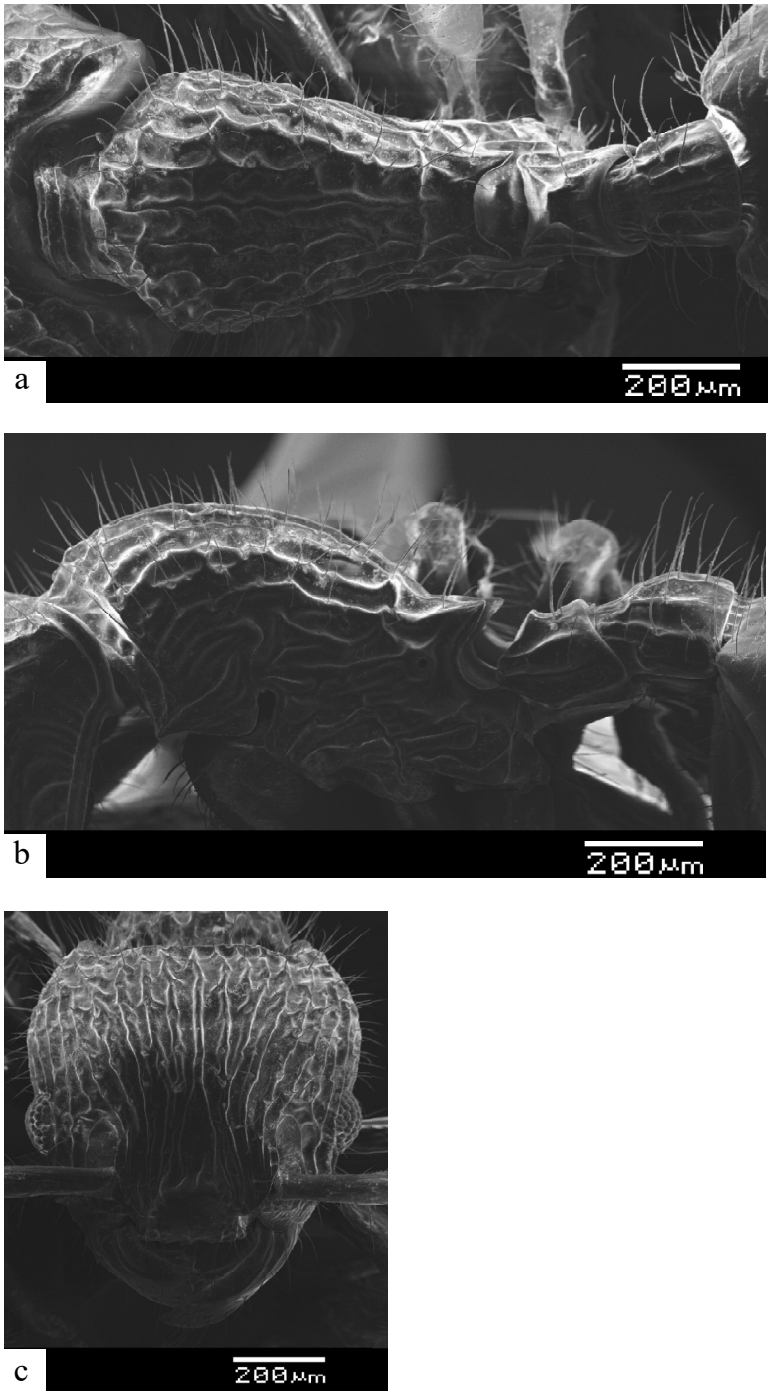


Fig. 22. *Myrmecina inflata* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

portion forming small denticle or an angle. Eumetanotal spine present but small and unclear. Propodeal spine triangular, directing upward and backward, just reaching vertical posteriormost limit of propodeum in profile; tips directing outward in dorsal view. Propodeal lobe low. Propodeal spiracle medium-sized, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole shorter than high in profile; dorsal crest located at midlength in profile; ventral outline flattened; subpetiolar process present. Postpetiole as broad as petiole and expanded posteriorly in dorsal view; dorsal outline slightly convex or flattened in profile; ventral outline projected with anterior apex at anterior portion.

Anterior margin of gaster concave in dorsal view.

Head with thin rugae which are weakly waved; ventrolateral portion with 2-3 rugae curved downward. Clypeus smooth and shining. Mesosoma with irregular rugae in profile. Mesosoma with thick rugae distinctly. Petiole and postpetiole with distinct rugae. Head and mesosoma with dense pilosity on dorsum, hairs of pronotum longer than propodeal spine. Pilosity of petiole and postpetiole slightly longer than that of mesosoma. Postpetiole with about 4 hairs, but varies on ventral surface. Body black, mandibles, antennae and legs reddish brown to yellowish brown.

Holotype worker, THAILAND: Phang Nga Prov., Tone Chong-Fah Waterfall, 20 km S. Takuapa, 100-200 m H, 11-14. 01. 1996 (*A. Schulz, K. Vock*) (NHMW).
Paratypes. 8 workers with same data as holotype (NHMW).

Remarks. *M. inflata* forms to the *M. spinosa* complex comprising *M. inflata, M. mahuana* sp. nov., *M. spinosa* sp. nov., *M. magnificens* and *M. tridentata* sp. nov. The definition and the distribution of the *spinosa* complex are given in the latter section. Among those species, *M. inflata* can be distinguished from the remains by having the concave anterior margin of the first gastral tergum and the straight masticatory margin of the mandible.

Distribution. THAILAND: Phang Nga Prov.

***Myrmecina insulana* sp. nov.**
(Fig. 23)

Holotype worker. TL 2.33, HL 0.56, HW 0.51, CI 91, SL 0.43, SI 84, PW 0.38, ML 0.61.
Paratype workers. TL 2.22-2.37, HL 0.53-0.58, HW 0.51-0.53, CI 92-97, SL 0.43-0.45, SI 82-88, PW 0.37-0.40, ML 0.58-0.59 (4 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin feebly projected with or without median paired processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, relatively close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes very small circularly and usually convex moderately, varying in size with maximum diameter 0.06-0.08 mm and 10-11 ommatidia; malar space twice as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye distinctly four times as long as diameter of eye or longer. Antennal scape short, not or just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma convex in profile. Pronotum with or without denticle; anterior portion marginate; anterior ventrolateral portion projected. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, variable in length, usually extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of the spiracle. Petiole short, as long as or slightly longer than high in profile, slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process variously developed from weakly

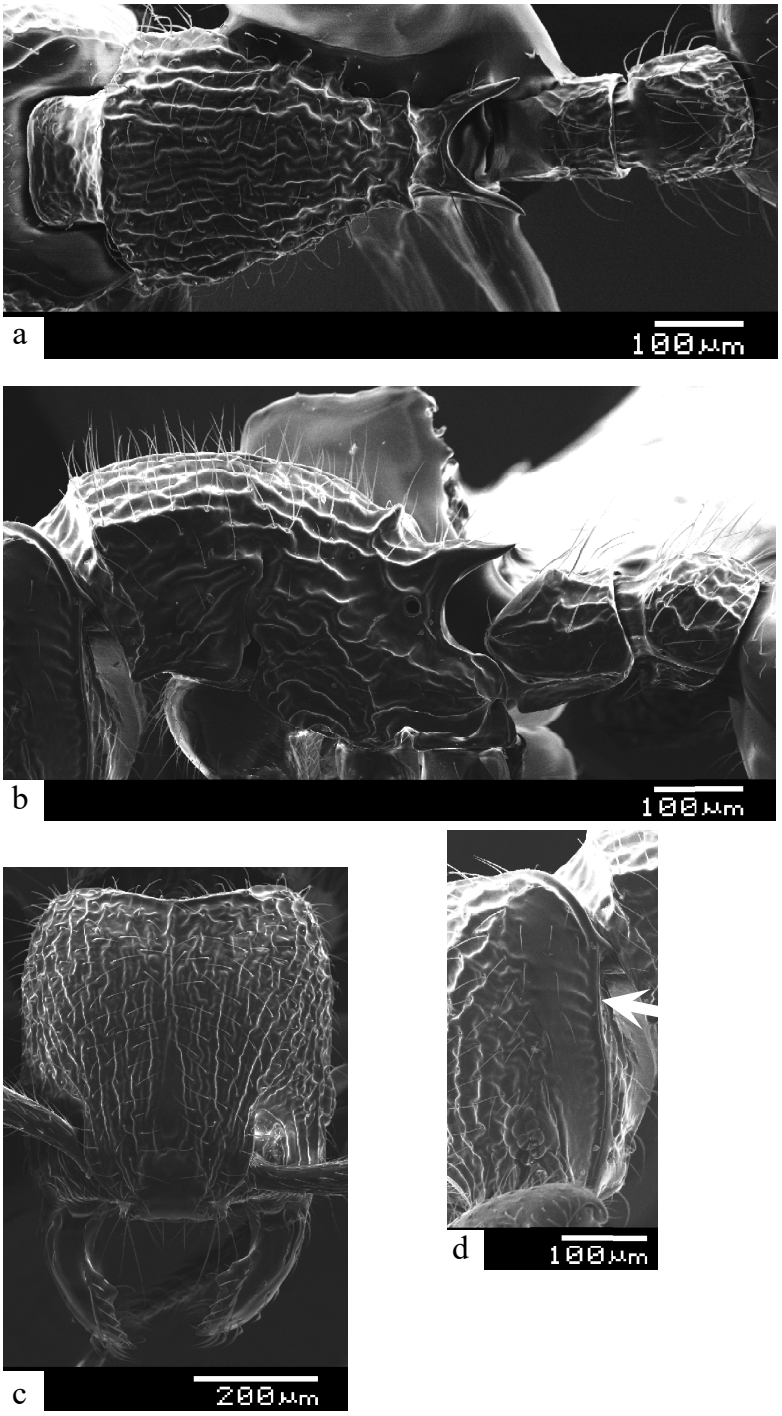


Fig .23. ***Myrmecina insulana*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, ventrolateral portion of head.**

raised median longitudinal ridge to distinct projection. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view.

Head with wavy rugae which are thin; ventrolateral portion with transverse, or vertical rugae sometimes unclearly. Clypeus smooth and shining. Mesosoma with wavy rugae which are thick. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Head and mesosoma black, petiole and postpetiole reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, MALAYSIA: Mahua Waterfall area, ca. 1000 m alt., Crocker Range N. P., Sabah, 5. xi. 2000 (*J. Fellowes*) (UMS). Paratypes. 2 workers and 1 queen with same data as holotype; 2 workers with same data as holotype but (*H. Okido*); MALAYSIA: Sabah, Kinabalu N. P., Poring Hot Springs, East Ridge, 560 m, 17. viii. 95 (*C. Brühl*); Danum Valley, Sabah, Borneo, 29. viii. 1995 (*H. Okido*); Sayap Kinabalu, ca. 1000 m alt., Sabah, Borneo, 14. vii. 1996 (*Sk. Yamane*); Sayap Kinabalu, ca. 1000 m alt., Sabah, Borneo, 14. vii. 1996, S-17 (*K. Eguchi*) (UMS, KUEC, KUIC).

Other material examined. MALAYSIA: Crocker Ra., Sabah (*Burckhardt & Löbl*) (BMNH); Poring Hot Springs, Sabah *(Burckhardt & Löbl*) (BMNH); 4th Division, Gn. Mulu NP. (*N. M.Collins; B. Bolton*) (BMNH); Marudi, Sarawak (*P. Hammond*) (BMNH); Neg. Sembilan, Pasoh For. Res. (*M. Brendell, K. Jackson & L. Ficken*) (BMNH). INDONESIA: Teluk Kabah, Kutai N. P., E. Kalimantan (*Sk. Yamane*); Mt. Gede, Cibodas, W. Java (*F. Ito*); Sukarami nr. Padang, W. Sumatra (*F. Ito*).

Remarks. *M. insulana* does not belong to any species complex. But in terms of the eye size, shape and sculpture of the first gastral segment, relative length of the antennal scape, and sculpture of the mesosoma, *M. insulana* is similar to *M. sabahna* sp. nov. and *M. yamanei* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M. insulana* can be distinguished from the remains by having ventrolateral portion of the head with transverse rugae. The species inhabits in soil and litter.

Distribution. MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); INDONESIA: Sumatra, Borneo (Kalimantan), Java.

***Myrmecina inthanonensis* sp. nov.**

(Fig. 24)

Holotype worker. TL 3.38, HL 0.80, HW 0.78, CI 97, SL 0.70, SI 91, PW 0.51, ML 0.88.

Paratype worker. TL 3.39, HL 0.80, HW 0.74, CI 92, SL 0.70, SI 96, PW 0.50, ML 0.90 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin distinctly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus concave; median portion of anterior margin projected with a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, close to each other. Frontal carinae virtually absent, indistinguishable

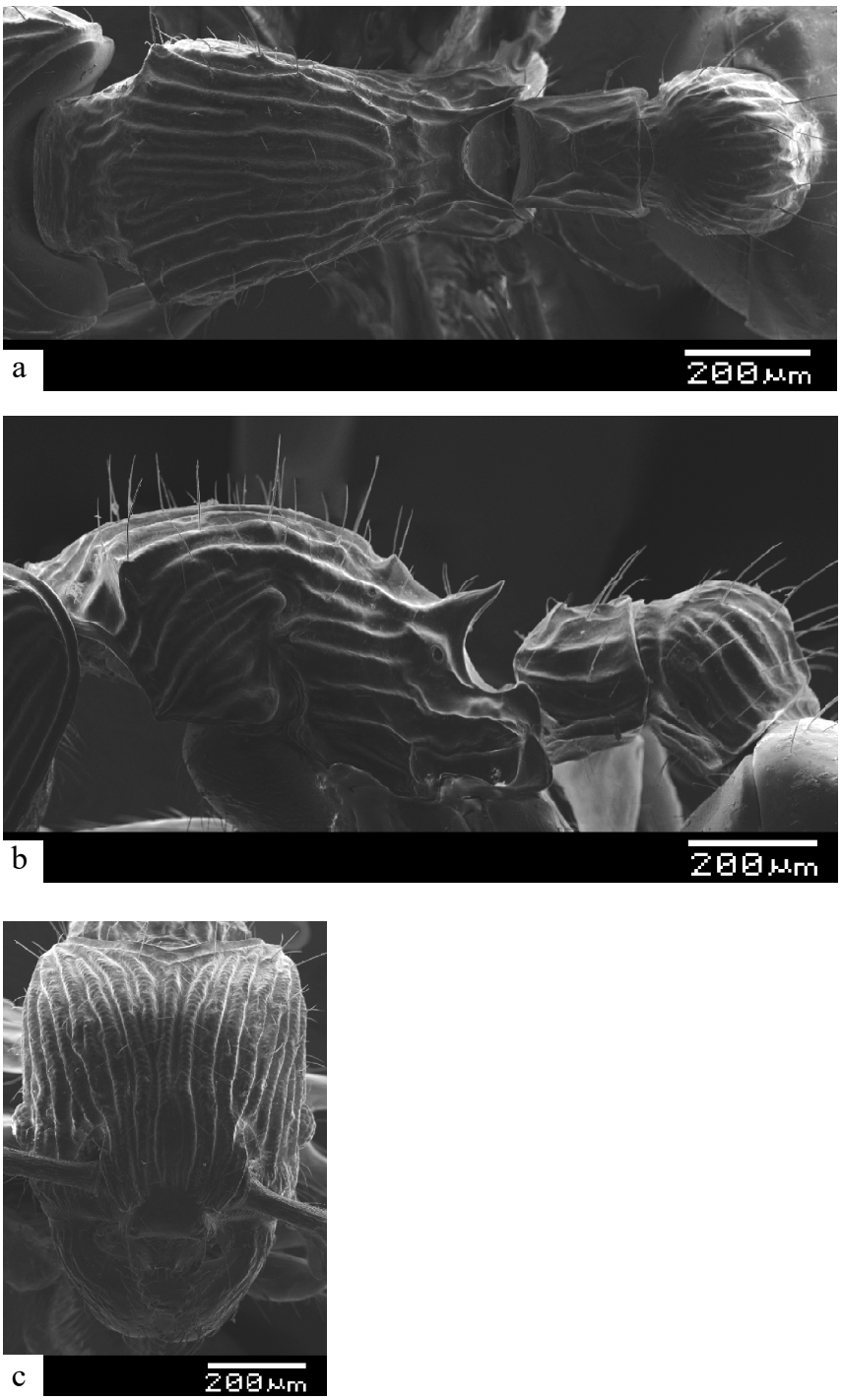


Fig. 24. ***Myrmecina inthanonensis*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

from rugae on dorsum of head. Eyes slightly large and distinctly convex, varying in size with maximum diameter 0.10-0.14 mm and 7-8 ommatidia; malar space twice as long as diameter of eye or slightly longer in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape long, slightly extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion feebly marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small, somtimes reduced. Propodeal spine triangular, slightly longer than broad at base, not or just reaching vertical

posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole short, as long as or slightly longer than high in profile, and as long as or slightly longer than broad in dorsal view; dorsal crest located anteriorly in profile; subpetiolar process absent, but median longitudinal ridge at ventral portion present. Postpetiole expanded posteriorly and slightly broader than petiole and larger than petiole in dorsal view; dorsal outline flattened in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head punctured with thick rugae distinctly; ventrolateral portion punctured with thick rugae distinctly. Clypeus smooth and shining. Mesosoma punctured with thick rugae distinctly. Forecoxa with transverse rugae weakly, but sometimes smooth and shining. Petiole and postpetiole with thick rugae. First gastral segment smooth and shining. Head with relatively sparse and short pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole with 4 hairs on ventral surface. Postpetiole with 4-6 hairs on ventral surface. Body and forecoxae black, mandibles, antennae and legs yellowish brown to reddish brown.

Holotype worker, THAILAND: Doi Inthanon, 7. xi. 85 (*Löbl & Burckhardt*) (BMNH). Paratypes. 5 workers with same data as holotype (BMNH).

Remarks. *M. inthanonensis* does not belong to any species complex. But in terms of the petiole with the subpetiolar process or median longitudinal ridge, relative length of the antennal scape, the mesosoma with the eumetanotal spine and relative size of the postpetiole, *M. inthanonensis* is similar to *M. nigra* sp. nov. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M. inthanonensis* can be distinguished from the remains by having the distinctly large postpetiole comparing with the petiole, the anterior clypeal margin with a single median process, and the mesosoma with straight and parallel rugae on dorsal surface.

Distribution. THAILAND: Chiang Mai Prov.

***Myrmecina itoi* sp. nov.**

(Fig. 25)

Holotype worker. TL 3.41, HL 0.82, HW 0.76, CI 93, SL 0.64, SI 84, PW 0.56, ML 0.93.

Paratype workers. TL 3.30-3.46, HL 0.78-0.82, HW 0.70-0.77, CI 90-94, SL 0.62-0.67, SI 88-89, PW 0.50-0.54, ML 0.93-0.96 (2 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible straight; apical tooth strong, third tooth robust, followed by 6 small teeth. Dorsal surface of clypeus concave; median portion of anterior margin distinctly projected without a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired blunt denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex, varying in size with maximum diameter 0.16-0.18 mm and 9-10 ommatidia; malar space 1.5 times as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye twice as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange weakly developed.

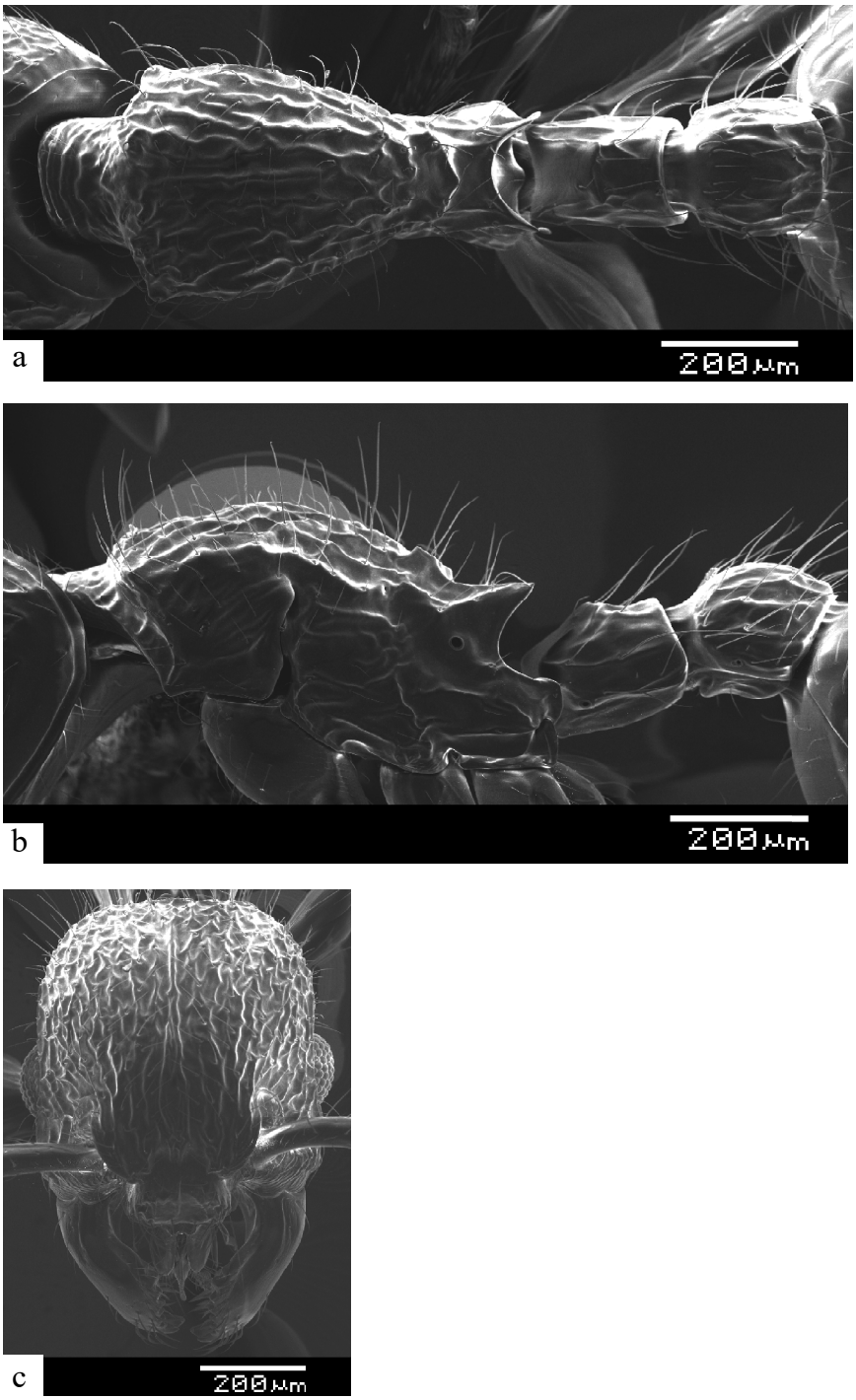


Fig. 25. *Myrmecina itoi* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior portion marginate, but unclearly; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection more or less broad. Eumetanotal spine present but small. Propodeal spine triangular, as long as broad at base, just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle slightly large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum much longer than diameter of spiracle. Petiole short, as long as high in profile, and slightly longer than broad in dorsal view; small dorsal crest located at midlength in profile; subpetiolar process present at anterior portion, bearing acute anterior apex. Postpetiole slightly broader than petiole and expanded posteriorly in dorsal view; dorsal outline

slightly convex or flattened in profile; ventral outline projected with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with irregular rugae distinctly; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with wavy rugae distinctly. Forecoxa smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively dense and short pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum as long as or slightly shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body black, mandibles, antennal funiculus and legs yellowish brown to reddish brown, antennal scapes dark reddish brown.

Holotype worker, MALAYSIA: Ulu Gombak, 24. x. 1996, FI96-695 (*F. Ito*) (UMS).
Paratypes. 11 workers and 2 males with same data as holotype (UMS, KUEC, KUIC).

Other material examined. MALAYSIA: Tawau Hills N. P., Sabah, Borneo, (*Sk. Yamane*) (KUIC). INDONESIA: Ketambe, Leuser N. P., Aceh, N-Sumatra (*D. Iskandar*) (KUEC).

Remarks. *M. itoi* does not belong to any species complex. The species can be distinguished from other species by having the straight masticatory margin of the mandible, simple anterior margin of the smooth and shining first gastral tergum, the short antennal scape just reaching occipital corner, the long petiole, and the large eye.

This species, which inhabits in rotten wood, is found without specialized myrmecophilous oribatid mite (Ito, per. comm.).

Distribution. MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra.

***Myrmecina lambirensis* sp. nov.**
(Fig. 26)

Holotype worker. TL 2.84 (head separated), HL 0.68, HW 0.61, CI 89, SL 0.56, SI 92, PW 0.38, ML 0.82.

Worker. Head subrectangular, slightly longer than broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible straight; apical tooth strong, third tooth robust, followed by 6 small teeth. Dorsal surface of clypeus slightly concave; median portion of anterior margin much projected with distinct three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes medium-sized and moderately convex with maximum diameter 0.10 mm, with 6 ommatidiain the longest row; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior portion not marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection relatively narrow. Eumetanotal spine present but small. Propodeal spine triangular, length as long as broad at base, not reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum much longer than diameter of spiracle. Petiole short, length as long as high in profile,

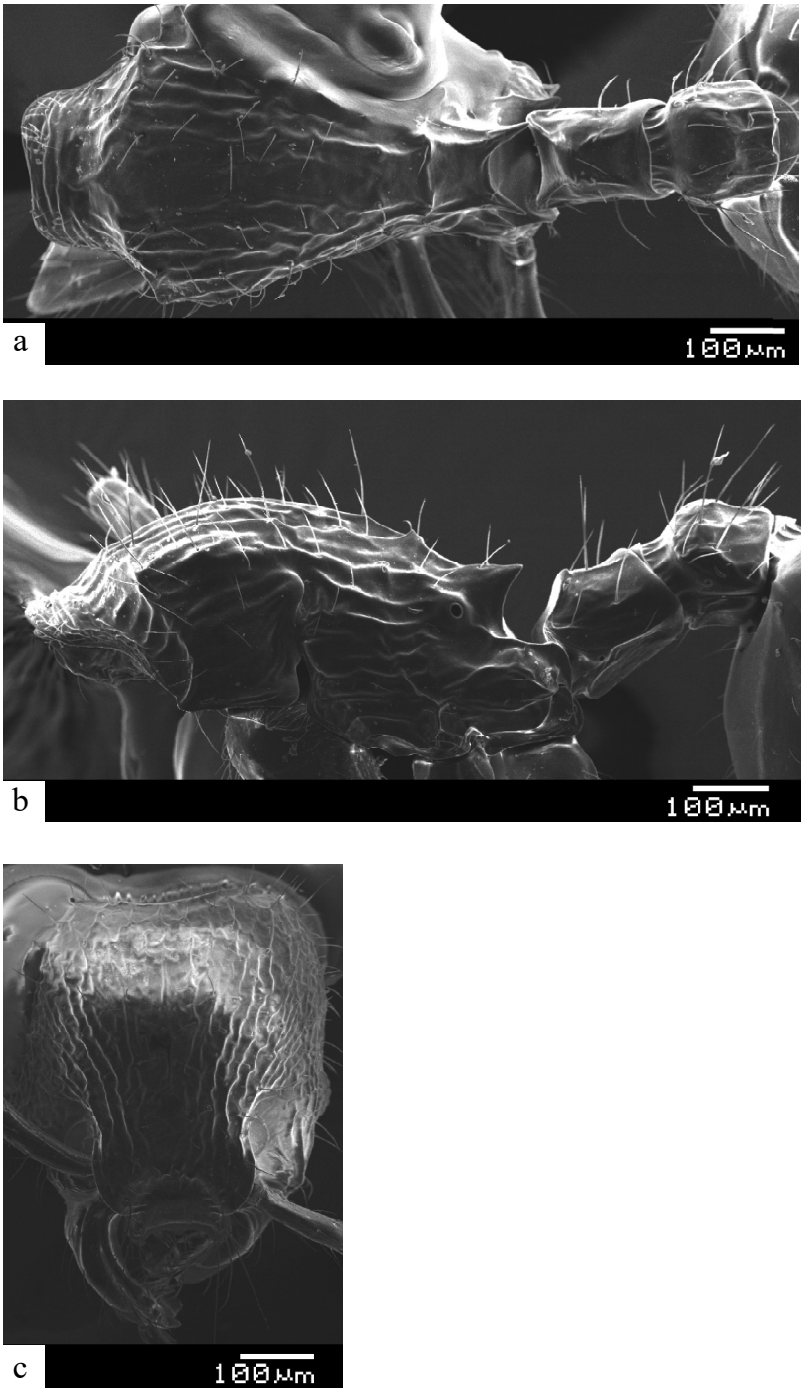


Fig. 26. *Myrmecina lambirensis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

longer than broad in dorsal view; dorsal crest located slightly at anterior portion in profile; subpetiolar process reduced. Postpetiole slightly broader than petiole; lateral margin straight; anterior portion slightly raised in profile; ventral outline slightly projected rectangularly.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with weakly waved rugae; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with weakly waved rugae. Forecoxa smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively sparse and short pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum

longer than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 4 hairs on ventral surface. Head and mesosoma black, antennal scapes, petiole, postpetiole and gaster reddish brown, mandibles, antennal funiculus and legs yellowish brown to reddish brown.

Holotype worker, MALAYSIA: Bt. Lambir, Lambir N. P., Miri, Sarawak, 22. viii. 1995 (*H. Okido*) (UMS).

Remarks. *M. lambirensis* does not belong to any species complex. The species can be distinguished from other species by having the smooth and shining dorsal median portion of the mesosoma and lateral portion of the pronotum, the anterior clypeal margin with distinct three processes, and the short antennal scape.

Distribution. MALAYSIA: Borneo (Sarawak).

***Myrmecina lombokensis* sp. nov.**

(Fig. 27)

Holotype worker. TL 2.45, HL 0.58, HW 0.58, CI 100, SL 0.48, SI 83, PW 0.42, ML 0.64.

Paratype worker. TL 2.65, HL 0.61, HW 0.61, CI 100, SL 0.53, SI 87, PW 0.43, ML 0.62 (1 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal blunt tooth; small teeth unclear. Dorsal surface of clypeus concave; median portion of anterior margin projected with a median process that are very small; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex with maximum diameter 0.08 mm, with 5 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye. Antennal scape short, just reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small; length shorter than broad at base. Propodeal spine elongate, directing backward and weakly curved upward, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from the margin by its diameter. Petiole short, as long as high in profile, and longer than broad in dorsal view; small but distinct dorsal crest located at midlength in profile; subpetiolar process small with acute anterior apex clearly. Postpetiole broader than petiole and expanded anteriorly in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head punctured with thin rugae longitudinally; ventrolateral portion shining, but punctured. Clypeus smooth and shining. Mesosoma punctured with thin rugae longitudinally. Forecoxa smooth and shining. Petiole and postpetiole with a few distinct rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than apical third segment of antenna. Petiole without hairs on ventral surface. Postpetiole with 2 hairs on ventral surface. Body black to dark reddish brown, mandibles, antennae and legs brown to yellowish brown.

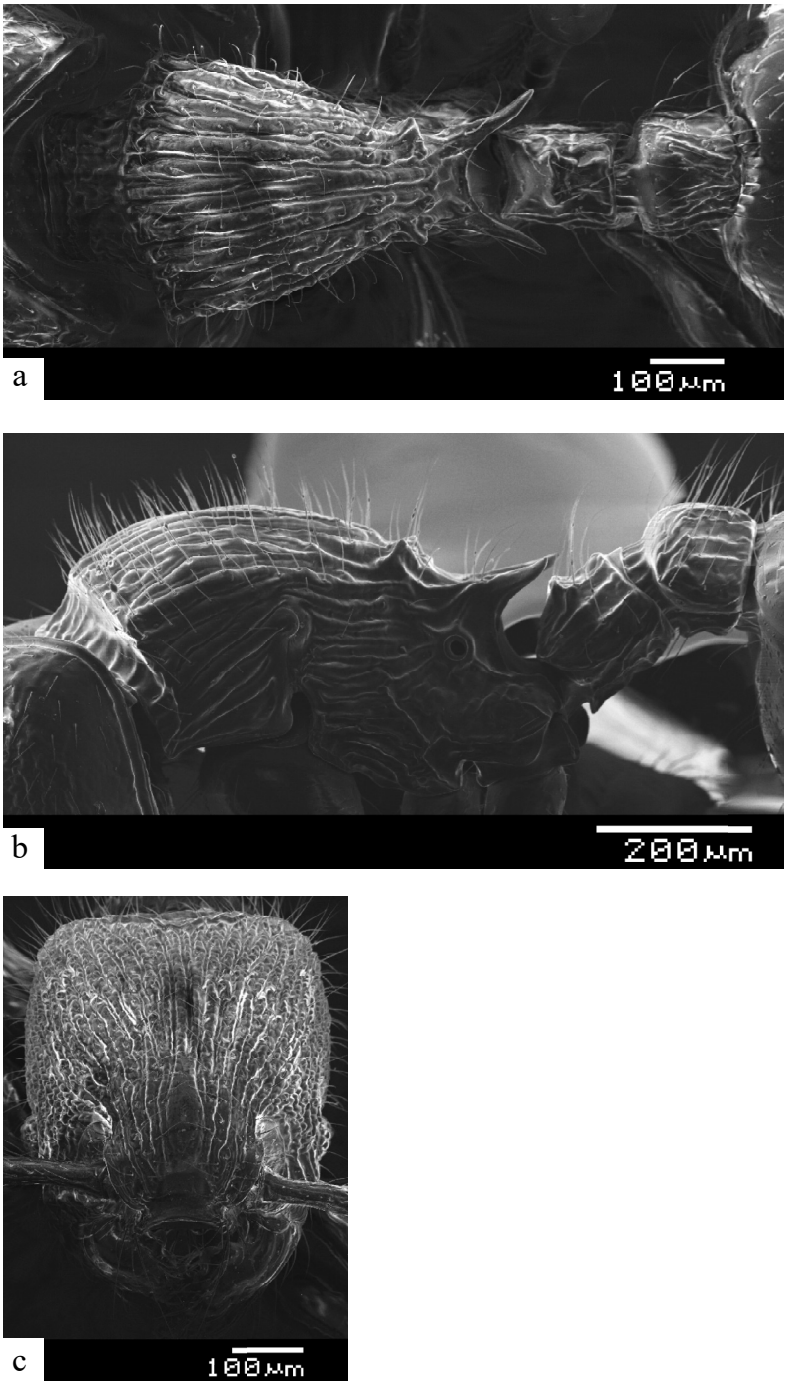


Fig. 27. *Myrmecina lombokensis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Holotype worker, INDONESIA: Pusuk Pass, 260 m alt., Lombok I., S 08°28′xE 116°5′, 1. x. 2000, TUS KO-3 (*K.Ogata*) (KUEC). Paratype. 1 worker, INDONESIA: Senaru, 750 m alt., Lombok I., S 08°20′xE 118°24′, 30. ix. 2000, TUS KO-2 (*K. Ogata*) (KUEC).

Remarks. *M. lombokensis* does not belong to any species complex. But *M. lombokensis* is similar to *M. asthena* sp. nov. on the basis of some characters (see the remarks of *M. asthena*). Among those species, *M. lombokensis* can be distinguished from the remains by having the medium-sized and ovally eye comprising about 14 ommatidia.

Distribution. INDONESIA: Lombok.

***Myrmecina longiseta* sp. nov.**

(Fig. 28)

Holotype worker. TL 3.37, HL 0.80, HW 0.76, CI 95, SL 0.72, SI 95, PW 0.56, ML 0.93.

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes slightly large and distinctly convex with maximum diameter 0.11 mm, with 7 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape long, slightly extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma convex in profile. Pronotum with unclear denticles on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, longer than broad at base, not reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle small, situated near base of propodeal spine, apart from margin by its diameter. Petiole long, longer than high in profile, and slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process and median longitudinal ridge at ventral portion absent. Postpetiole as broad as petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae which are thin distinctly; ventrolateral portion with longitudinal rugae anteriorly, and smooth and shining posteriorly. Clypeus smooth and shining. Mesosoma with some transverse rugae anteriorly, and longitudinal rugae posteriorly. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with sparse and long pilosity on dorsum. Mesosoma with sparse and extremely long pilosity on dorsum, hairs of pronotum twice as long as propodeal spine or longer. Petiole without hairs on ventral surface. Postpetiole with 2 hairs on ventral surface. Head, mesosoma, forecoxae, petiole and postpetiole black, gaster dark reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Sumatra, Padang (*no collector's name*) (BMNH).

Remarks. *M. longiseta* does not belong to any species complex. But *M. longiseta* is similar to *M. boltoni* sp. nov., *M. monticola* sp. nov. and *M. parallela* sp. nov. on the basis of some characters (see the remarks of *M. boltoni*). Among those species, *M. longiseta* can be distinguished from the remains by having the sparse and extremely long pronotal pilosity and the short propodeal spine.

Distribution. INDONESIA: Sumatra.

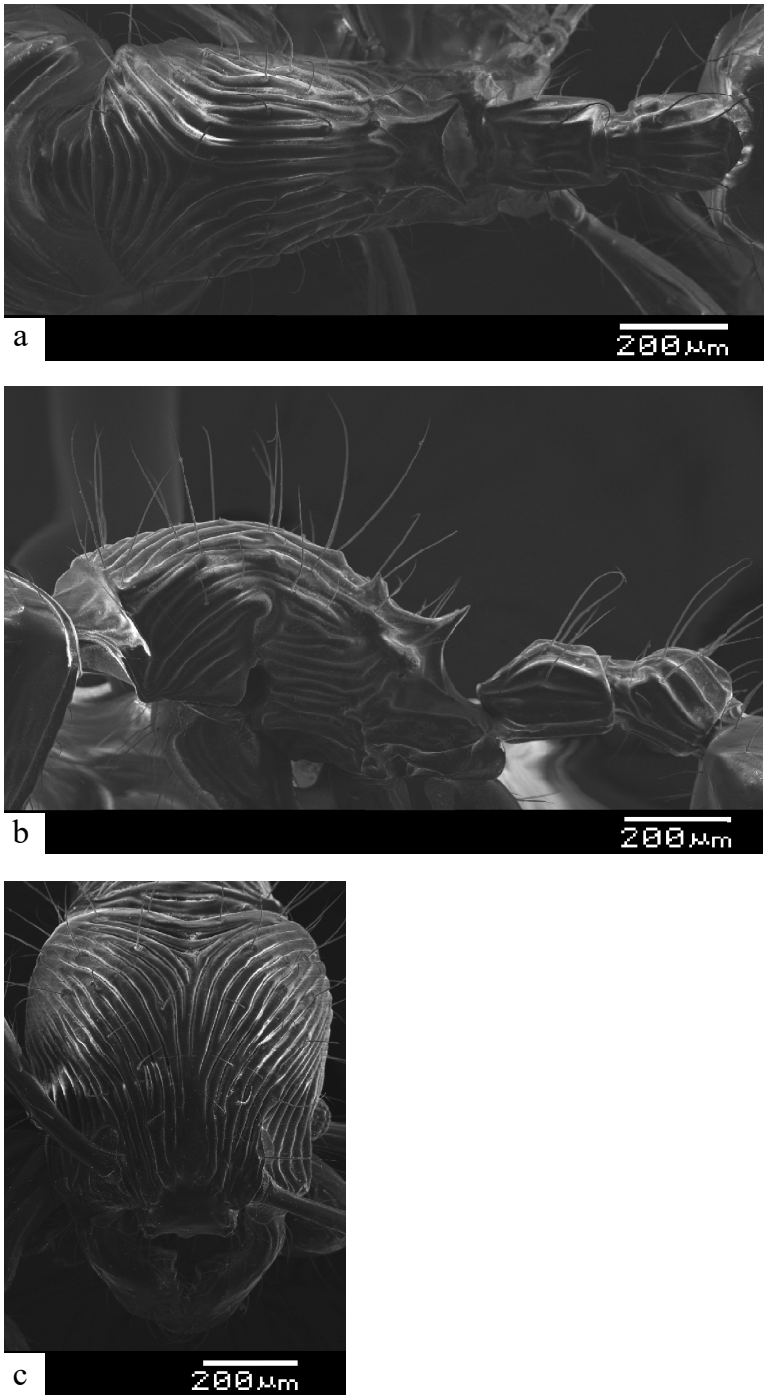


Fig. 28. ***Myrmecina longiseta*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

Myrmecina macrops **sp. nov.**

(Fig. 29)

Holotype worker. TL 2.80, HL 0.66, HW 0.69, CI 105, SL 0.56, SI 81, PW 0.48, ML 0.75.

Paratype workers. TL 2.57-2.77, HL 0.62-0.67, HW 0.65-0.70, CI 104-105, SL 0.53-0.59, SI 81-86, PW 0.45-0.50, ML 0.69-0.73 (5 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin flattened or slightly concave; occipital corners widely rounded, not projected posteriorly in profile. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by about 4 small teeth and a stout basal tooth bearing blunt apex; small teeth unclear. Dorsal surface of clypeus slightly concave; median portion of anterior margin weakly projected with a median process; the process frequently unclear; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, very closed to each other without fusion. Frontal carinae present, running back to about mid point level of eyes but very unclearly. Eyes extremely large and moderately convex, varying in size with maximum diameter 0.18 mm and 8-9 ommatidia; malar space as long as diameter of eye in profile. Antennal scape long, extending beyond

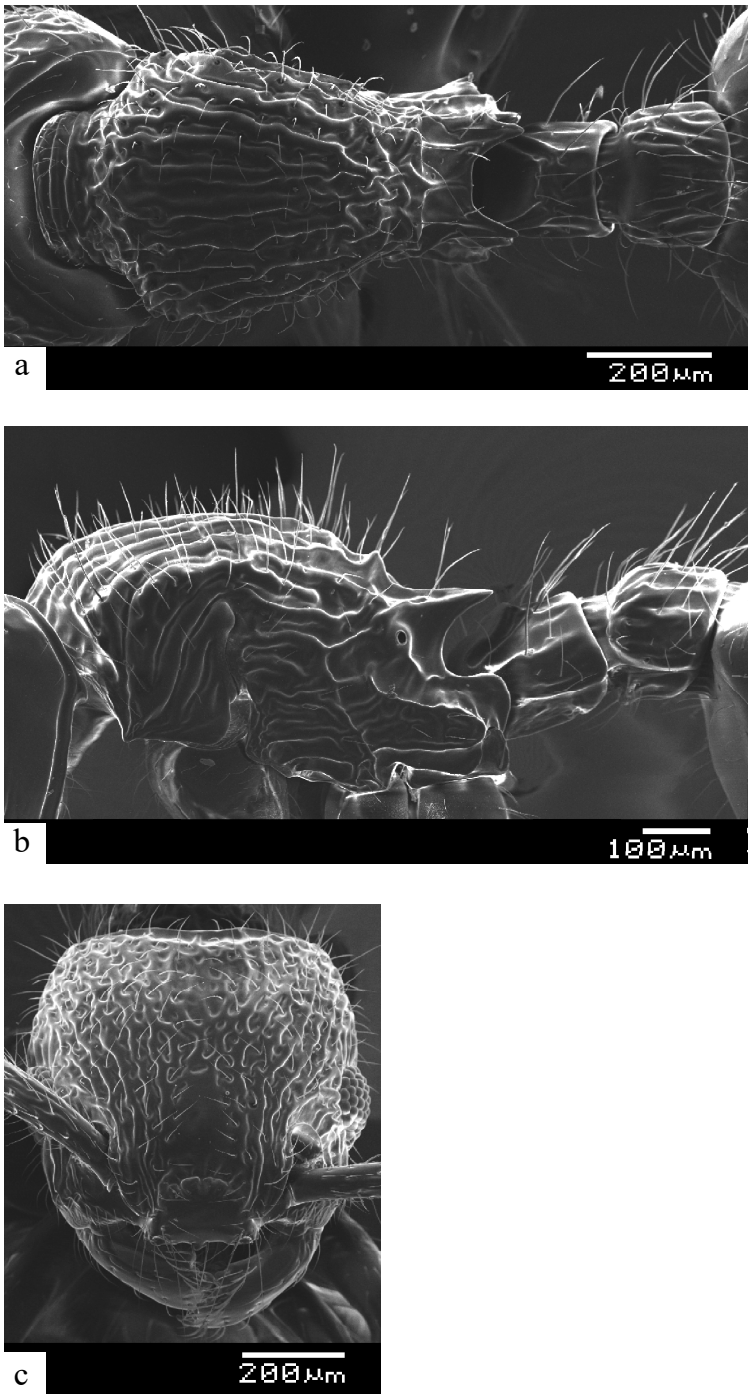


Fig. 29. *Myrmecina macrops* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior ventrolateral portion angulate. Eumetanotal spine present but small, frequently unclear. Propodeal spine triangular, just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle small, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum much longer than diameter of spiracle. Petiole short, as long as high in profile, and slightly longer than broad in dorsal view; small but distinct dorsal crest located almost at midlength in profile; subpetiolar process projecting forward with acute apex. Postpetiole slightly broader than petiole in dorsal view; lateral margin straight; dorsal outline slightly convex or flattened in profile; ventral outline projected rectangularly, frequently undeveloped.

Anterior margin of gaster not concave in dorsal view.

Head distinct foveolate, but variable from opaque to foveolate on the whole surface; ventrolateral portion smooth and shining. Mandibles smooth and shining sometimes with yellow spots on dorsal surface. Clypeus smooth and shining. Mesosoma with wavy rugae distictly. Petiole and postpetiole with wavy longitudinal rugae. Head with more or less dense pilosity on dorsum. Mesosoma with more or less dense pilosity on dorsum. Pilosity of pronotum slightly shorter than propodeal spine, but variable in length, sometimes longer than propodeal spine. Pilosity of petiole and postpetiole longer than that of mesosoma. Petiole with or without hairs on ventral surface. Postpetiole with about 4 hairs on ventral surface. Body dark reddish brown.

Holotype worker, MALAYSIA: Sepilok Forest, Sabah, Borneo, 4. vii. 1998 (*K. Eguchi*) (UMS). Paratypes. 9 workers and 1 queen (dealate) with same data as holotype (KUIC, KUEC).

Other material examined. MALAYSIA: Danum Valley, Sabah (*C. Brühl*); Deramakot Forest Reserve, Sabah (*C. Brühl*); Poring, 600 m alt., Kinabalu Park, Sabah (*T. Kikuta*); Tambunan Village Resort Centre, Sabah (*H. Okido*); Ulu Gombak (*F. Ito*; *Sk. Yamane*). INDONESIA: Brastagi, 1500 m, N. Sumatra (*Rougemont*); Padang, Sumatra (no data); Kebun Raya, Bogor, W-Java (*F. Ito*).

Remarks. *M. macrops* belongs to the *M. macrops* complex comprising *M. breviata* sp. nov., *M. gymnocephala* sp. nov. and *M. macrops*. This species is different from the related species in having developed propodeal spine, the pronotum and mesonotum with wavy rugae. This species corresponds to "*Myrmecina* sp. M" of Ito *et al*. (2001).

The species inhabits in soil and litter, and has been collected by the pitfall trap.

Distribution. MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra, Java.

Myrmecina magnificens Wong & Guénard

(Fig. 30)

Myrmecina magnificens Wong & Guénard, 2016: 132. Holotype worker, SINGAPORE: Seletar Trail, Central Catchment Nature Reserve, 1.395141°N, 103.802595°E, 47 m, 2.ix.2015, leaf litter (*MKL Wong*), label "MW020915-L1.1" (ANTWEB1009004) (LKCNHM). Paratypes. Four workers (ANTWEB1009005–ANTWEB1009008), same data as holotype (SBSHKU). [not examined].

Workers. TL 4.02-4.26, HL 1.08-1.13, HW 1.06-1.09, CI 96-99, SL 0.93-1.01, SI 87-93, PW 0.69, ML 1.10-1.14 (5 measured).

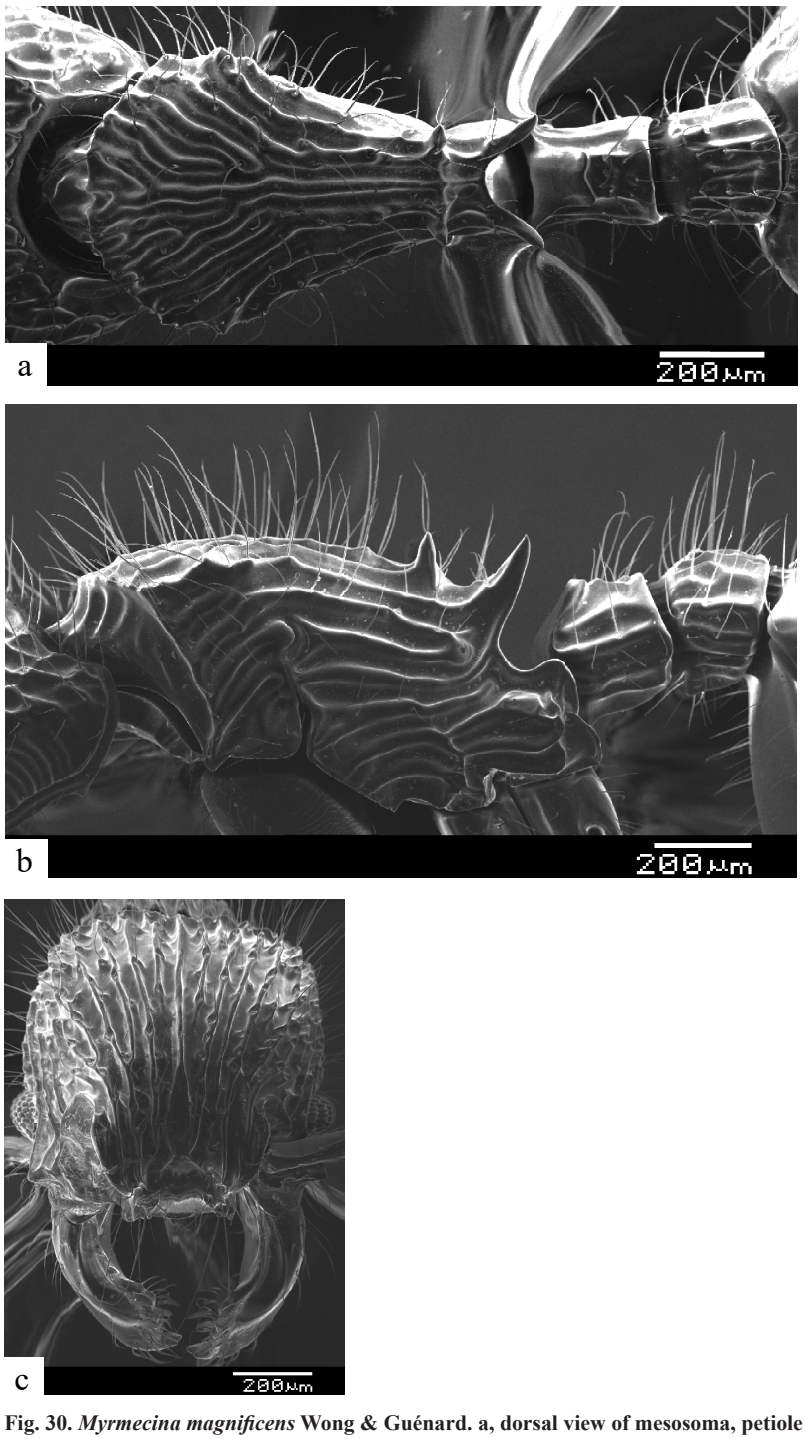


Fig. 30. *Myrmecina magnificens* Wong & Guénard. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Worker. Occipital margin strongly concave in full-face view; occipital corners projected posteriorly. Masticatory margin of mandible straight; apical tooth strong, third tooth acute, followed by 6 small but distinct teeth. Dorsal surface of clypeus concave; median portion of anterior margin weakly projected, without a median process; lateral portion without a sharp ridge of shield wall, but weakly carinate on each side, in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other without fusion. Frontal carinae present, running to near occipital corners but frequently unclear. Eyes large and convex, varying in size with maximum diameter 0.18-0.20 mm and 8-10 ommatidia; malar space longer than diameter of eye in profile. Antennal scape just reaching posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum with two or four small denticles on anterior dorsolateral portion in dorsal view, but frequently unclear; anterior ventrolateral portion with small denticle directing forward and downward but varying in shape and direction; frequently not forming denticle but angulately. Eumetanotal spine long with acute apex. Propodeal spine elongate, variable in length, strongly curved upward. Propodeal lobe low. Propodeal spiracle situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole short, almost as long as high in profile; small dorsal crest located anterioriy in profile; subpetiolar process triangular but variable; ventral outline flattened. Postpetiole almost as broad as petiole and expanded posteriorly in dorsal view; lateral portion not marginated; dorsal outline slightly convex in profile; ventral outline projected at anterior portion.

Anterior margin of gaster concave in dorsal view.

Head with weakly waved rugae which are thick and longitudinal; ventrolateral portion usually with longitudinal rugae which are curved at posterior portion. Mandibles sometimes with reddish brown spots on dorsal surface clearly. Clypeus smooth and shining. Mesosoma with weakly waved rugae which are thick and longitudinal; lateral portion with weakly waved rugae which are thick. Petiole and postpetiole with a few longitudinal rugae. First gastral tergum smooth and shining. Head and mesosoma with long pilosity on dorsum. Pilosity of pronotum as long as propodeal spines or longer. Head, mesosoma, petiole and postpetiole black, legs varying from yellowish brown to light reddish brown, forecoxae varying from reddish brown to black, gaster reddish brown.

Other material examined. MALAYSIA: Tioman Is., 17-22. ix. 1992, MT-1 (*F. Ito*) (UMS); Tioman Is., 17-22. ix. 1992, MT-2 (*F. Ito*); Tioman Is., 17-22. ix. 1992, MT-3 (*F. Ito*) (KUIC, KUEC); Ulu Gombak (*F. Ito*); Pasoh (*K. Masuko*). INDONESIA: Sitiung, W-Sumatra (*F. Ito*).

Remarks. *M. magnificens* belongs to the *M. spinosa* complex. The other members of the complex are: *M. inflata* sp. nov., *M. mahuana* sp. nov., *M. spinosa* sp. nov. and *M. tridentata* sp. nov. The definition and the distribution of the *spinosa* complex are given in the latter section. Among those species, *M. magnificens* can be distinguished from the remains by having the concave anterior margin of the first gastral tergum, the bent masticatory margin of the mandible, and the strongly elevated propodeal spine.

Ergatogynes are present in the species, and only distinguished from the workers in width and length of the first gastral tergum (Ito, 1996).

The species inhabits in rotten branches (Ito, pers. comm.), and litter.

Distribution. MALAYSIA: Tioman Is., The Malay Pen.; INDONESIA: Sumatra.

***Myrmecina mahuana* sp. nov.**

(Fig. 31)

Holotype worker. TL 3.73, HL 0.96, HW 0.94, CI 98, SL 0.93, SI 98, PW 0.61, ML 1.02.

Worker. Head convex on lateral margin; occipital margin strongly concave in full-face view; occipital corners projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth weakly developed, followed by 5 small teeth and a stout basal tooth bearing blunt apex; small teeth frequently unclear. Dorsal surface of clypeus not concave; median portion of anterior margin weakly projected with a median process bearing two tops; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other. Frontal

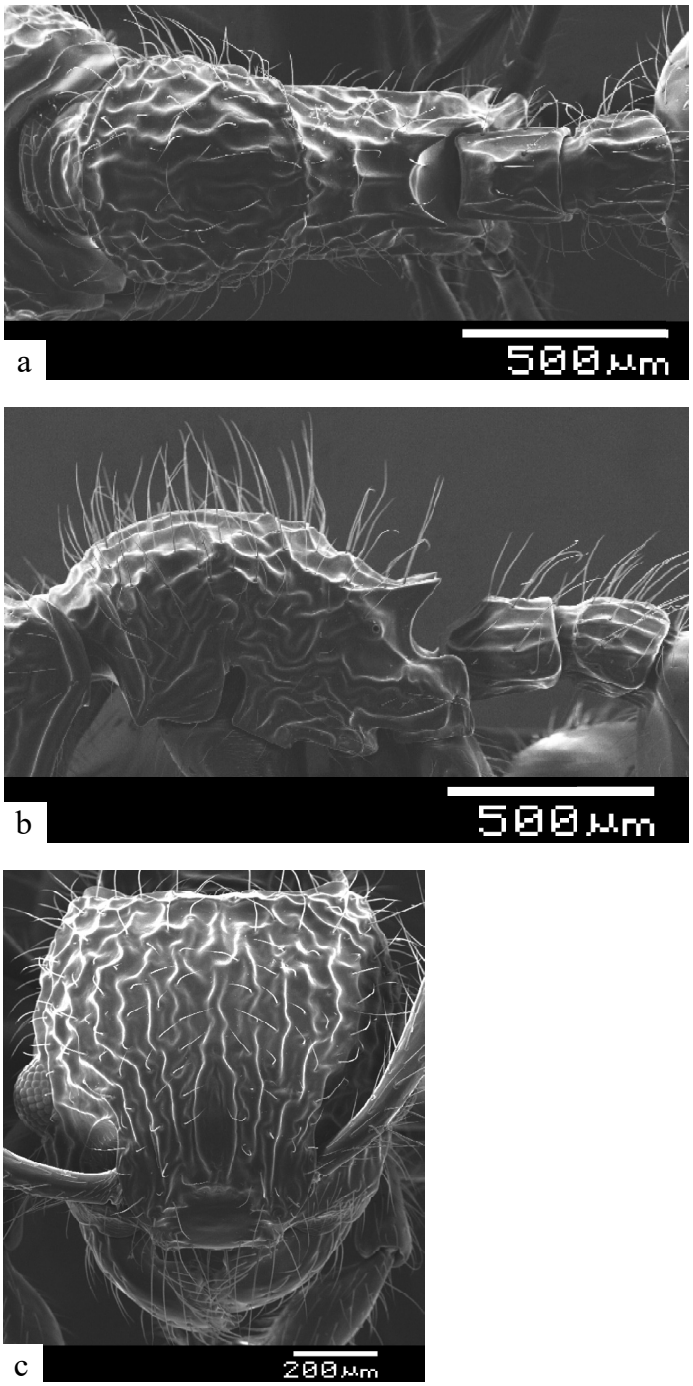


Fig. 31. *Myrmecina mahuana* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

carinae present, running back to or beyond the level of the posterior margin of the eyes, but very obscure, difficult to distinguish from rugae on dorsum of head. Eyes large and convex with maximum diameter 0.18 mm, with 11 ommatidia; malar space twice as long as diameter of eye or shorter in profile. Antennal scape long, extending beyond posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior ventrolateral portion with small denticle. Eumetanotal spine present but small and unclear. Propodeal spine triangular, directing upward and backward, just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle small, situated near base

of propodeal spine, between posterior margin of spiracle and posterior margin of propodeum much longer than diameter of spiracle. Petiole longer than high in profile; dorsal crest absent; subpetiolar process absent. Postpetiole slightly broader than petiole in dorsal view; lateral margin straight; dorsal outline slightly convex or flattened in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view.

Head with wavy rugae distinctly; ventrolateral portion with 2-3 rugae longitudinally. Mandibles smooth and shining. Clypeus smooth and shining. Mesosoma with irregular rugae. Petiole and postpetiole with longitudinal rugae. Head and mesosoma with long pilosity on dorsum, hairs of pronotum longer than apical second segment of antenna. Pilosity of petiole and postpetiole as long as that of mesosoma. Postpetiole with paired hairs on ventral surface. Head, mesosoma, petiole and postpetiole dark reddish brown, mandible yellowish brown, gaster black.

Holotype worker, MALAYSIA: Mahua Waterfall area, ca. 1000 m alt., Crocker Range N. P., Sabah (*H. Okido*) (UMS).

Other material examined. MALAYSIA: Gun. Lawit, Summit ridge, Trengganu (*T. Clay*) (BMNH). INDONESIA: Sumatra, Padang (*no collector's name*) (BMNH).

Remarks. *M. mahuana* belongs to the *M. spinosa* complex. Among those species, *M. mahuana* can be distinguished from the remains by having the propodeal spine directed posteriorly and simple anterior margin of the first gastral tergum.

Distribution. MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Sumatra.

***Myrmecina maryatiae* sp. nov.**

(Fig. 32)

Holotype worker. TL 2.58, HL 0.62, HW 0.58, CI 92, SL 0.50, SI 86, PW 0.43, ML 0.66.

Paratype workers. TL 2.37-2.80, HL 0.58-0.67, HW 0.53-0.62, CI 90-97, SL 0.48-0.53, SI 84-94, PW 0.38-0.45, ML 0.59-0.74 (24 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus concave; median portion of anterior margin slightly projected and concave without a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes extremely large and moderately convex, varying in size with maximum diameter 0.11-0.16 mm and 7-10 ommatidia; malar space as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye twice as long as diameter of eye. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum usually without denticle, but sometimes with small denticles; anterior portion marginate; anterior ventrolateral portion angulate; anterior dorsolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, as long as broad at base, not or just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle small, situated near base

of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum much longer than diameter of spiracle. Petiole short, as long as high in profile, and slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process usually present with acute anterior apex. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened in profile; ventral outline slightly projected rectangularly.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with irregular rugae which are thin distinctly; ventrolateral portion smooth and shining. Clypeus smooth and shining, but

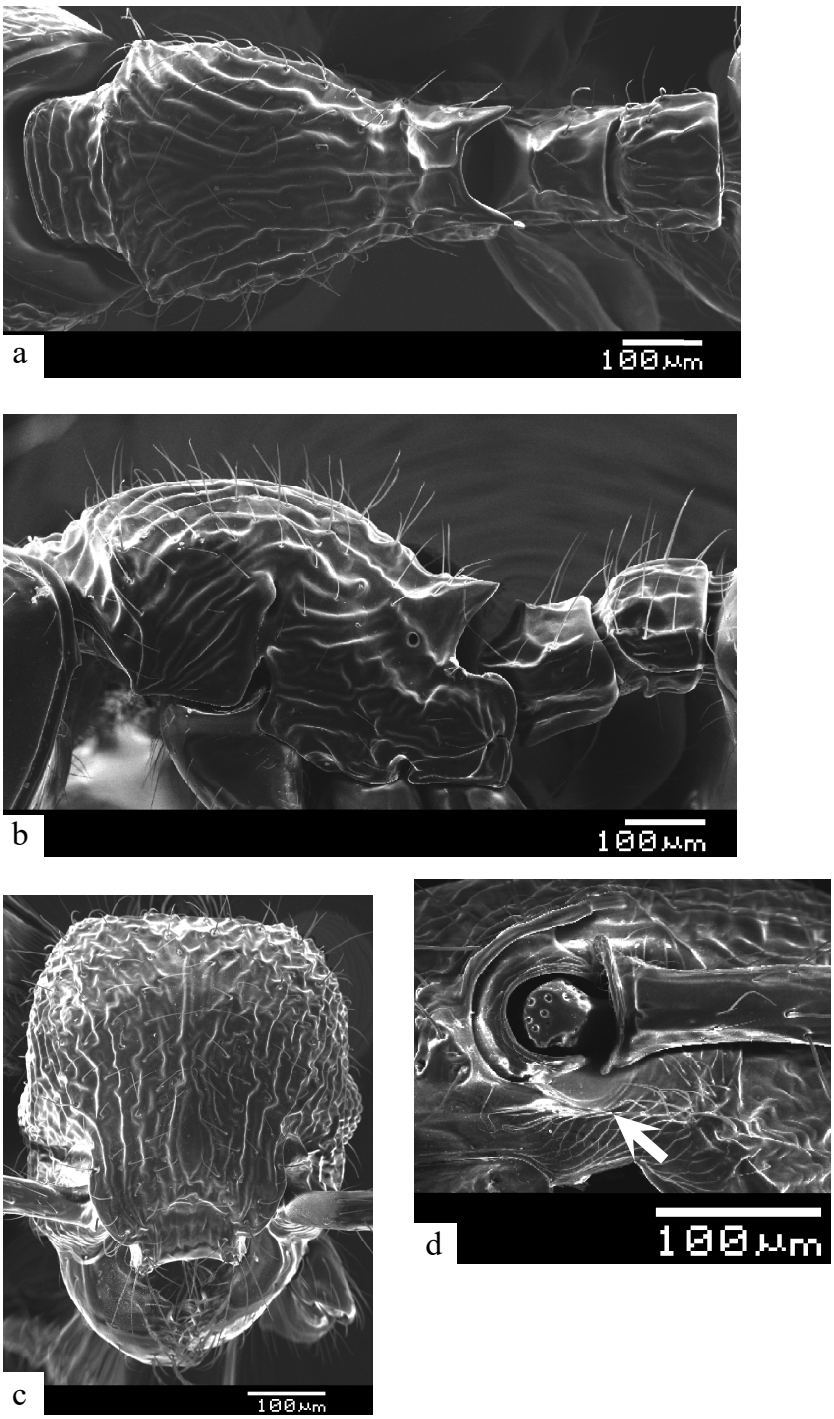


Fig. 32. *Myrmecina maryatiae* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, lateral portion of clypeus.

posterior portion sculptured. Mesosoma with wavy rugae distinctly. Forecoxa smooth and shining. Petiole and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body usually black, mandibles, antennae and legs yellowish brown to black.

Holotype worker, MALAYSIA: Ulu Gombak, 27. x. 1996, FI96-721, 19. ii. 1997 fixed (*F. Ito*) (UMS).

Paratypes. numerous workers, queens and males with same data as holotype; 15 workers and 1 queen with same data as holotype but vii-x. 1992, FI92MG502, no date for fix; numerous workers, queens and males with same data as holotype but vii-x. 1992, FI92MG565, no date for fix; numerous workers, queens and males with same data as holotype but 24. x. 1996, FI96-694; 32 workers, 1 queen and 1 male with same data as holotype but 24. x. 1996, FI96-698; numerous workers, queens and males with same data as holotype but 26. x. 1996, FI96-700; 4 workers, 1 queen and 2 males with same data as holotype but 28. x. 1996, FI96-729; numerous workers, queen and male with same data as holotype but 28. x. 1996, FI96-738; numerous workers, queens and males with same data as holotype but 28. x. 1996, FI96-740; 10 workers and 1 queen with same data as holotype but 18. vii. 1998, FI98-108, no date for fix (KUEC, KUIC, UMS).

Other material examined. MALAYSIA: Bunga Buah, nr Genting H. L. (*Sk. Yamane*) (KUIC, KUEC); Neg. Sembilan, Pasoh For. Res. (*M. Brendell, K. Jackson & L Ficken*) (BMNH); 4th Division, Gn. Mulu N. P. (*P. M. Hammond & J. E. Marshall*) (BMNH); Selangor, Gombak (*B. Bolton*) (BMNH); Tower Region, Lambir N. P., Miri, Sarawak (*Sk. Yamane*) (KUEC, KUIC); Niah N. P., Sarawak (*Sk. Yamane*) (KUEC); Danum Valley, Sabah, Borneo (*H. Okido*) (KUEC). BRUNEI: Tasek Merimbum, (*K. Eguchi*) (KUEC, KUIC). INDONESIA: Sangkimah, Kutai N. P., E. Kalimantan (*Sk. Yamane*) (KUEC). THAILAND: Tone Chong-Fah Waterfall, 20 km S. Takuapa, Phang Nga Prov. (*A. Schulz*) (NHMW).

Remarks. *M. maryatiae* does not belong to any species complex. But *M. maryatiae* is similar to the species of the *macrops* complex on the basis of two characters. Among those species, *M. maryatiae* can be distinguished from the remains by having the sculptured head and the short antennal scape. This species corresponds to "*Myrmecina* sp. B" of Aoki & Ito (1997). Aoki & Ito (1997) reported that this species had a myrmecophilous oribatid mite *Protoribates myrmecophilus* Aoki & Ito, which was also found in the nest of *M.grandis* sp. nov. (=*Myrmecina* sp. E).

The species inhabits in litter or under bark.

Distribution. THAILAND: Phang Nga Prov.; MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); INDONESIA: Borneo (Kalimantan).

***Myrmecina monticola* sp. nov.**

(Fig. 33)

Holotype worker. TL 3.13, HL 0.78, HW 0.72, CI 93, SL 0.69, SI 96, PW 0.51, ML 0.86.

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion

of anterior margin projected with four processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with small but distinct paired denticles, very close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes medium-sized and convex with maximum diameter 0.11 mm, with 8 ommatidia; malar space twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye or longer. Antennal scape long, extending beyond posterolateral corner of head; antennal flange weakly developed.

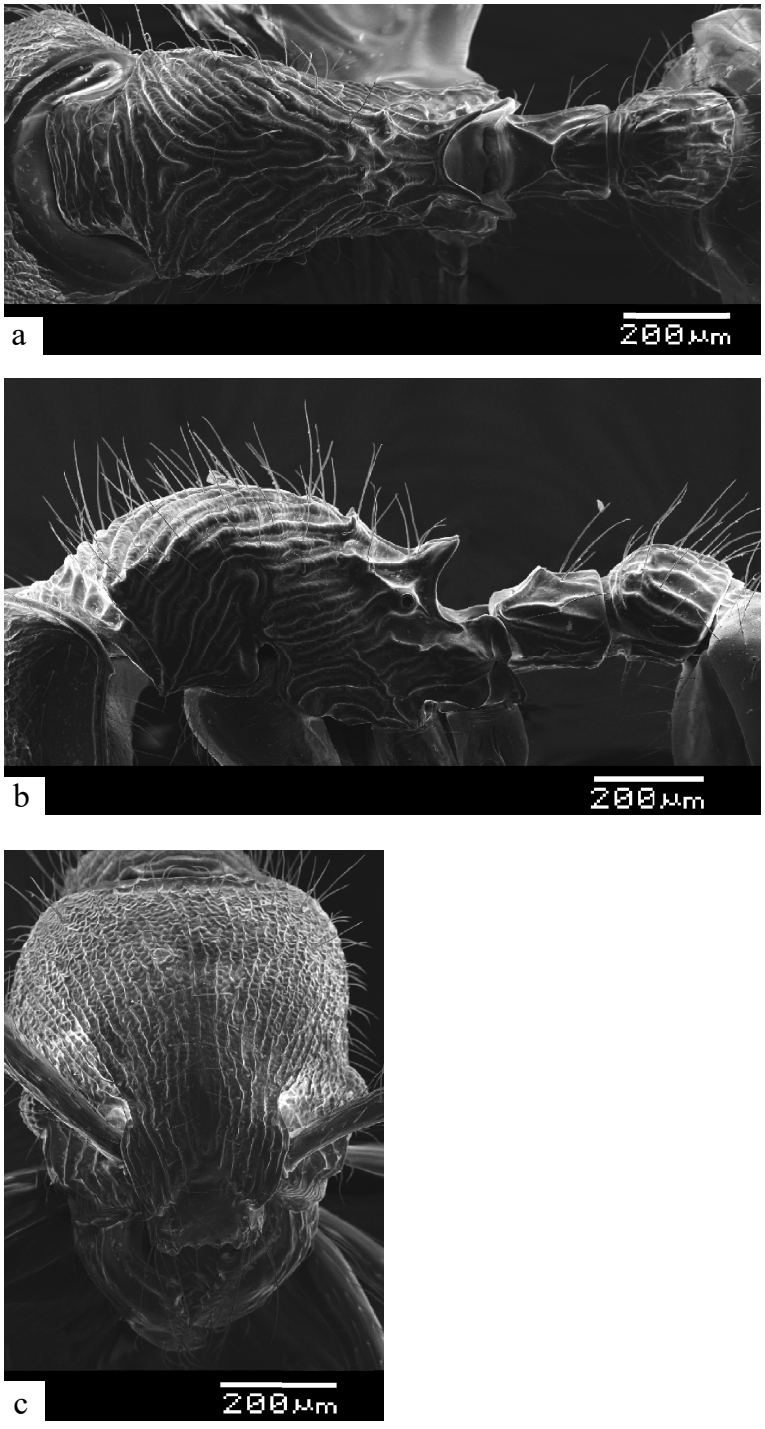


Fig. 33. *Myrmecina monticola* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, as long as broad at base, not reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle medium-sized, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole short, slightly longer than high in profile, and slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process and median longitudinal ridge at ventral portion absent. Postpetiole slightly broader than petiole and expanded posteriorly in dorsal view; larger than petiole in profile; dorsal outline flattened; ventral outline slightly projected rectangularly.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head punctured with thin rugae weakly; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with thick rugae diverging anteriorly on dorsal surface. Anterior portion of pronotum with a few transverse rugae in dorsal view. Forecoxa smooth and shining. Petiole and postpetiole with thick rugae. First gastral segment smooth and shining. Head with relatively dense and long pilosity on dorsum. Mesosoma with dense and long pilosity on dorsum, hairs of pronotum longer than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 4 hairs on ventral surface. Body black, mandibles, antennae and legs yellowish brown to brown, forecoxae dark reddish brown.

Holotype worker, MALAYSIA: Cameron Highlands, 1500 m alt., Malay Pen., 25. iv. 2000 (*K. Eguchi*) (UMS).

Remarks. *M. monticola* does not belong to any species complex. But *M. monticola* is similar to *M. boltoni* sp. nov. on the basis of some characters (see the remarks of *M. boltoni*). Among those species, *M monticola* can be distinguished from the remains by having the anterior clypeal margin with median paired processes and the smooth and shining forecoxa.

Distribution. MALAYSIA: The Malay Pen.

***Myrmecina muluensis* sp. nov.**

(Fig. 34)

Holotype worker. TL 3.56, HL 0.85, HW 0.80, CI 94, SL 0.72, SI 90, PW 0.50, ML 0.99.

Paratype worker. TL 3.43, HL 0.84, HW 0.75, CI 90, SL 0.72, SI 96, PW 0.50, ML 0.93 (1 measured).

Worker. Head subrectangular, slightly longer than broad in full-face view; median portion of occipital margin much concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with a median process or three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles, which are well separated. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes small circularly and moderately convex, varying in size with maximum diameter 0.09 mm and 12-13 ommatidia; malar space distinctly twice as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye five times as long as diameter of eye or longer. Antennal scape long, extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion not

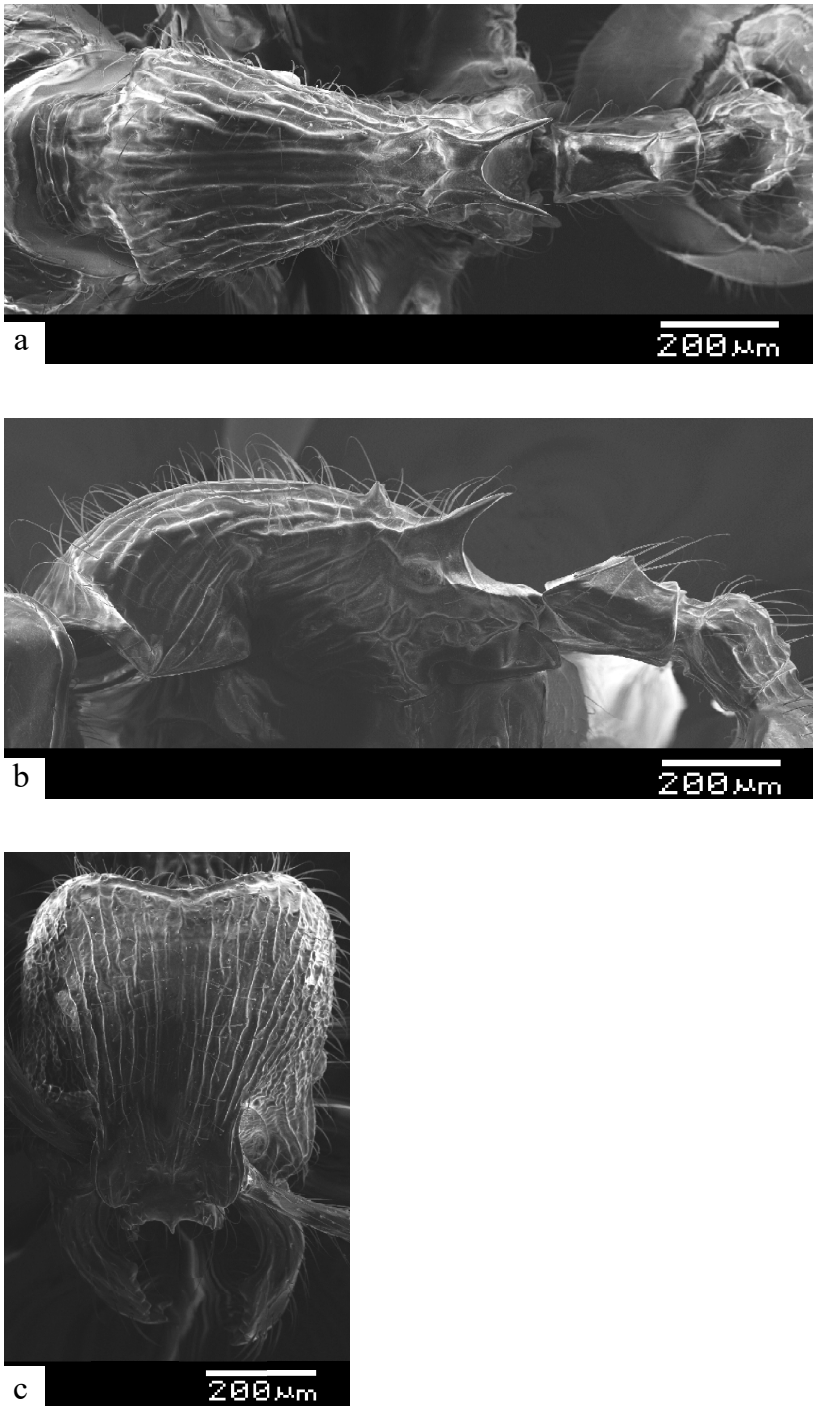


Fig. 34. *Myrmecina muluensis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

marginate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine distinctly present. Propodeal spine elongate, much longer than broad at base, not reaching or just reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of the spiracle. Petiole long, longer than high in profile, and much longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process variously developed from weakly raised median longitudinal ridge to distinct projection. Postpetiole slightly broader than petiole in

dorsal view; anterolateral margin rounded; anterior portion raised in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view.

Head with thin rugae longitudinally; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with straight rugae which are thick. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with dense and long pilosity on dorsum. Mesosoma with dense and long pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Head, mesosoma, petiole, postpetiole reddish brown or yellowish brown but variable, mandibles, antennae and legs yellowish brown.

Holotype worker, MALAYSIA: Sarawak, 4th Division, Gn. Mulu NP., 20. iii. 78 (*N. M. Collins*) (BMNH).
Paratypes. 2 workers with same data as holotype (BMNH).

Remarks. *M. muluensis* does not belong to any species complex. But in terms of the smooth and shining ventrolateral portion of the head, the petiole with subpetiolar process or median longitudinal ridge, the mesosoma with the eumetanotal spine and relative length of the antennal scape, *M. muluensis* is similar to *M. sulcata* Emery. The similarity of those species does not always reflect the relationships, because the characters mentioned above tend to change independently. Among those species, *M muluensis* can be distinguished from the remains by having the small eye comprising 15 ommatidia or less, and the long head. The species inhabits in soil.

Distribution. MALAYSIA: Borneo (Sarawak).

Myrmecina nesaea Wheeler

Myrmecina nesaea Wheeler, 1924: 247. Syntype queen, INDONESIA: Sebesi I. (Dammerman) (depository unknown) [not seen].

Remarks. Worker of this species is unknown.

Distribution. INDONESIA: Sebesi I. (near Krakatau Is.)

Myrmecina nigra sp. nov.

(Fig. 35)

Holotype worker. TL 3.20, HL 0.77, HW 0.74, CI 96, SL 0.70, SI 96, PW 0.50, ML 0.82.
Paratype workers. TL 3.05-3.36, HL 0.76-0.80, HW 0.74-0.75, CI 94-98, SL 0.67-0.69, SI 91-92, PW 0.49-0.51, ML 0.77-0.79 (4 measured).

Worker. Head subrectangular, as long as broad in full-face view or longer; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal tooth. Dorsal surface of clypeus concave; median portion of anterior margin projected with three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae

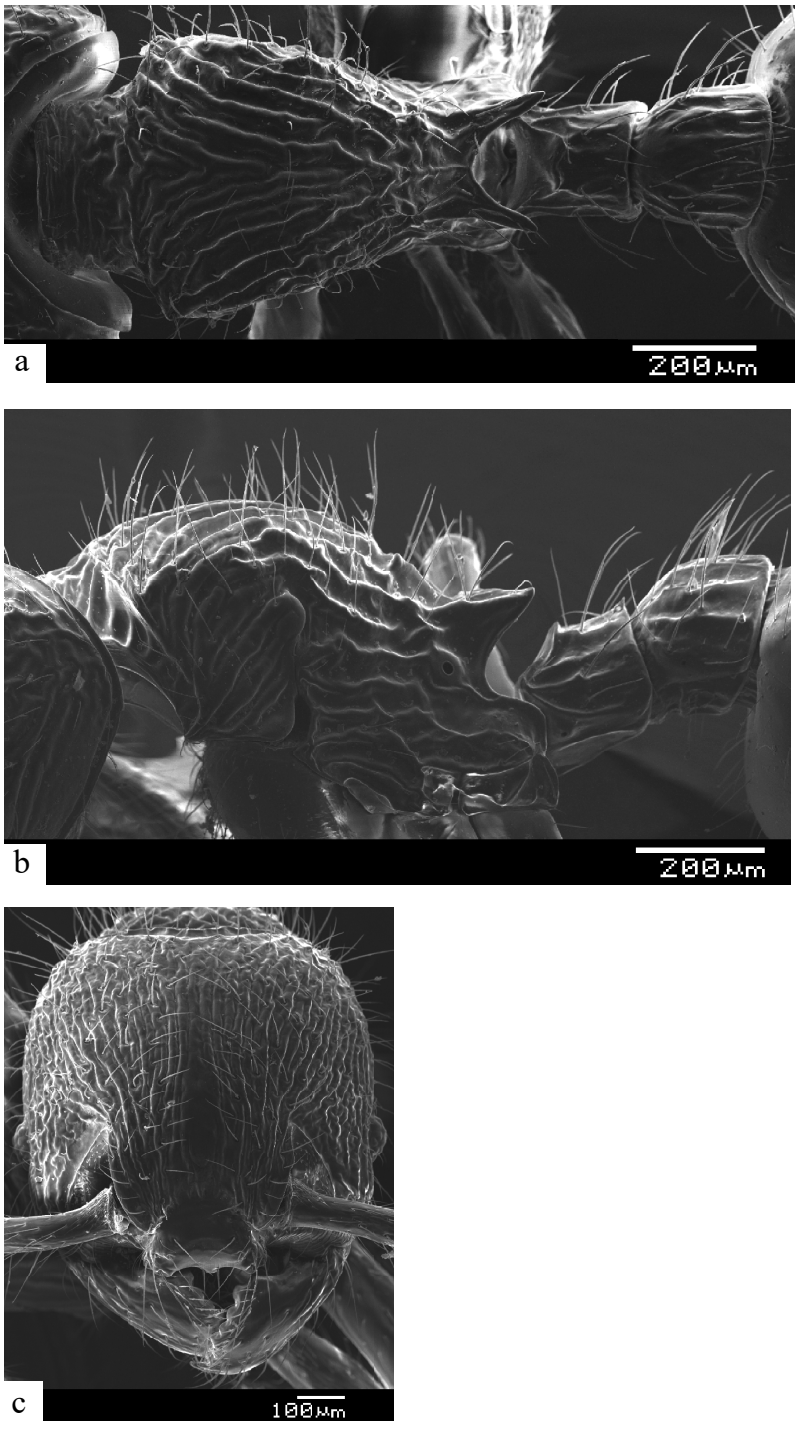


Fig. 35. *Myrmecina nigra* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

on dorsum of head. Eyes small circularly and moderately convex, varying in size with maximum diameter 0.08-0.10 mm and 13-14 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye. Antennal scape long, extending beyond posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior portion marginate but unclearly in dorsal view; anterior ventrolateral portion more or less angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small, sometimes unclear. Propodeal spine triangular, extending over vertical posteriormost limit of

propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum slightly longer than diameter of spiracle. Petiole short, as long as or slightly longer than high in profile, and longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process variously developed from weakly raised median longitudinal ridge to distinct projection. Postpetiole slightly longer than petiole and expanded posteriorly in dorsal view; anterior portion not raised in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view.

Head with wavy rugae which are thin distinctly; ventrolateral portion sculptured irregularly. Clypeus smooth and shining. Mesosoma with wavy rugae distinctly. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with relatively dense and long pilosity on dorsum. Mesosoma feebly dense and long pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 4 hairs on ventral surface. Body black to dark reddish brown, antennae and legs brown to yellowish brown.

Holotype worker, VIETNAM: Deo O Quy Ho, 1750 m alt., Lao Cai Prov., 28. vi. 1997 (*S. Nomura*) (KUEC).
Paratypes. 4 workers with same data as holotype (KUEC, IEBR, KUIC).

Remarks. *M. nigra* does not belong to any species complex. But *M. nigra* is similar to *M. inthanonensis* sp. nov. on the basis of some characters (see the remarks of *M. inthanonensis*). Among those species, *M nigra* can be distinguished from the remains by having the slightly large postpetiole comparing with the petiole, the anterior clypeal margin with three processes, and the mesosoma with wavy and diverging rugae on dorsal surface.

Distribution. VIETNAM: Lao Cai Prov.

Myrmecina nitidiuscula Satria & Yamane

Myrmecina nitidiuscula Satria & Yamane, 2019: 188. Holotype worker, INDONESIA: Sumatra, Aceh, Leuser Ecosystem, Putri Betung, 21.ix.2012 (*R. Satria*) (SEMUT20180326B) (MZB). Paratypes. Two workers (SEMUT20180808A, SEMUT20180808B), same data as holotype (RSC); 2 workers (SKYUSI-FOR004-005), same locality, but at. >1100 m, good forest, 20.ix.2012 (*Yamane & Syaukani*) (SKYC); 1 dealate queen (SEMUT20181112), same locality, but alt. 850 m, plantation, 19.ix.2012 (*Yamane & Syaukani*) (RSC). [one SKYC paratype worker examined].

Remarks. *M. nitidiuscula* belongs to the *macrops* complex comprising *M. breviata* sp. nov., *M. gymnocephala* sp. nov. and *M. macrops* sp. nov. This species is different from the related species in having the smooth and shingy head, the developed propodeal spine, and the pronotum and mesonotum with straight rugae.

Distribution. INDONESIA: Sumatra.

Myrmecina nomurai sp. nov.

(Fig. 36)

Holotype worker. TL 2.24, HL 0.56, HW 0.53, CI 94, SL 0.43, SI 82, PW 0.35, ML 0.60.

Paratype worker. TL 2.34, HL 0.58, HW 0.53, CI 90, SL 0.46, SI 88, PW 0.35, ML 0.63 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin moderately concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth acute, followed by 5 small teeth and a stout basal tooth bearing blunt apex. Dorsal surface of clypeus slightly concave; median portion of anterior margin weakly projected with small median process but frequently unclear; lateral portion raised

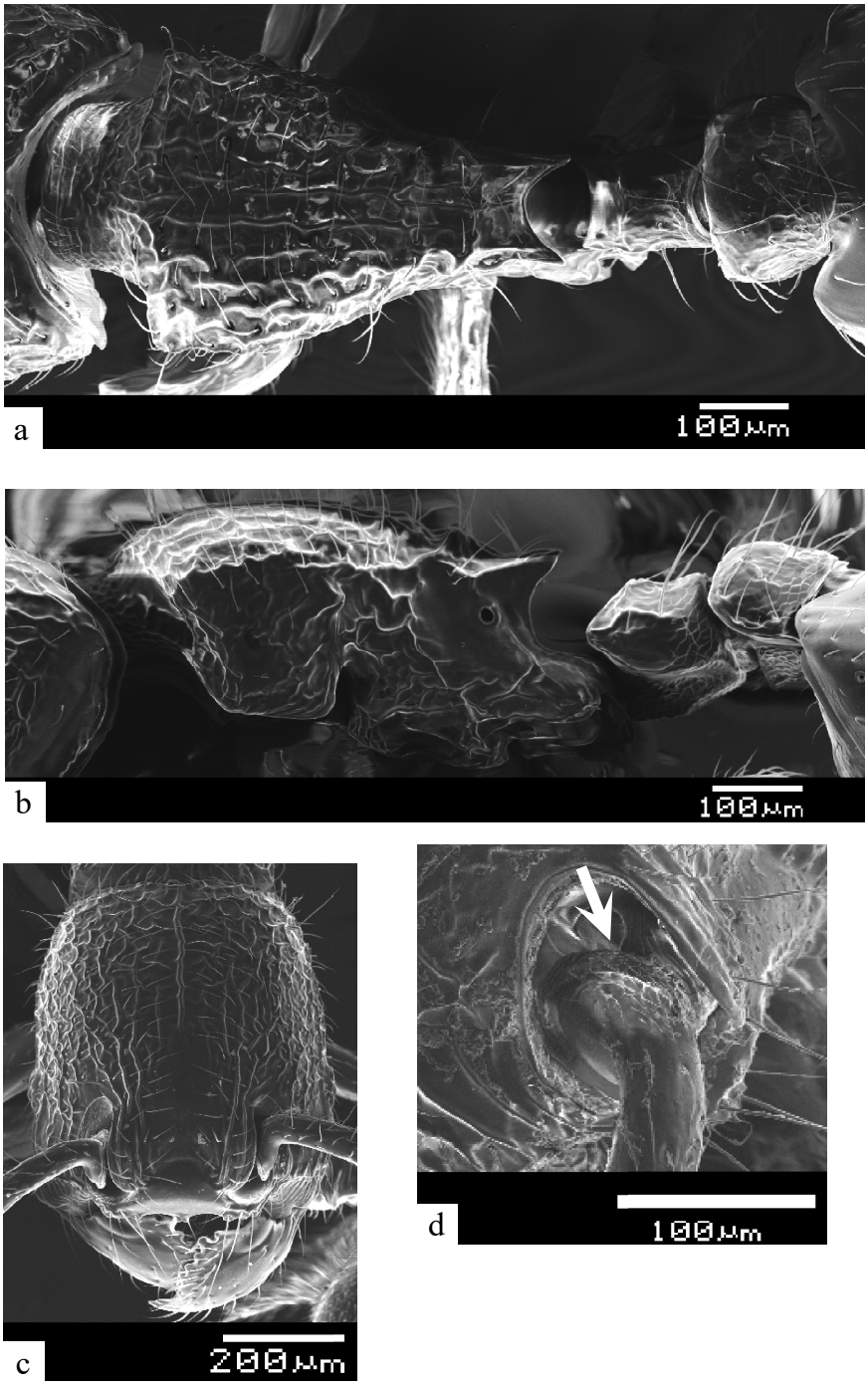


Fig. 36. M*yrmecina nomurai* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, antennal flange.

into a sharp ridge of shield wall on each side, in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles fused with each other at base. Frontal carinae present and running back to or beyond the level of the posterior margin of the eyes, but frequently unclear. Eyes very small, varying in size with maximum diameter 0.06 mm and 6-7 ommatidia. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma more or less flattened in profile. Pronotum without denticles; anterior ventrolateral portion not angulate. Eumetanotal spine present but small. Propodeal spine triangular, directing slightly upward and backward, not reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, apart from margin by its diameter. Petiole short; small dorsal crest located almost at midlength in profile; subpetiolar process projecting forward with acute apex. Postpetiole much broader than petiole and usually expanded anteriorly in dorsal view; lateral portion strongly marginated; dorsal outline flattened in profile; ventral outline projected forward with acute apex at anterior portion.

Anterior margin of gaster concave in dorsal view.

Head weakly punctured with irregular rugae which are thin, but variable; ventrolateral portion weakly punctured or smooth and shining, without rugae. Mandibles sometimes with yellow spot on dorsal surface. Clypeus smooth and shining. Mesosoma with irregular rugae which are thin in profile. Petiole and postpetiole with a few longitudinal rugae. First gastral tergum weakly punctured on dorsal surface. Head with sparse pilosity on dorsum. Mesosoma with sparse pilosity on dorsum, hairs of pronotum longer than propodeal spines and shorter than that of petiole and postpetiole. Petiole and postpetiole with or without hairs on ventral surface. Head, mesosoma, petiole and postpetiole varying from yellowish brown to reddish brown, gaster dark reddish brown.

Holotype worker, VIETNAM: Tam Dao, 900 m alt., Vinh Phuc Prov., 9. xi. 1999, VN99-HO-054 (*H. Okido*) (IEBR).
Paratypes. 3 workers with same data as holotype (KUIC, KUEC).

Other material examined. VIETNAM: Mt. Pia Oac, Bamboo st., 1230 m, Cao Bang Prov. (*S. Nomura*).

Remarks. *M. nomurai* belongs to the *M. vieti* complex. The other members of the complex are: *M. guangxiensis* and *M. vieti* sp. nov. Among those species, *M. nomurai* can be distinguished from the remains by having the short and sculptured petiole which is expanded laterally at the anterior portion in dorsal view, and the mesosoma with the longitudinal and parallel rugae.

The species inhabits in soil.

Distribution. VIETNAM: Cao Bang Prov., Vinh Phuc Prov.

***Myrmecina padangensis* sp. nov.**
(Fig. 37)

Holotype worker. TL 3.56, HL 0.88, HW 0.88, CI 100, SL 0.68, SI 77, PW 0.58, ML 0.93.
Paratype worker. TL 3.49, HL 0.86, HW 0.90, CI 104, SL 0.72, SI 80, PW 0.58, ML 0.94 (1 measured).

Worker. Head subrectangular, as long as or shorter than broad, broad posteriorly in full-face view; median portion of occipital margin concave; occipital corners widely rounded, not projected posteriorly; dorsal outline convex in profile. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with or without a median

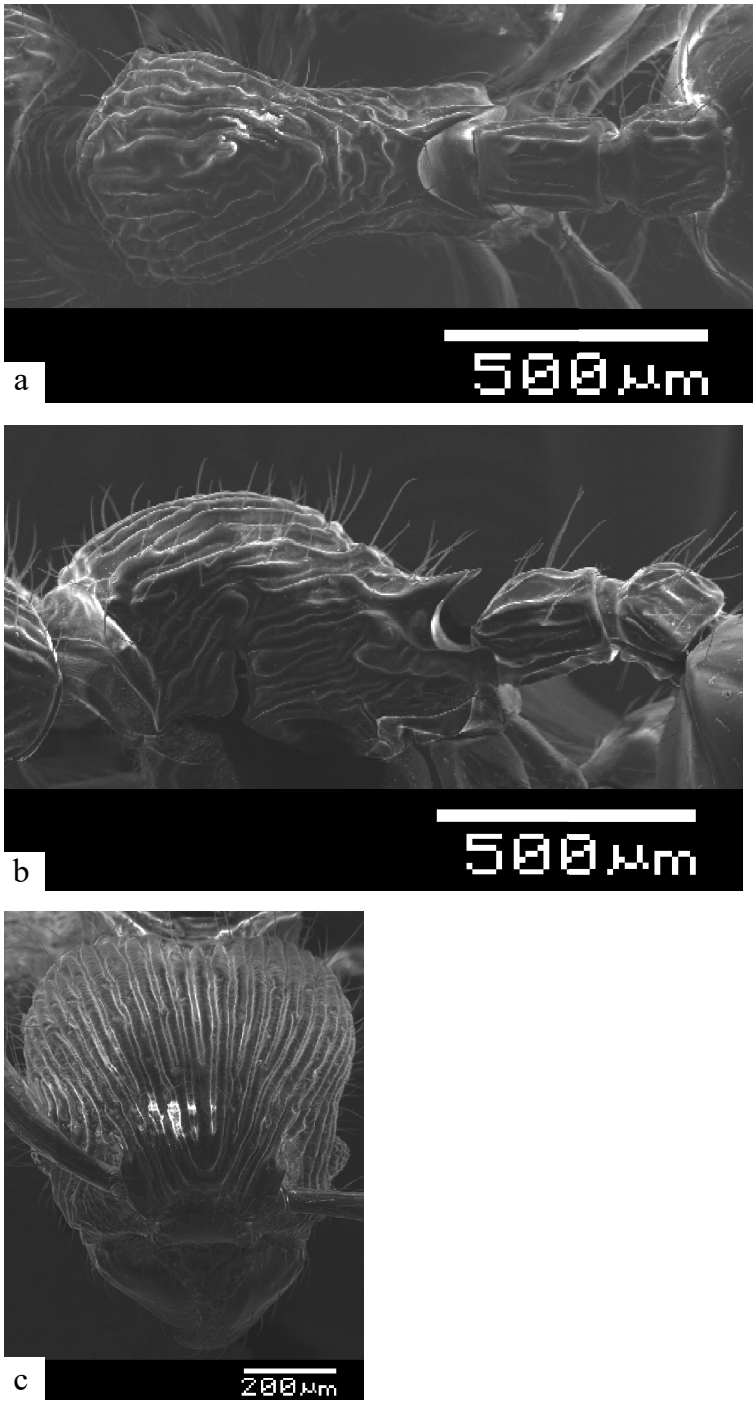


Fig. 37. *Myrmecina padangensis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired large denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex with maximum diameter 0.14 mm, with 8 ommatidia; malar space twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye four times twice as long as diameter of eye or shorter. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma strongly convex in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion projected or angulate; anterior dorsolateral portion rounded, not angulate. Furrow between pronotum and

mesoepisternal projection variable, narrow to broad. Eumetanotal spine present but small. Propodeal spine triangular, longer than broad at base, slightly extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe usually low, sometimes raised. Propodeal spiracle large, situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole long, longer than high in profile, longer than broad in dorsal view; dorsal crest absent; subpetiolar process present, but unclearly without acute anterior apex. Postpetiole slightly broader than petiole in dorsal view; anterolateral portion raised; dorsal outline flattened or convex in profile; ventral outline slightly projected with two tops.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae which are thin; ventrolateral portion with longitudinal rugae. Clypeus smooth and shining. Mesosoma with wavy rugae which are thick. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with relatively sparse and long pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body black to dark reddish brown, forecoxae reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Sumatra, Padang (*no collector's name*) (BMNH). Paratypes. 2 workers with same data as holotype (BMNH).

Remarks. *M. padangensis* does not belong to any species complex. The species can be distinguished from other species by having the posteriorly broad head, simple anterior margin of the smooth and shining first gastral tergum, the short antennal scape just reaching occipital corner, the long petiole, and the large eye.

Distribution. INDONESIA: Sumatra.

***Myrmecina parallela* sp. nov.**

(Fig. 38)

Holotype worker. TL 2.98, HL 0.70, HW 0.65, CI 92, SL 0.55, SI 85, PW 0.46, ML 0.78.

Paratype workers. TL 2.82-3.09, HL 0.67-0.72, HW 0.62-0.70, CI 92-97, SL 0.54-0.61, SI 84-95, PW 0.45-0.50, ML 0.74-0.83 (7 measured).

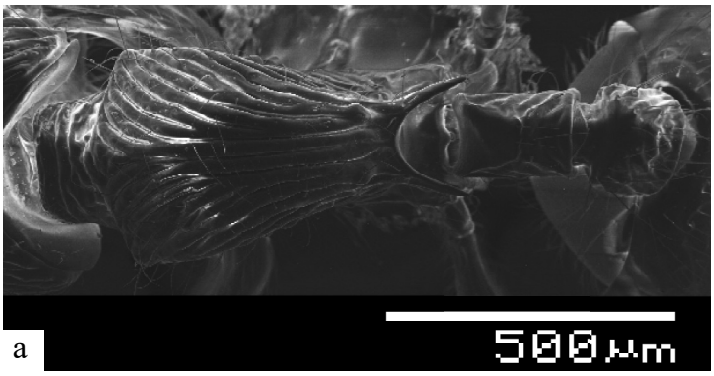
Worker. Head subrectangular, slightly longer than broad in full-face view; median portion of occipital margin much concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected, usually without a median process but sometimes present; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes very small circularly and convex, varying in size with maximum diameter 0.06-0.08 mm and 12-14 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye five times as long as diameter of eye or longer. Antennal scape long, extending beyond posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate posteriorly in dorsal view; anterior ventrolateral portion projected. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present. Propodeal spine elongate, much longer than broad at base, extending over vertical posteriormost limit of

propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near base of propodeal spine, apart from margin by its diameter. Petiole long, longer than high in profile, and longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process and median longitudinal ridge at ventral portion absent. Postpetiole slightly broader than petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline slightly projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view.

Head with parallel rugae which are thin and longitudinal; ventrolateral portion variable sculptured, with longitudinal rugae or smooth and shining. Clypeus smooth and shining. Mesosoma usually with straight rugae longitudinally, sometimes with transverse



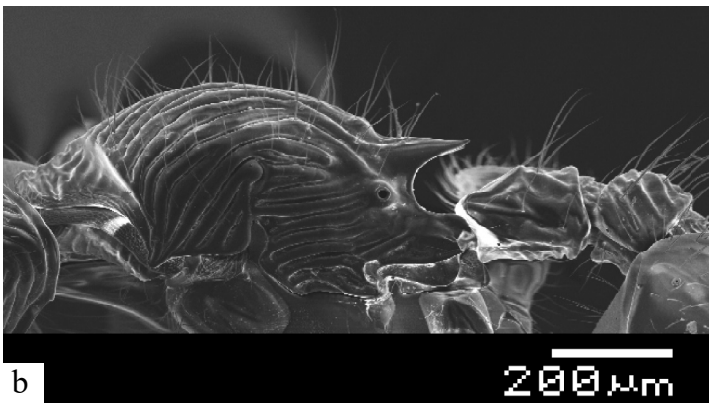


Fig. 38. *Myrmecina parallela* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

rugae at pronotum. Forecoxa smooth and shining. Petiole and postpetiole with irregular rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole with or without 2 hairs on ventral surface. Postpetiole with 4-6 hairs on ventral surface. Head, mesosoma, petiole and postpetiole black, forecoxae and gaster dark reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Sumatra, Padang (*no collector's name*) (BMNH). Paratypes. 9 workers with same data as holotype (BMNH).

Remarks. *M. parallela* does not belong to any species complex. But *M. parallela* is similar to *M. boltoni* sp. nov., *M. longiseta* sp. nov. and *M. monticola* sp. nov. on the basis of some characters (see the remarks of *M. boltoni*). Among those species, *M parallela* can be distinguished from the remains by having the anterior clypeal margin without median paired processes and the long propodeal spine.

Distribution. INDONESIA: Sumatra.

***Myrmecina poringensis* sp. nov.**

(Fig. 39)

Holotype worker. TL 2.45, HL 0.58, HW 0.54, CI 93, SL 0.46, SI 87, PW 0.69, ML 0.61.
Paratype worker. TL 2.34, HL 0.54, HW 0.53, CI 97, SL 0.45, SI 85, PW 0.38, ML 0.59 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (second small tooth or fifth tooth); apical tooth strong, third tooth robust, followed by 4 small teeth, without a basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with a median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes slightly large and moderately convex, varying in size with maximum diameter 0.09-0.10 mm and 5-6 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye. Antennal scape short, just reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate; anterior dorsolateral portion angulate; anterior ventrolateral portion not angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine absent. Propodeal spine triangular, shorter than broad at base, clearly not reaching vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole short, slightly longer than high in profile, longer than broad in dorsal view; dorsal crest located posteriorly in profile; subpetiolar process present with acute anterior apex. Postpetiole much broader than petiole in dorsal view; anterior portion slightly raised in profile; ventral outline slightly projected rectangularly with two tops.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae which are thin; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with transverse rugae on anterior portion, and longitudinal rugae on posterior portion in dorsal view. Forecoxa smooth and shining. Petiole

and postpetiole with a few rugae. First gastral segment smooth and shining. Head with relatively sparse and short pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum much longer than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2 hairs on ventral surface. Head and mesosoma black or dark reddish brown, petiole, postpetiole and gaster reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, MALAYSIA: Sabah, Poring Hot Springs, 7. v. 87, 500 m (*Burckhardt & Löbl*) (BMNH).
Paratypes. 1 worker with same data as holotype; 2 workers with same data as holotype but 10. v. 87, 600 m (BMNH).

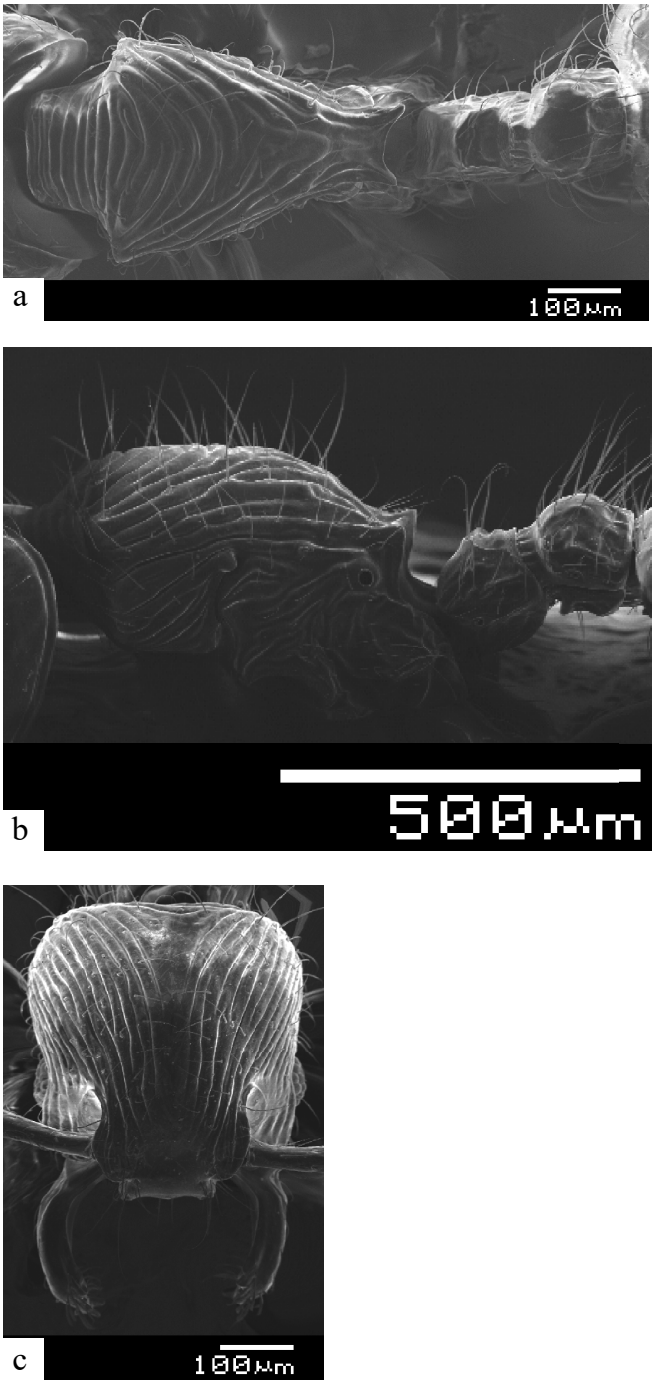


Fig. 39. *Myrmecina poringensis* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Remarks. *M. poringensis* does not belong to any species complex. But *M. poringensis* is similar to *M. dechai* sp. nov. on the basis of some characters (see the remarks of *M. dechai*). Among those species, *M. poringensis* can be distinguished from the remains by having the extremely short propodeal spine pointing upward.

Distribution. MALAYSIA: Borneo (Sabah).

Myrmecina raviwonghei Jaitrong, Samung, Waengsothorn & Okido

(Fig. 40)

Myrmecina raviwonghei Jaitrong, Samung, Waengsothorn & Okido, 2019: 3. Holotype worker (THNHM-I-05470), THAILAND: Nakhon Ratchasima Province, Wang Nam Kheao District, Udom Sub Subdistrict, 14.46805°N, 101.90416°E, 22.vi.2018 (*W. Jaitrong*) (WJT220618-6) (THNHM). Paratypes. Twenty-four workers (THNHM-I-05471, MHNG, SKYC, THNHM, USNM), same data as holotype. [not examined].

Workers. TL 2.50-2.63, HL 0.59-0.62, HW 0.56-0.59, CI 95-96, SL 0.45, SI 76-80, PW 0.40-0.43, ML 0.66-0.69 (2 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal blunt tooth; small teeth frequently unclear. Dorsal surface of clypeus concave; median portion of anterior margin projected usually with three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, which are well separated. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes extremely small and moderately convex, varying in size with maximum diameter 0.05-0.06 mm and 4-6 ommatidia, sometimes 8 ommatidia. Antennal scape short, not reaching posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma more or less flattened in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion with denticle directing forward and downward. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine elongate, directing backward and weakly curved upward, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle medium-sized, situated near posterior margin of propodeum, apart from the margin by its diameter. Petiole short, as long as high in profile, longer than broad in dorsal view; small but distinct dorsal crest located at midlength in profile; subpetiolar process developed with acute anterior apex. Postpetiole broader than petiole in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline distinctly projected with acute anterior apex.

Anterior margin of gaster concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head puncutred with thin rugae longitudinally; ventrolateral portion punctured with thin rugae. Mandible sometimes with paired yellow spots on dorsal surface. Clypeus smooth and shining. Mesosoma punctured with thin rugae longitudinally. Forecoxa smooth and shining. Petiole and postpetiole punctured with a few distinct rugae. First gastral tergum punctured dorsally. First gastral sternum rugulose or punctured. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum much shorter than propodeal spine. Longest dorsal pilosity of petiole as long as propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body black or dark reddish brown, mandibles, forecoxae reddish brown, antennae and legs yellowish brown.

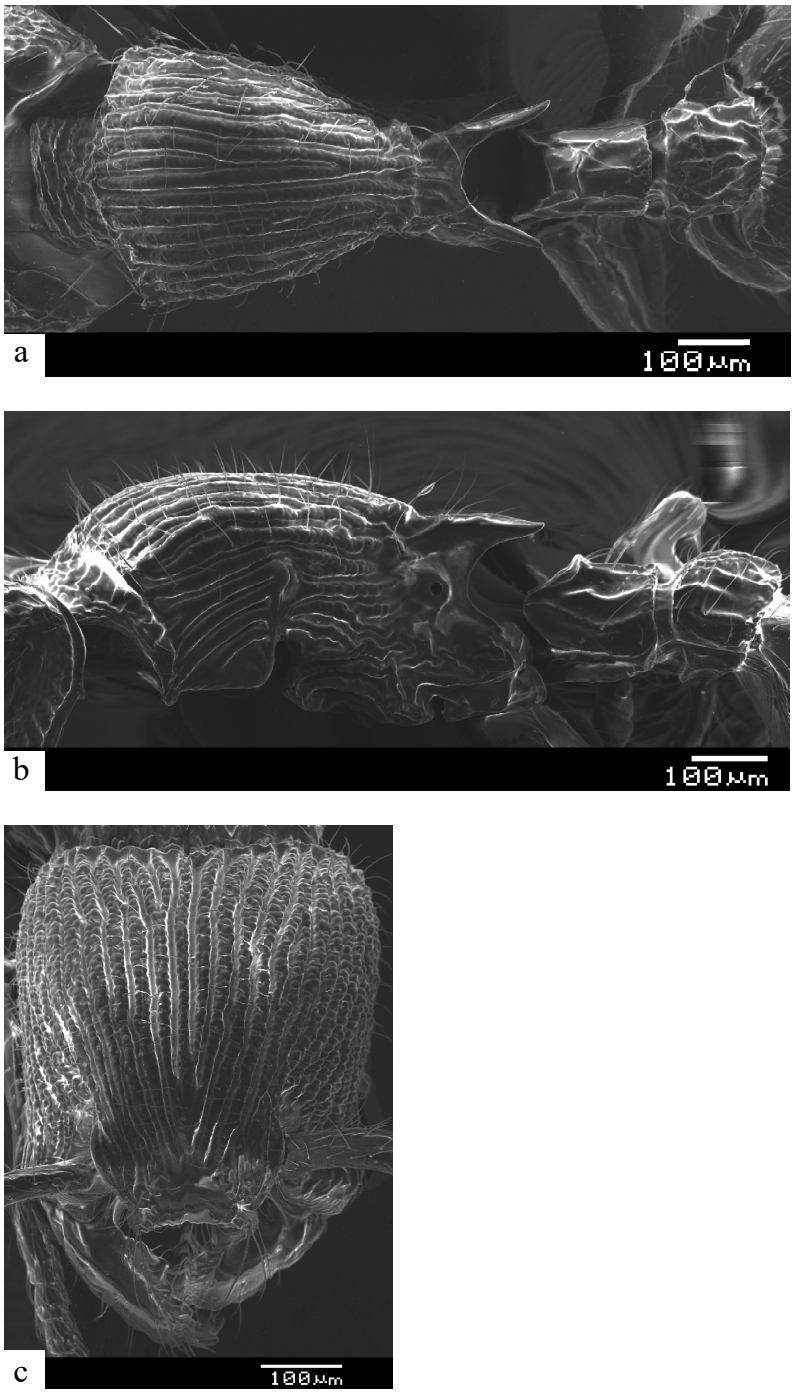


Fig. 40. *Myrmecina raviwonghei* Jaitrong, Samung, Waengsothorn & Okido. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Other material examined. THAILAND: Doi Chiang Dao, 500-600 m alt. nr. Chiang Mai, 19. viii. 1998 (*H. Okido*) (KUFF): Doi Chiang Dao, 500-600 m alt. nr. Chiang Mai, 19. viii. 1998 (*H. Okido*), TH98-HO-015 (KUEC, KUIC); Sakaerat lowland, Necornrat-chasima (*Sk. Yamane*).

Remarks. *M. raviwonghei* belongs to the *M. gracilis* complex comprising *M. curvispina, M. gracilis* sp. nov. and *M. raviwonghei*. The definition and the distribution of the *gracilis* complex are given in the latter section. Among those species, *M. raviwonghei* can be distinguished from the remains by having the sculptured first gastral sternum without ridge at anterior median portion, and the

broad head.

Ergatogynes are present in this species.

Distribution. THAILAND: Chiang Mai Prov., Necornratchasima Prov.

***Myrmecina sabahna* sp. nov.**

(Fig. 41)

Holotype worker. TL 2.86, HL 0.69, HW 0.62, CI 91, SL 0.59, SI 95, PW 0.46, ML 0.74.

Paratype workers. TL 2.88-2.98, HL 0.70-0.74, HW 0.64-0.69, CI 91-93, SL 0.59-0.65, SI 93-94, PW 0.48-0.51, ML 0.69-0.75 (2 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 4 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with four processes, sometimes unclearly; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, which are very close to each other. Frontal carinae present but unclearly, running to about apical two thirds of the line through eyes. Eyes medium-sized and moderately convex, varying in size with maximum diameter 0.08-0.09 mm and 5-6 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum usually without denticles on dorsolateral portion, but sometimes bearing small denticles; anterior portion marginate but unclearly in dorsal view; anterior dorsolateral portion angulate; anterior ventrolateral portion variable, not angulate or projected bluntly. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, longer than broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum longer than diameter of spiracle. Petiole short, as long as or slightly longer than high in profile, slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process absent. Postpetiole slightly broader than petiole in dorsal view; lateral margin straight; dorsal outline flattened in profile; ventral outline slightly projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with wavy rugae which are thin weakly; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma usually with wavy rugae distinctly. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with about 6 hairs on ventral surface. Body black, mandibles, forecoxae reddish brown, antennae and legs yellowish brown.

Holotype worker, MALAYSIA: Mahua Waterfall area, ca. 1000 m alt., Crocker Range N. P., Sabah, 5. xi. 2000, MA00-HO-025 (*H. Okido*) (UMS).

Paratypes. 5 workers with same data as holotype (KUEC, KUIC).

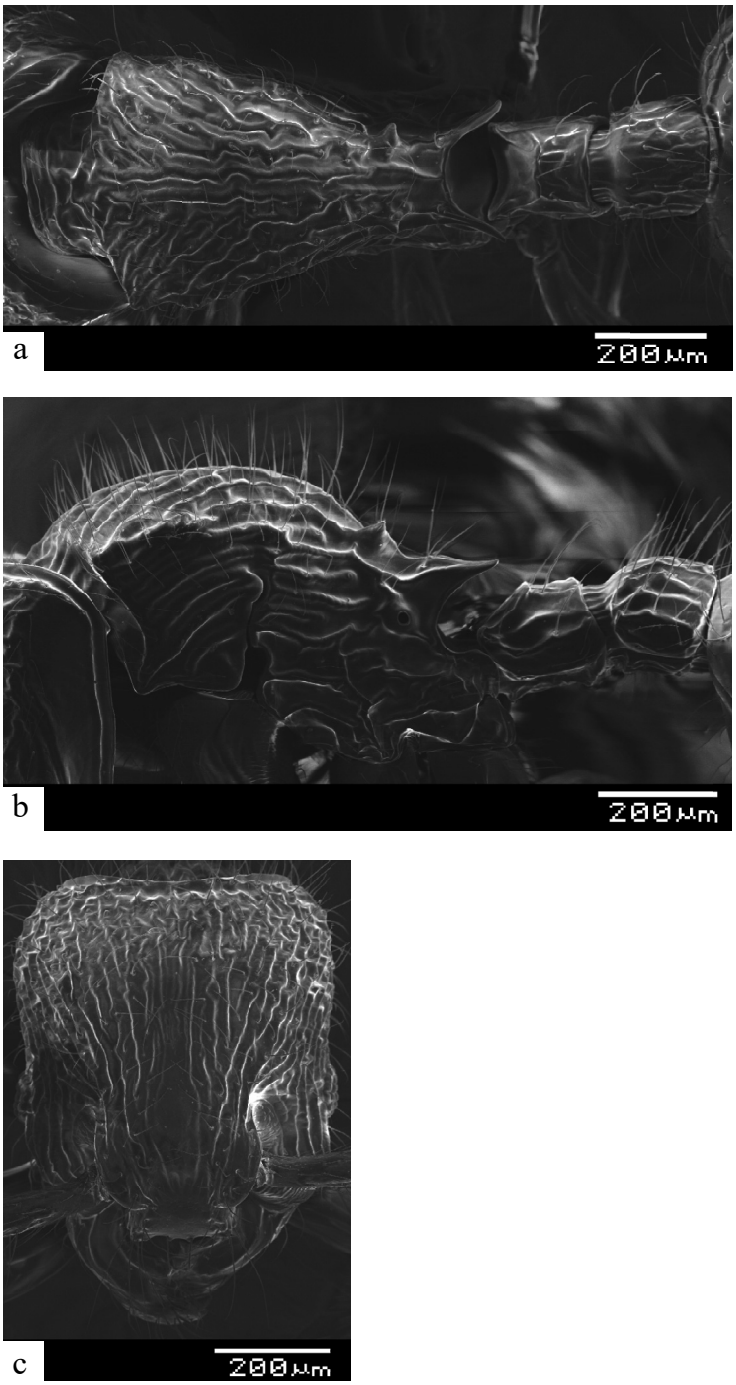


Fig. 41. *Myrmecina sabahna* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Other material examined. MALAYSIA: East Ridge, Poring Hot Springs, Kinabalu N. P., Sabah (*C. Brühl*).

Remarks. *M. sabahna* does not belong to any species complex. But *M. sabahna* is similar to *M. insulana* sp. nov. and *M. yamanei* sp. nov. on the basis of some characters (see the remarks of *M. insulana*). The species can be distinguished from the latters by having the smooth and shining ventrolateral portion of the head, the anterior clypeal margin with median paired processes, and the short antennal scape just reaching occipital corner.

Distribution. MALAYSIA: Borneo (Sabah).

Myrmecina semipolita Forel

Myrmecina semipolita Forel, 1905: 15. Syntype worker, INDONESIA: Buitenzorg (=Bogor), Java (*K. Kraepelin*) (depository unknown) [not seen].

Diagnosis of worker. The following description is based on Forel (1905). Head subrectangular, length shorter than broad in full-face view. Sides of head slightly convex; median portion of occipital margin straight. Antennal scrobe absent. Mandible smooth and shining with apical and preapical tooth following 4-5 small and unclear teeth. Eyes convex. Antennal scape extending beyond occipital margin of head. Dorsal outline of mesosoma convex without suture. Propodeal spine directing backward, slightly longer than broad at base. Eumetanotal spine small. Petiole longer than broad. Postpetiole length shorter than broad, and slightly broader than petiole. Gaster oval. Ventrolateral portion of head with rugae. Mesosoma with thick and irregular rugae longitudinally. Remains of the body smooth and shining. Body black to almost black, antenna, legs, clypeus, mandible reddish.

Remarks. We have not been able to examine type material of *M. semipolita*.

Distribution. INDONESIA: Java.

Myrmecina spinosa sp. nov.

(Fig. 42)

Holotype worker. TL 4.21, HL 1.06, HW 1.02, CI 97, SL 0.96, SI 94, PW 0.77, ML 1.15.
Paratype workers. TL 3.87-4.10, HL 1.01-1.04, HW 0.99-1.04, CI 97-103, SL 0.83-0.94, SI 84-92, PW 0.74-0.77, ML 1.04-1.12 (3 measured).

Worker. Occipital margin strongly concave in full-face view; lateral margin slightly convex; occipital corners projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by about 5 small teeth and a stout basal tooth bearing blunt apex. Dorsal surface of clypeus concave; median portion of anterior margin weakly projected, usually with a distinct median process; lateral portion simple, lacking a sharp ridge, but slightly marginate on each side, in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles usually distinct, which are well separated but varied in size and distance between denticles. Frontal carinae virtually absent indistinguishable from rugae on dorsum of head. Eyes medium-sized and convex, varying in size with maximum diameter 0.08-0.14 mm and 6-9 ommatidia. Antennal scape long, usually extending beyond posterolateral corner of head but length varied; antennal flange developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum with two or four denticles on anterior dorsolateral portion in dorsal view; anterior ventrolateral portion with denticle directing forward and downward. Eumetanotal spine long with acute apex; length usually longer than broad at base. Propodeal spine extremely long and curved abruptly upward at their shafts, much extending over vertical posteriormost limit of propodeum in profile; tips curved outward in dorsal view. Propodeal lobe raised. Propodeal spiracle situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum

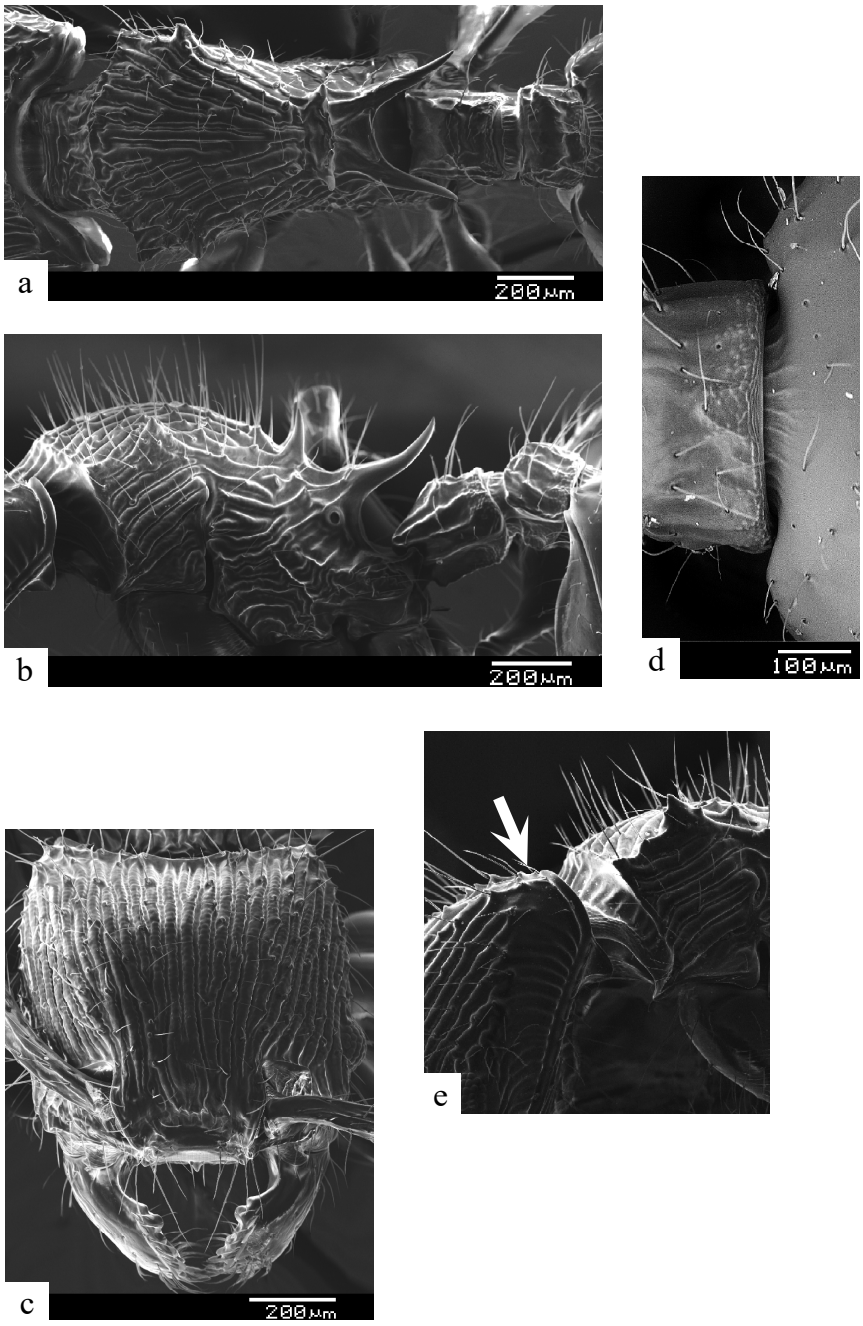


Fig. 42. *Myrmecina spinosa* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, anterior margin of gaster; e, occipital corner.

slightly longer than diameter of spiracle. Petiole long; small dorsal crest located at midlength in profile; subpetiolar process present; ventral outline slightly concave. Postpetiole broader than petiole in dorsal view; lateral margin straight and marginated distinctly, sometimes lateral lobes projected; anterior portion slightly raised in profile; ventral outline projected triangularly.

Anterior margin of gaster concave in dorsal view.

Head weakly punctured with parallel rugae distinctly; ventrolateral portion with longitudinal rugae which are transversely curved at posterior portion. Mandibles usually with large yellow spots on dorsal surface. Clypeus smooth and shining. Mesosoma with parallel rugae diverging anteriorly (forming "Y"-shape); lateral portion with longitudinal or oblique rugae. Petiole and postpetiole with a few longitudinal rugae. First gastral tergum smooth and shining. Head and mesosoma with long pilosity on dorsum. Pilosity

of pronotum usually longer than broad of apical second segment of antenna. Pilosity of petiole and postpetiole as long as that of mesosoma. Head, mesosoma, petiole and postpetiole black, legs yellowish, forecoxae varying from reddish brown to black, gaster reddish brown especially posterior portion lighter than anterior.

Holotype worker, MALAYSIA: Mahua Waterfall area, ca. 1000 m alt., Crocker Range N. P., Sabah, 4. xi. 2000, MA00-HO-005 (*H. Okido*) (UMS).
Paratypes. 18 workers with same data as holotype; 13 workers with same data as holotype but MA00-HO-006; 3 workers with same data as holotype but 5. xi. 2000, MA00-HO-026 (KUIC, KUEC).

Other material examined. MALAYSIA: Mahua Waterfall area, ca. 1000 m alt., Crocker Range N. P., Sabah (*H. Okido; K. Eguchi; S. Sonthichai*); Sayap Kinabalu, ca. 1000 m alt., Sabah, Borneo (*Sk. Yamane*); Tawau Hills N. P., Sabah, Borneo (*K. Eguchi; Sk. Yamane*); Taman Kinabalu, 1500 m, Sabah, Borneo (*Sk. Yamane*); Danum Valley, Sabah, Borneo (*H. Okido; Sk. Yamane; C. Brühl*); Deramakot Forest Reserve, Sabah (*C. Brühl*); Old Tower R., Lambir N. P., Miri, Sarawak (*Sk. Yamane*); 50 ha plot, Lambir N. P., Miri, Sarawak (*Sk. Yamane*); Sabal, Sarawak, Borneo (*Sk. Yamane*); Neg. Sembilan, Pasoh For. Res. (*M. Brendell, K. Jackson & L. Ficken; M. Brendell, K. Jackson & S. Lewis*). INDONESIA: Sangkimah, Kutai N. P., E. Kalimantan (*Sk. Yamane*); Mt. Halimon, W-Java (*F. Ito*). BRUNEI: Tasek Merimbun (*K. Eguchi*).
Dimensions of these workers. TL 2.72-3.52, HL 0.72-0.92, HW 0.67-0.85, CI 90-98, SL
0.59-0.86, SI 88-102, PW 0.53-0.62, ML 0.74-0.98 (3 measured).

Remarks. *M. spinosa* belongs to the *M. spinosa* complex. The other members of the complex are: *M. inflata* sp. nov., *M. mahuana* sp. nov., *M. magnificens* and *M. tridentata* sp. nov. The definition and the distribution of the *M. spinosa* complex are given in the latter section. Among those species, *M. spinosa* can be distinguished from the remains by having the concave anterior margin of the first gastral tergum, the bent masticatory margin of the mandible, the propodeal spine extending backward, and the head and the mesosoma with straight and longitudinal rugae. The species shows wide variations in some of characters, such as the lateral lobes of the postpetiole, the position and the shape of denticles on the labrum, the body size (See dimensions), and number and length of the pilosity on the head and the mesosoma.

The species inhabits in soil and litter.

Distribution. MALAYSIA: The Malay Pen., Borneo (Sabah, Sarawak); BRUNEI: Tasek Merimbun; INDONESIA: Borneo (Kalimantan), Java.

Myrmecina striata Emery

Myrmecina striata Emery, 1889: 500. Syntype worker, MYANMAR: Tenasserim, Mt. Mooleyit (*L. Fea*) (depository unknown) [not seen].

Diagnosis of worker. The following description is based on Emery (1889) and Bingham (1903). Head as long as broad; median portion of occipital margin concave. Anterior clypeal margin without processes. Antennal scape very nearly extending to occipital margin. Dorsal outline of mesosoma slightly convex on dorsum in profile. Propodeal spine directing backward and slightly upward. Head and mesosoma with longitudinal rugae on dorsal and lateral surface. Petiole and postpetiole with longitudinal rugae on dorsum.

Mandible, median portion of clypeus, legs and gaster smooth and shining. Head, mesosoma and gaster with pilosity sparsely. Body black, mandibles, antennae, legs and gaster reddish yellow.

Remarks. We have not been able to examine type material of *M. striata*. According to the original descriptions, this species is similar to *M. curvispina* and *M. raviwonghei*.

Distribution. MYANMAR: Tenasserim.

***Myrmecina sulawesiana* sp. nov.**

(Fig. 43)

Holotype worker. TL 2.59, HL 0.61, HW 0.61, CI 100, SL 0.51, SI 84, PW 0.43, ML 0.67.
Paratype workers. TL 2.48-2.61, HL 0.61-0.62, HW 0.59-0.61, CI 96-97, SL 0.50-0.53, SI 84-88, PW 0.40-0.42, ML 0.61-0.69 (3 measured).

Worker. Head subrectangular, as long as or slightly longer than broad in full-face view; median portion of occipital margin flattened; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin slightly projected with an unclear median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and moderately convex with maximum diameter 0.10 mm, with 6 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye. Antennal scape short, just reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion angulate bluntly. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, longer than broad at base, just reaching or feebly extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior portion of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum shorter than diameter of spiracle. Petiole short, slightly longer than high in profile, slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process present but much reduced, bearing acute anterior apex. Postpetiole broader than petiole in dorsal view; lateral margin straight; dorsal outline flattened in profile; ventral outline slightly projected with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with wavy rugae which are thin and longitudinal; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with weakly waved rugae longitudinally. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum as long as propodeal spine. Petiole and postpetiole without hairs on ventral surface. Body black to reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Bantimurung, 40 m alt., S. Sulawesi, S 05°01′xE 119°41′, 8. x. 2000, TUS 15 min. #3 (*K. Ogata &*

K. Masaoka) (KUEC).

Paratypes. 4 workers with same data as holotype (KUEC, BZM).

Other materials examined. INDONESIA: Sulawesi, Utara, Dumoga-Bone, N 0°34′xE 123°54′ (*M. Horak; no collector's name*) (BMNH); Tengah, Solato R., Taronggo, S 01°45′xE 121°40′ (*M. J. D. Brendell*) (BMNH); Sulawesi, Utara, G. Muajat, 1780 m (*no collector's name*) (BMNH); N. C. Seram, Manusela N. P., Wae Mual Plain (*M. J. D. Brendell*) (BMNH).

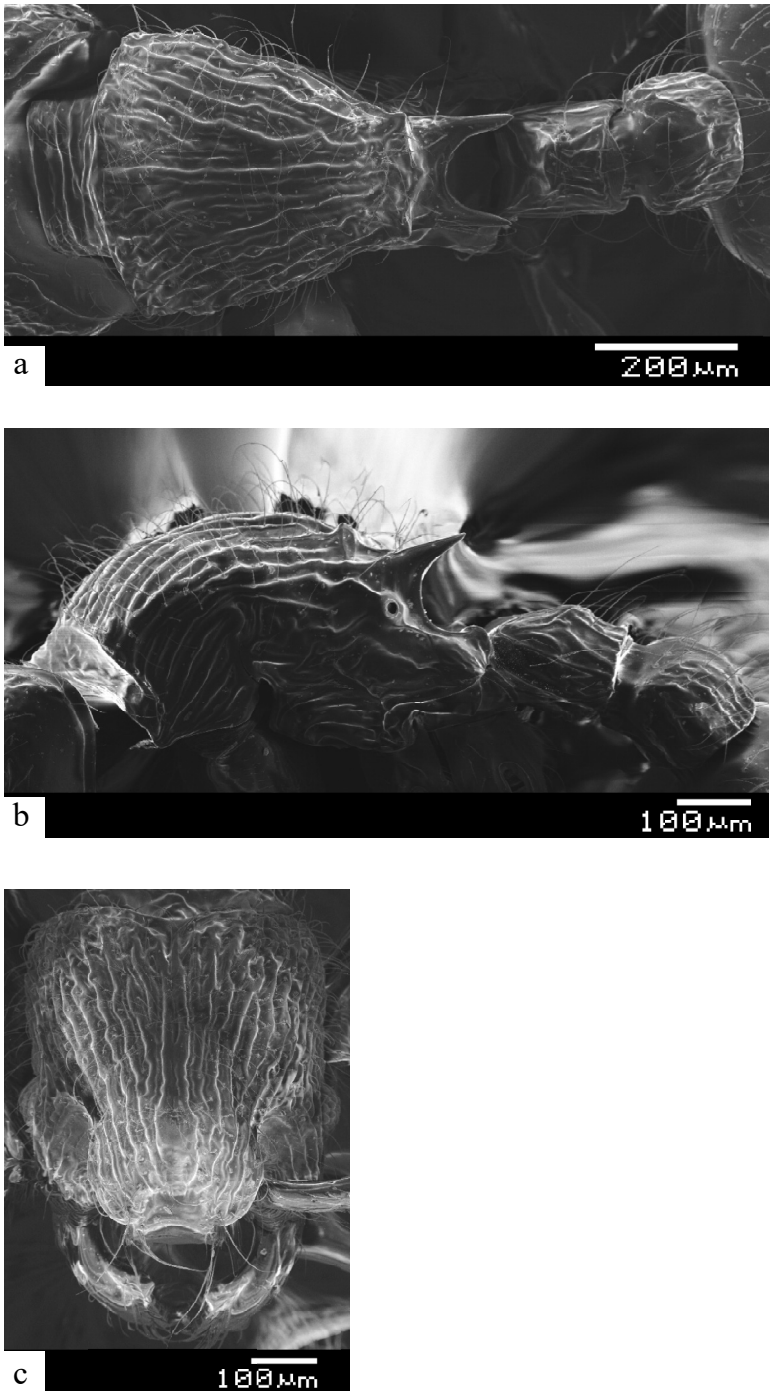


Fig. 43. *Myrmecina sulawesiana* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.

Remarks. *M. sulawesiana* does not belong to any species complex. But *M. sulawesiana* is similar to *M. asiatica* sp. nov. on the basis of some characters (see the remarks of *M. asiatica*). The species can be distinguished from the latter by having the medium-sized and ovally eye comprising 15 ommatidia or more.

The species inhabits in litter.

Distribution. INDONESIA: Sulawesi, Seram.

Myrmecina sulcata Emery

(Fig. 44)

Myrmecina sulcata Emery, 1887: 449. Syntype workers and male, INDONESIA: Kandari, Celebes (=Sulawesi), iii. 74 (*O. Beccari*) (MCSN); Buitenzorg (=Bogor) (*Ferrari*) (depository unknown) [syntypes examined].

Worker. TL 2.57-2.75, HL 0.62-0.66, HW 0.62-0.67, CI 99-104, SL 0.56-0.62, SI 88-93, PW 0.43-0.45, ML 0.62-0.66 (3 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal blunt tooth; small teeth frequently unclear. Dorsal surface of clypeus usually not concave; median portion of anterior margin projected with a median process but frequently reduced; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles close to or fused with each other at base. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes large and convex, varying in size with maximum diameter 0.11-0.13 mm and 7-8 ommatidia; malar space twice as long as diameter of eye or shorter in profile; distance between occipital margin and posterior margin of eye three times as long as diameter of eye. Antennal scape long, extending beyond posterolateral corner of head; antennal flange developed.

Dorsal outline of mesosoma convex in profile. Pronotum without denticles; anterior portion not marginate; anterior ventrolateral portion with denticle, but variable. Furrow between pronotum and mesoepisternal projection more or less broad. Eumetanotal spine present; the length longer than broad at base. Propodeal spine elongate, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole long, longer than high in profile, longer than broad in dorsal view; very small dorsal crest located at midlength in profile; subpetiolar process absent, but median longitudinal ridge at ventral portion present. Postpetiole slightly broader than petiole in dorsal view; lateral margin straight; anterior portion slightly raised in profile; ventral outline not projected.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head with straight rugae distinctly; ventrolateral portion smooth and shining. Clypeus smooth and shining. Mesosoma with straight rugae distinctly. Forecoxa with transverse rugae, but variable, frequently smooth and shining. Petiole and postpetiole with a few distinct rugae. First gastral segment smooth and shining. Head with sparse and long pilosity on dorsum. Mesosoma with sparse and long pilosity on dorsum, hairs of pronotum slightly longer than apical third segment of antenna. Pilosity of petiole as long as that of mesosoma. Petiole without hairs on ventral surface. Postpetiole with or without 1-4 hairs on ventral surface. Head and mesosoma black or dark reddish brown, forecoxae, petiole, postpetiole and gaster reddish brown, mandibles, antennae and legs yellowish brown.

Other material examined. INDONESIA: Wawoteno nr. Kendari, SE Sulawesi (*K. Ogata & K. Masaoka*) (KUEC).

Remarks. *M. sulcata* does not belong to any species complex. But *M. sulcata* is similar to *M. muluensis* sp. nov. on the basis of some characters (see the remarks of *M. muluensis*). Among those species, *M. muluensis* sp. nov. can be distinguished from the remains by having the large eye comprising 20 ommatidia or more, and the broad head.

Distribution. INDONESIA: Sulawesi, Java.

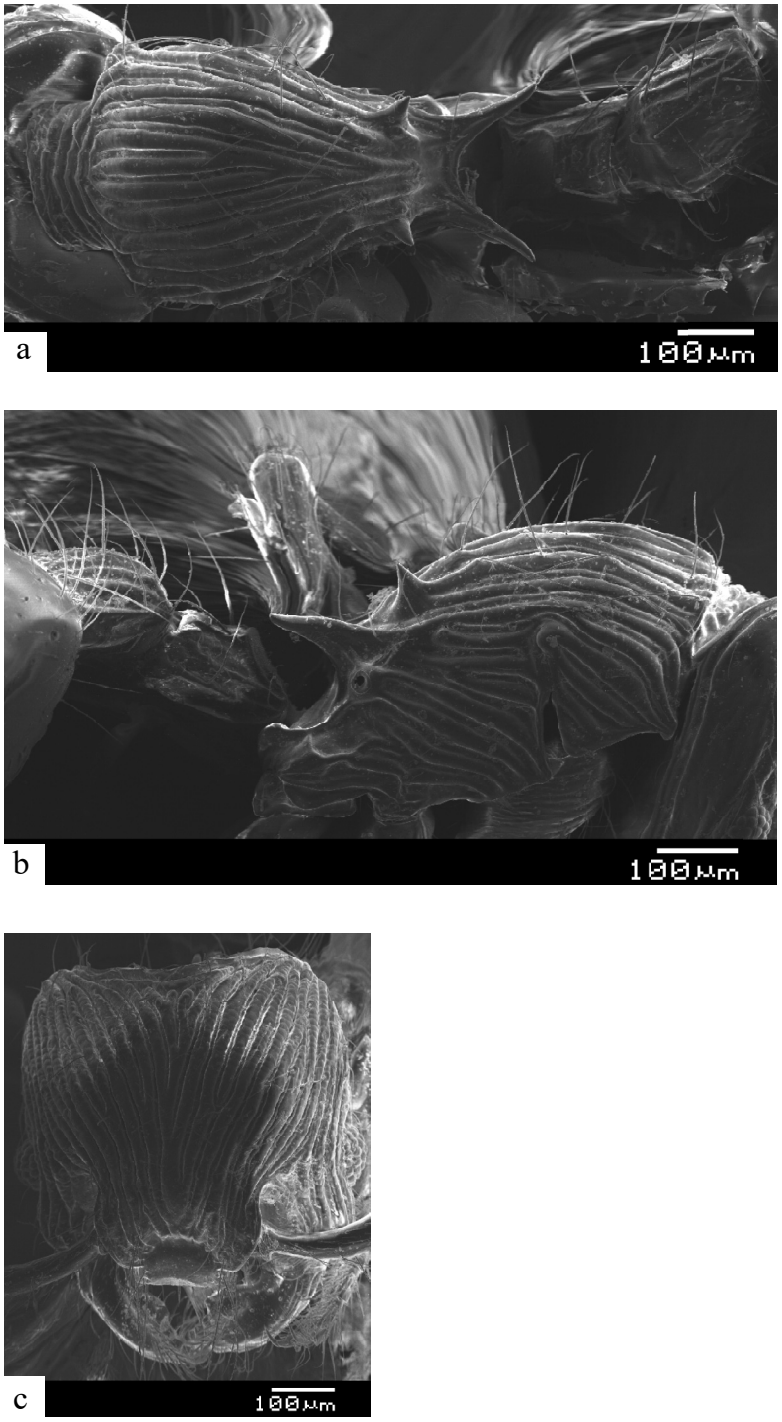


Fig. 44. ***Myrmecina sulcata*** **Emery. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

***Myrmecina sundanica* sp. nov.**

(Fig. 45)

Holotype worker. TL 2.45, HL 0.56, HW 0.50, CI 89, SL 0.45, SI 90, PW 0.34, ML 0.62.

Paratype worker. TL 2.39, HL 0.54, HW 0.51, CI 94, SL 0.43, SI 84, PW 0.35, ML 0.64 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a blunt basal tooth. Dorsal surface of clypeus not concave; median portion of anterior margin feebly projected with a small median process; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles bearing acute apex, close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes extremely small circularly and moderately convex with maximum diameter 0.06 mm, with 9 ommatidia; malar space twice as long as diameter of eye in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles on dorsolateral portion; anterior portion marginate; anterior ventrolateral portion slightly projected. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, longer than broad at base, extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole short, slightly longer than high in profile, longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process present but much reduced, usually bearing acute anterior apex. Postpetiole broader than petiole, 1.5 times as broad as its length except for helcium in dorsal view; anterolateral margin usually rounded; anterior portion slightly raised in profile; ventral outline projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view; first gastral sternum simple without median longitudinal ridge.

Head weakly punctured with almost staight rugae which are thin; ventrolateral portion usually smooth and shining, sometimes punctured. Clypeus smooth and shining. Mesosoma weakly punctured with almost straight rugae which are thin and longitudinal. Forecoxa smooth and shining. Petiole and postpetiole with weak irregular rugae. First gastral tergum punctured dorsally. First gastral sternum usually smooth and shining, rarely with longitudinal rugae at anterior median portion; lateral portion smooth and shining. Head with dense and short pilosity on dorsum. Mesosoma with dense and short pilosity on dorsum, hairs of pronotum much shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body black to reddish brown, mandibles, antennae and legs yellowish brown.

Holotype worker, INDONESIA: Kebun Raya, Bogor, W-Java, 15. iv. 1997, FI97-635 (*F. Ito*) (BZM).

Paratypes. 5 workers and 1 ergatogyne with same data as holotype; 1 worker and 2 ergatogynes with same data as holotype but FI97-616; 7 workers and 1 male with same data as holotype but 3. iv. 1997, FI97-545; 2 workers and 1 ergatogyne with same data as holotype but 1. iii. 1997, FI97-38 (KUEC, KUIC).

Other material examined. INDONESIA: W. Bali (*IKT. Ginarsa*) (BMNH); Java, Bogor (*B. Bolton*) (BMNH); Botanical Garden, Bedugul, 1250 m alt., Bali I., S 08°17′xE 115°09′ (*J. Abe*) (KUEC). MALAYSIA: Ulu Gombak, ca. 250 m alt., Selangor Prov., Malay Pen. (*Sk. Yamane*); Sabah, Kibongol Valley, 7 km N. Tambunan (*Burckhardt & Löbl*) (BMNH).

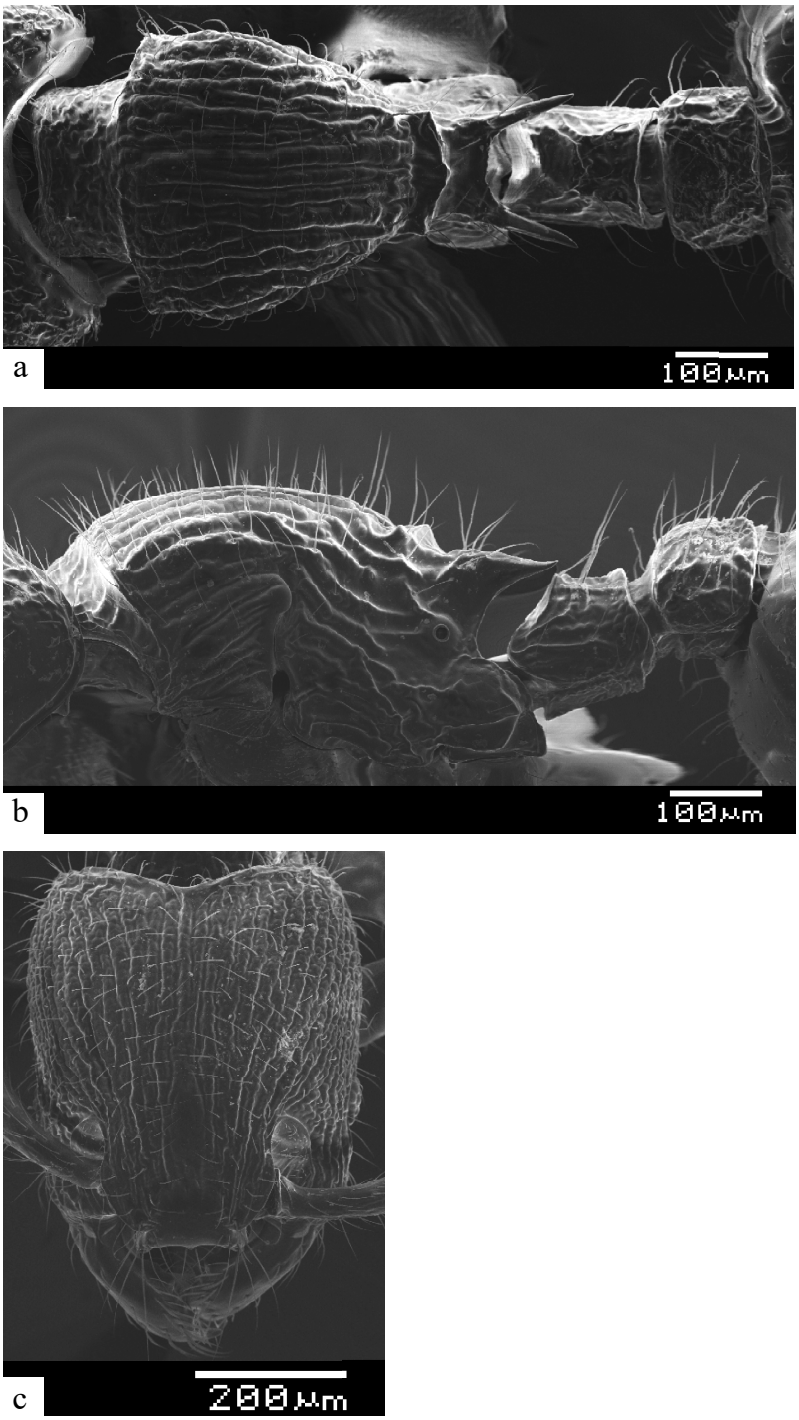


Fig. 45. ***Myrmecina sundanica*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

Remarks. *M. sundanica* does not belong to any species complex. The species is a distinctive species in having the simple anterior margin of the sculptured first gastral tergum, and the smooth and shining first gastral sternum. This species corresponds to "*Myrmecina* sp. F" of Ito *et al*. (2001). Ergatogynes are present in this species.

The species inhabits in litter.

Distribution. MALAYSIA: The Malay Pen., Borneo (Sabah); INDONESIA: Java, Bali.

***Myrmecina tridentata* sp. nov.**

(Fig. 46)

Holotype worker. TL 3.34, HL 0.86, HW 0.78, CI 91, SL 0.77, SI 98, PW 0.62, ML 0.93.

Paratype workers. TL 3.28-3.51, HL 0.84-0.94, HW 0.78-0.83, CI 87-93, SL 0.74-0.82, SI 94-100, PW 0.62-0.67, ML 0.91-0.99 (5 measured).

Worker. Occipital margin strongly concave in full-face view; occipital corners projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth acute, followed by 5 small but distinct teeth and a stout basal tooth bearing blunt apex. Dorsal surface of clypeus concave; median portion of anterior margin projected, usually with three distinct processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes medium-sized, varying in size with maximum diameter 0.13-0.14 mm and 7-8 ommatidia. Antennal scape short, just reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma convex in profile. Pronotum with two or four denticles on anterior dorsolateral portion in dorsal view but frequently unclear; anterior ventrolateral portion with denticle directing forward and downward. Eumetanotal spine triangular distinctly. Propodeal spine elongate, abruptly curved upward at their shafts but varying, distinctly extending over vertical posteriormost limit of propodeum in profile; tips curved outward in dorsal view. Propodeal lobe raised. Propodeal spiracle situated near base of propodeal spine, distance between posterior margin of spiracle and posterior margin of propodeum slightly longer than diameter of spiracle. Petiole long; small dorsal crest located at midlength in profile; subpetiolar process triangular; ventral outline slightly convex or flattened. Postpetiole almost as broad as petiole in dorsal view; lateral margin straight; lateral portion not marginated; dorsal outline slightly convex or almost flattened in profile; ventral outline projected at anterior portion.

Anterior margin of gaster concave in dorsal view;

Head usually with irregular rugae which are wavy, sometimes with longitudinal or parallel rugae; ventrolateral portion marginated on behind eyes in profile, with longitudinal rugae. Mandibles sometimes with small yellow spots on dorsal surface but varying and unclear. Clypeus smooth and shining. Mesosoma with irregular rugae which are wavy, sometimes with transverse (forming "U"-shape) rugae lateral portion with irregular rugae which are wavy, rarely with longitudinal rugae. Petiole and postpetiole with a few longitudinal rugae. First gastral tergum smooth and shining. Head with long pilosity on dorsum. Mesosoma with long pilosity on dorsum, hairs of pronotum usually as long as broad of apical second segment of antenna. Head, mesosoma, petiole and postpetiole black, legs yellowish brown, forecoxae varying from reddish brown to black, gaster reddish brown.

Holotype worker, MALAYSIA: Sepilok, Sabah, Borneo, 14. viii. 1981 (*K. Masuko*) (KUEC).

Paratypes. 20 workers and 1 queen (dealate) with same data as holotype (KUIC, KUEC, UMS).

Other material examined. MALAYSIA: Sepilok Forest, Sabah, Borneo (*K. Eguchi; Sk. Yamane*); Danum Valley, Sabah, Borneo (*H. Okido; Sk. Yamane; C. Brühl*); Sayap Kinabalu, Sabah, Borneo (*Y. Hashimoto*); Tawau Hills N. P., Sabah, Borneo (*Sk. Yamane*); Mt. Kinabalu, Sabah, Borneo (*Y. Hashimoto*); East Ridge, 1530 m, Poring Hot Springs, Kinabalu N. P., Sabah (*C. Brühl*); Sg., Segerugok, Song, Sarawak (*A. Rahman*).

Remarks. *M. tridentata* belongs to the *M. spinosa* complex. The other members of the complex are: *M. inflata* sp. nov., *M. mahuana* sp. nov., *M. spinosa* sp. nov. and *M. magnificens*. The definition and the distribution of the *M. spinosa* complex are given in the latter

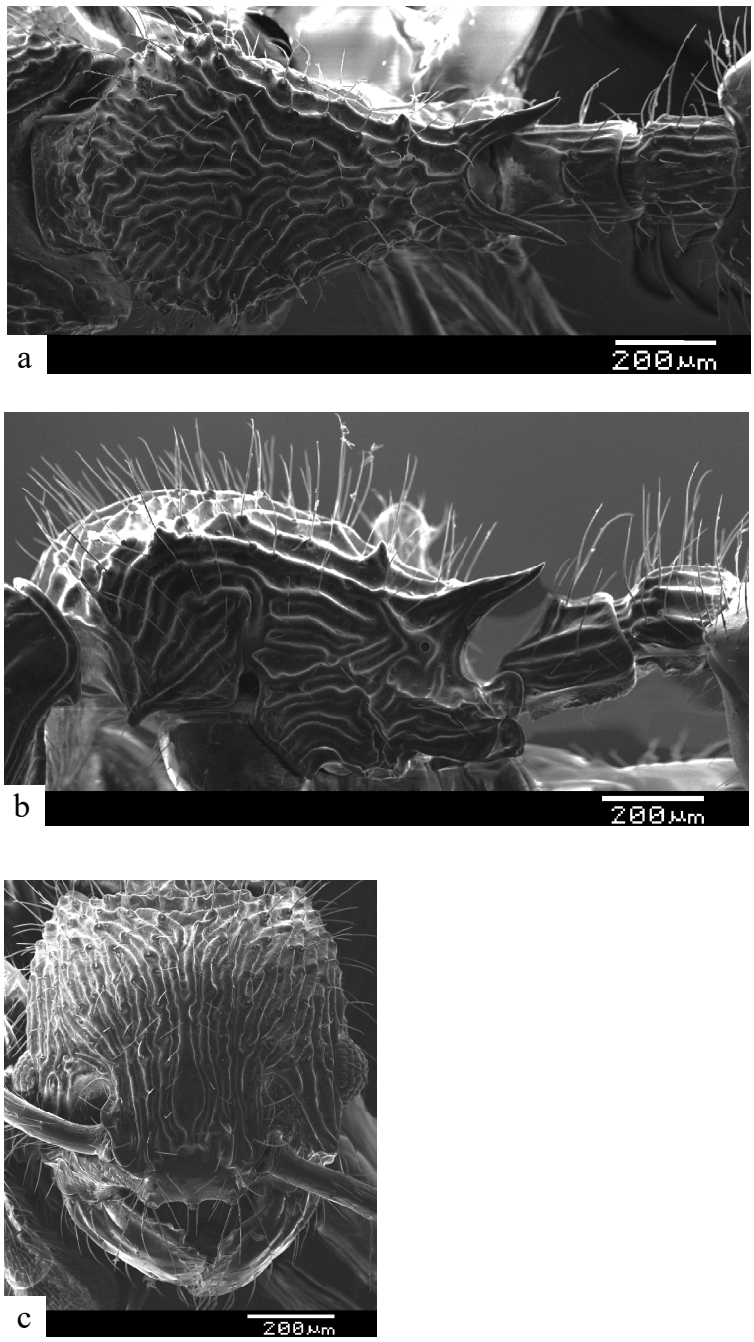


Fig. 46. ***Myrmecina tridentata*** **sp. nov. a, dorsal view of mesosoma, petiole and post-petiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

section. Among those species, *M. tridentata* can be distinguished from the remains by having the concave anterior margin of the first gastral tergum, the bent masticatory margin of the mandible, the propodeal spine extending backward, and the head and the mesosoma with wavy and irregular, or transverse rugae.

The species inhabits in soil.

Distribution. MALAYSIA: Borneo (Sabah, Sarawak).

Myrmecina undulata Emery

Myrmecina undulata Emery, 1900: 678. Syntype worker and queen, INDONESIA: Si Rambé, Sumatra (*E. Modigliani*); Pulo Laut (=Laut I.), Borneo (*E. Modigliani*) (depository unknown) [not seen].

Diagnosis of worker. The following description is based on Emery (1900). Mandible with a few rugae at base. Masticatory margin of mandible with 7-8 acute teeth. Antennal scape long, extending beyond occipital margin. Eumetanotal spine very acute and smaller than that of *M. graminicola* (Latreille). Propodeal spine short and triangular. Petiole and postpetiole usual shape, and with longitudinal rugae. Head and mesosoma with wavy rugae. Gaster very shiny. Pilosity long and bristly. Body black and shiny.

Remarks. We have not been able to examine type material of *M. undulata*.

Distribution. INDONESIA: Sumatra, Laut I. (SE of Borneo).

Myrmecina vieti sp. nov.

(Fig. 47)

Holotype worker. TL 2.45, HL 0.58, HW 0.58, CI 100, SL 0.53, SI 92, PW 0.40, ML 0.64.
Paratype worker. TL 2.61, HL 0.62, HW 0.62, CI 99, SL 0.51, SI 83, PW 0.43, ML 0.72 (1 measured).

Worker. Head subrectangular, as long as broad in full-face view; median portion of occipital margin moderately concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth short, followed by 4-6 small teeth and a stout basal tooth bearing blunt apex. Dorsal surface of clypeus not concave; median portion of anterior margin weakly projected with blunt and distinct median process; lateral portion raised into a sharp ridge of shield wall on each side, in front of antennal insertions. Anterior dorsal surface of labrum with paired denticles fused with each other at base. Frontal carinae present, running back to or beyond level of posterior margin of eyes, but frequently unclear. Eyes very small, varying in size with maximum diameter 0.05 mm and 5-7 ommatidia. Antennal scape short, just reaching posterolateral corner of head; antennal flange fully developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior ventrolateral portion more or less angulate. Eumetanotal spine small but distinct. Propodeal spine triangular, directing upward and backward, not reaching vertical posteriormost limit of the propodeum in profile. Propodeal lobe low. Propodeal spiracle large, situated near posterior margin of propodeum, apart from margin by its diameter. Petiole longer than high in profile; dorsal crest absent; subpetiolar process projecting forward with acute apex; ventral outline concave; Postpetiole broader than petiole in dorsal view; lateral margin straight; dorsal outline flattened in profile; ventral outline projected forward with acute apex at anterior portion in profile.

Anterior margin of gaster concave in dorsal view.

Head with irregular rugae which are thin; ventrolateral portion punctured weakly without rugae. Mandibles smooth and shining, sometimes with yellow spots on anterodorsal surface. Clypeus smooth and shining. Mesosoma with wavy rugae longitudinally. Petiole and postpetiole almost smooth and shining. Head and mesosoma with sparse pilosity, hairs of head and pronotum as long as propodeal spines. Pilosity of petiole and postpetiole as long as that of mesosoma; ventral surface with or without hairs. Head, mesosoma, petiole and postpetiole reddish brown, gaster dark reddish brown.

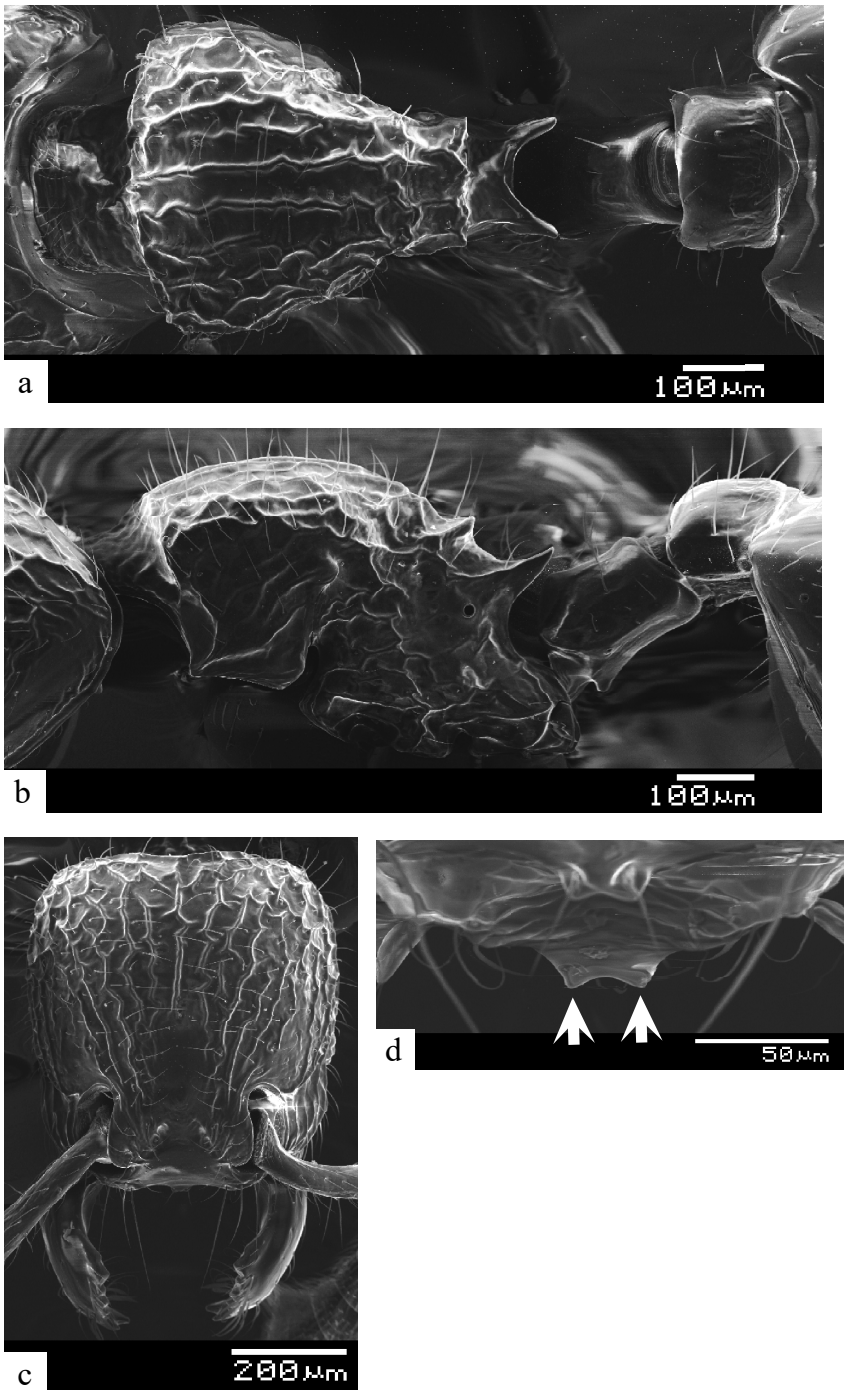


Fig. 47. M*yrmecina vieti* sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head; d, denticles of labrum.

Holotype worker, VIETNAM: Bavi N. P., 600 m alt., Ha Tai Prov., 12. xi. 1999, VN99-HO-090 (*H. Okido*) (IEBR).
Paratypes. 4 workers with same data as holotype (KUIC, KUEC); numerous workers and 1 queen (dealate) with same data as holotype but 670m alt., 21°03´N x 105°22´E, 12. xi. 2001, VN01-HO-111(BZM, KUEC, KUIC, UMS).

Remarks. *M. vieti* belongs to the *M. vieti* complex. The other members of the complex are: *M. guangxiensis* and *M. nomurai* sp. nov. Among those species, *M. vieti* can be distinguished from the remains by having the long and smooth petiole.

The species inhabits under stones.

Distribution. VIETNAM: Ha Tai Prov.

***Myrmecina yamanei* sp. nov.**

(Fig. 48)

Holotype worker. TL 2.12, HL 0.51, HW 0.48, CI 94, SL 0.37, SI 77, PW 0.37, ML 0.55.

Paratype worker. TL 2.08, HL 0.49, HW 0.48, CI 98, SL 0.36, SI 75, PW 0.36, ML 0.53 (1 measured).

Worker. Head subrectangular, longer than broad in full-face view; median portion of occipital margin slightly concave; occipital corners rounded, not projected posteriorly. Masticatory margin of mandible bent at midlength (third small tooth or sixth tooth); apical tooth strong, third tooth robust, followed by 5 small teeth and a basal tooth. Dorsal surface of clypeus slightly concave; median portion of anterior margin feebly projected with a median process or three processes; lateral portion simple, lacking sharp ridge in front of antennal insertions. Anterior dorsal surface of labrum with paired small denticles distinctly, relatively close to each other. Frontal carinae virtually absent, indistinguishable from rugae on dorsum of head. Eyes small ovally, and moderately convex, varying in size with maximum diameter 0.06 mm and 12-14 ommatidia; malar space twice as long as diameter of eye or longer in profile; distance between occipital margin and posterior margin of eye four times as long as diameter of eye or longer. Antennal scape short, not reaching posterolateral corner of head; antennal flange weakly developed.

Dorsal outline of mesosoma slightly convex in profile. Pronotum without denticles; anterior portion marginate; anterior ventrolateral portion angulate. Furrow between pronotum and mesoepisternal projection broad. Eumetanotal spine present but small. Propodeal spine triangular, just reaching or slightly extending over vertical posteriormost limit of propodeum in profile. Propodeal lobe low. Propodeal spiracle medium-sized to large, situated near posterior margin of propodeum, distance between posterior margin of spiracle and posterior margin of propodeum variable. Petiole short, as long as or slightly longer than high in profile, slightly longer than broad in dorsal view; dorsal crest located at midlength in profile; subpetiolar process variously developed from weakly raised median longitudinal ridge to distinct projection. Postpetiole broader than petiole, 1.5 times longer than its length except for helcium in dorsal view; dorsal outline flattened or slightly convex in profile; ventral outline projected rectangularly with acute anterior apex.

Anterior margin of gaster not concave in dorsal view.

Head punctured with straight rugae diverging posteriorly; ventrolateral portion sculptured variable, with or without irregular rugae. Clypeus smooth and shining. Mesosoma punctured with parallel rugae which are thick and longitudinal. Forecoxa smooth and shining. Petiole and postpetiole with longitudinal rugae. First gastral segment smooth and shining. Head with more or less dense and short pilosity on dorsum. Mesosoma more or less with dense and short pilosity on dorsum, hairs of pronotum shorter than propodeal spine. Petiole without hairs on ventral surface. Postpetiole with 2-4 hairs on ventral surface. Body black, forecoxae black to dark reddish brown, mandibles, antennae and legs brown to yellowish brown.

Holotype worker, MALAYSIA: Ulu Gombak, ca. 250 m alt., Selangor Prov., Malay Pen., 5. vii. 1999 (*Sk. Yamane*) (UMS).

Paratypes. 1 worker with same data as holotype; MALAYSIA: Neg. Sembilan, Pasoh For. Res., xi. 1994 (*M. Brendell, K. Jackson & S. Lewis*); Malaya, Selangor, Gombak, 15. x. 84 (*C. Betts*) (UMS, KUEC, KUIC).

Remarks. *M. yamanei* does not belong to any species complex. But the species is similar to *M. insulana* sp. nov. and *M. sabahna* sp. nov. on the basis of some characters (see the remarks of *M. insulana*). The species can be distinguished from the latters by having the short antennal scape not reaching occipital corner by the length of scape width (SI≤77), and the anterior clypeal margin with a median

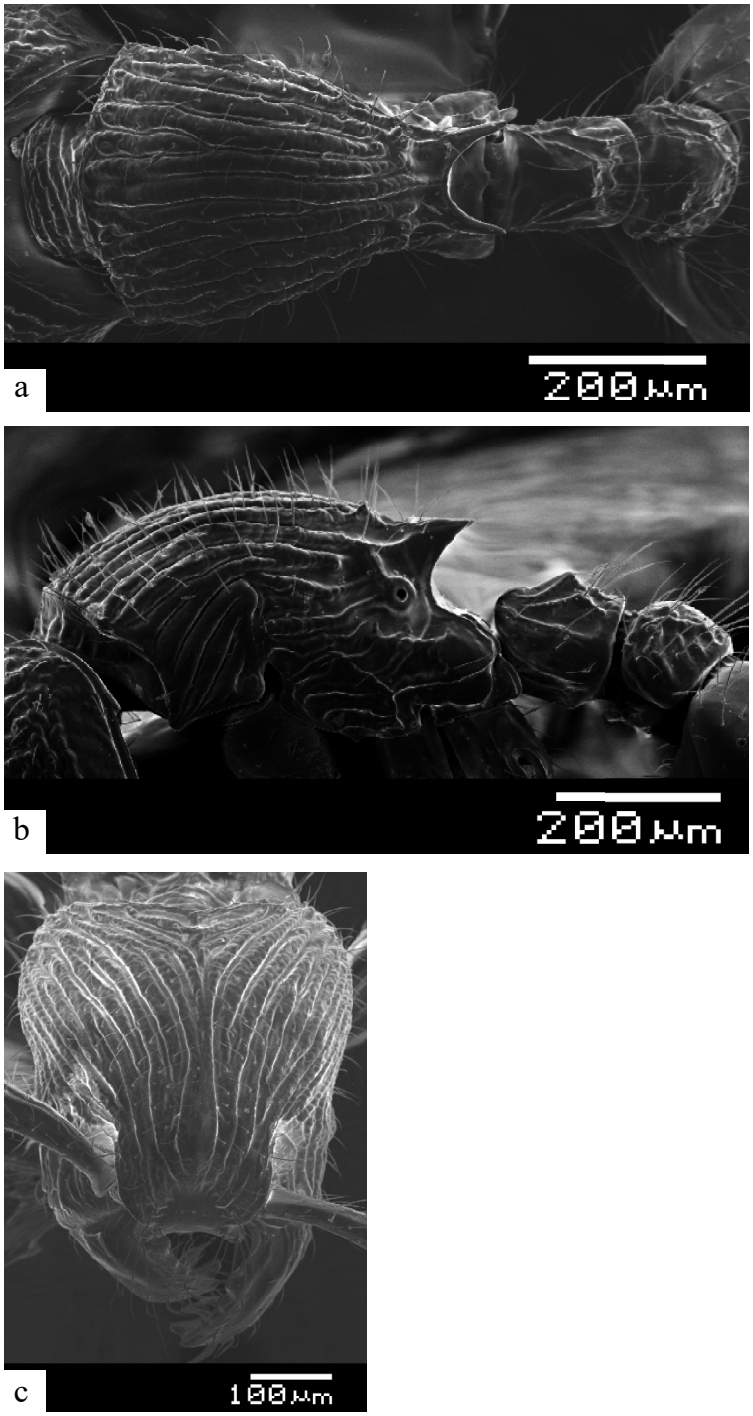


Fig. 48. ***Myrmecina yamanei*** **sp. nov. a, dorsal view of mesosoma, petiole and postpetiole; b, lateral view of mesosoma, petiole and postpetiole; c, full-face view of head.**

process.

The species inhabits in litter.

Distribution. MALAYSIA: The Malay Pen.

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東南アジアにおけるカドフシアリ属の分類学的再検討（ハチ目：アリ科）

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要旨：東南アジア産カドフシアリ属 *Myrmecina*（アリ科フタフシアリ亜科）について分類学的再検討を行い、40新種を含む53種を整理した。このうち16種について４種群を設立した。働きアリを用いた種の検索表を作成した。