Revue suisse Zool.	Tome 99	Fasc. 2	p. 405-429	Genève, juin 1992

Revision of the ant genus *Myrmoteras* of the Malay Archipelago (Hymenoptera, Formicidae)

by

Donat AGOSTI[1]

With 42 figures

ABSTRACT

The species of *Myrmoteras* from the Malay Archipelago are reviewed, and a key to the species is provided. Thirteen species are described as new: *Myrmoteras arcoelinae*, *baslerorum*, *brigitteae*, *danieli*, *elfeorum*, *estrudae*, *ivani*, *jacquelineae*, *marianneae*, *maudeae*, *nicoletteae*, *susanneae*, *tonboli*. The distribution of *Myrmoteras* within the Malay Archipelago is discussed.

INTRODUCTION

Ants are among the most familiar animals. They are considered to be a relatively well known insect family, with most of the genera described, and with approximately 12,000 named species of an expected total of 20,000 species (HÖLLDOBLER & WILSON, 1990). Recent collecting in the Malay Archipelago, especially from leaf litter, confirms these figures as a minimal estimate but also points out where a potentially rich source for new species, and thus a higher number of species, can be found.

In the collections of the Natural History Museum, London and the Museum d'Histoire Naturelle, Geneva are, for example, in each of the two taxa *Leptogenys* and Dacetini over 100 undescribed species based on samples from only a few expeditions led by researchers not specialized on ants. This includes only leaf litter ants and not those of the canopy, but from where high numbers of species are also expected (VERHAAG *in* HÖLLDOBLER & WILSON, 1990; WILSON 1987). In a comparative quantitative study in Northern Sulawesi, HAMMOND (1990) pointed out, that in the Coleoptera the leaf litter fauna is richer than the canopy fauna. These facts point out a possible doubling of the number of existing ant species and that the attribute 'rare' for certain ant taxa should not yet be applied, but is better considered to be due to a lack of collections and revisionary studies.

[1] Zoologisches Institut, Universität Zürich, Winterthurerstr. 190, CH-8057 Zürich, Switzerland.

Myrmoteras is hardly represented in collections and therefore is supposed to be a rare genus. These ants with their long mandibles which can be opened well over 270° and their large eyes are among the most bizarre forms. Moffett's revision of the genus revealed 10 new species totalling 18 species (MOFFETT, 1985). Over half of the newly described species are based upon samples obtained using Winkler-Moszarski apparatus which is often used by coleopterists and only recently by myrmecologists for the study of the leaf litter fauna. In leaf litter samples of moist tropical lowland rain forests, processed by using Winkler-Moszarski apparatus, and not in direct hand collections, *Myrmoteras* is regularly represented but never in large numbers. Consequently, collections since 1985 revealed another 13 new species, now totalling 31 species, and an extension of the range of the genus further East to the Lesser Sundas. Almost all the species are known by their worker caste only.

The aim of this study is to describe the new species of the Malay Archipelago, including the Malay peninsula South of the Kra Isthmus, the Philippines, Indonesia, New Guinea, and the Islands of New Britain and New Ireland, based on the worker caste, to provide a new key to the species, and to present and discuss the distribution of the species.

MATERIAL AND METHODS

All scanning electron micrographs were prepared with a Hitachi S700 with uncoated specimens. The measurements and indices in the text follow HÖLLDOBLER & WILSON (1990).

Alitrunk Length (TL). The diagonal length of the alitrunk in profile from the point at which the pronotum meets the cervical shield to the posterior base of the metapleuron.

Cephalic Index (CI). HW x 100 / HL.

Eye Index (EI). EL x 100 / HW.

Eye Length (EL). The maximum length of the eye.

Head Length (HL). The length of the head proper, excluding the mandibles, measured from the mid-point of the anterior clypeal margin to the mid-point of the occipital margin, including the occipital lobe, in full-face view.

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

Mandibular Index (MI). ML x 100 / HL.

Mandibular Length (ML). The maximum length of the mandible when closed, from the anterior teeth to the lateral basal joint.

Palp Formula (PF). Number of maxillary palp segments followed by number of labial palp segments; e.g PF 6/4.

Scape Index (SI). SL x 100 / HW.

Scape Length (SL). The maximum length of the antennal scape excluding the basal constriction or neck to the condylar bulb.

All measurements are given as minimum, maximum and in brackets the median, the unit is mm; e.g. AL 1.23-1.45 (1.40). The measurements of the species included in MOFFETT (1985) are based on his data.

Material from the following collections has been included in the study.

BMNH The Natural History Museum, London, U.K.

DAAC Collection of D. Agosti, Uster, Switzerland.

MBBJ Museum Zoologicum Bogoriense, Bogor, Indonesia.
MCZC Museum of Comparative Zoology, Harvard University, Cambridge, U.S.A.
MHNG Muséum d'Histoire Naturelle, Geneva, Switzerland.
MCSN Museo Civico di Storia Naturale, Genova, Italy.
RMNH Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

Myrmoteras Forel

Myrmoteras Forel, 1893:607. Type species *Myrmoteras binghami* Forel, by monotypy.

D i a g n o s i s . Worker.
Formicine ant with the following diagnostic characters.
1 Mandibles long (longer than head length), subparallel with a distinctive dentition pattern with the apical teeth the longest (Figs 7-10).
2 The mandibles can be opened up to 270°.
3 Maxillary palps not exceeding half the distance between the buccal opening and the foramen magnum.
4 Clypeus anteriorly bilobed, antero-medially emarginate (Fig. 1).
5 Frontal carinae not present, but toruli prominent (Fig. 1).
6 Large eyes (EI > 55).
7 Long erect hair present antero-ventral of the eyes.
8 Head posteriorly truncated and with a distinctive transverse lobe (Figs 1-2).
9 Pronotum anteriorly with transverse straight sculpture (Fig. 5).
10 Mesonotum tubular and forming a constriction of the alitrunk (Fig. 6).
11 On the dorsum of the meso- and metanotum restricted hair pattern. A group of symmetrically positioned hairs and the anterior part of the mesonotum and 2 to 6 hairs on the metanotal spiracles, rarely 1 to 2 single hairs on the margins between the two groups.
12 Propodeal spiracle round, situated at some distance from the declivous and the basal face (Fig. 42).
13 Anteriormost point of the metanotal petiolar cavity not crossing a line spanned between the anteriormost points of the metanotal coxal cavities.
14 Petiole squamiforme.
15 First gastral segment of *Formica* type (see Agosti, 1991, fig. 4).
16 First gastral tergite much smaller then the second.
17 Hind legs and and antennae with long, scattered, erect pilosity.
18 Mid and hind femora swollen.

D e s c r i p t i o n . The palpal formula is variable, from 6/4 to to 3/3, in most cases 6/4 (44%). The reduction of the terminal segments does not have a very distinct influence on the overall length of the maxillary palps, which generally do not reach beyond the midpoint between the buccal orifice and the foramen magnum.

The frontal sulcus is in most species very distinct and wide, but can be absent, especially in the *Myrmoteras* subgenus.

The coloration is yellowish to dark brown with different brown shades and can be variable in some species.

The diagnostic characters 1, 2, 4, 6 and 8 are very likely autapomorphies of the genus, as they are not present in other formicine genera. These make *Myrmoteras* one of the most easily diagnosable monophyletic formicine genera.

P h y l o g e n y . *Myrmoteras* belongs to the *Formica* genus group, based on the construction of the first gastral sternite which is not part of the helcium (AGOSTI, 1991). The phylogenetic relationships of this genus within the subfamily and within the *Formica* genus group are not resolved, but are currently being studied (AGOSTI, in prep.). Within *Myrmoteras* the two sister groups *Myrmoteras* s. str. and *Myagroteras* can be diagnosed by the following autapomorphies: the labral shape and the presence of trigger hairs, and the frontal sulcus and mandibular bend character respectively (MOFFETT, 1985). Whereas these two clades are in congruence with the results of this study and additional material from Thailand in MHNG, not all the new species can be placed into Moffett's species groups. For this reason and without the re-assessment of the characters Moffett's species groups have been suppressed.

D i s t r i b u t i o n . *Myrmoteras* is an Indomalayian genus, with some species in Southern India, Sri Lanka, Burma, Thailand, and the islands west of the Wallace Line with the exception of Sulawesi and Lombok (see maps in MOFFETT, 1985). Within the Malay Archipelago, the subgenus *Myrmoteras* is restricted to the West of the Wallace Line and *Myagroteras* to the West of Weber's Line.

The fauna of Sulawesi and Lombok deserve special attention. On Lombok *brigitteae* is the only species which has been collected so far. It has also been collected in Bali. The fine differences between the two populations have been considered as intraspecific, and indicate that there is a link with the islands west of the Wallace Line based on dispersal.

In contrast, Sulawesi has an isolated fauna which, with its 10 species, is as rich as the fauna of Borneo, but does not share any species with any other islands.

The low number of species found in Sumatra and Java is surprising. Both in Sulawesi and Borneo, wherever the genus *Myrmoteras* is present, there are almost always several species to be found. They are not necessarily in exactly the same habitat but rather present at different altitudes. Our collections in Java and Sumatra included the same collecting techniques and sampling strategy as in Sulawesi or in Borneo. It is thus probably an indication that *Myrmoteras* might have the highest number of species in Borneo and Sulawesi.

Thailand and W-Malaysia are certainly underrated, with regard to the 13 species here described, an increase of over 70% based on a few collecting sites and limited time. Mainland Asia has to be studied before generalizations can be made.

However, Sulawesi and Lombok might very likely define the Eastern limits of the distribution, as specific collections from Seram, Flores, Timor and the Vogelkop did not reveal any *Myrmoteras* species (W.L. Brown, Jr, pers. com.; Agosti, unpubl.). The apparent high degree of endemism, if not contradicted by further collections, would make this genus an ideal object for biogeographic studies.

B i o l o g y . The biology of *Myrmoteras* ants is virtually unknown. They are elements of the leaf litter fauna in moist tropical forest, from lowland up to montane forests with the highest recorded altitude of a species at 2200 m in Assam. The uniform morphology, especially the head with the two long mandibles, indicate that all the species are predatory on soft bodied insects, which was observed in colonies kept in captivity (Moffett, 1985). Most *Myrmoteras* specimens have been collected from leaf litter samples from beneath rotting logs. In one case a *Myrmoteras* sp. has been observed on a shrub in the understory. Nests have been found in hollow dead twigs in the litter (Moffett, 1985).

SYNOPSIS OF THE SPECIES OF *Myrmoteras*

Myrmoteras subgenus

barbouri Creighton, 1930. Java, Peninsular Malaysia, Sabah, Sarawak.

= *kemneri* Wheeler, 1933.

baslerorum new species. Sumatra.
binghami Forel, 1893. Burma, Thailand.
brachygnathum Moffett, 1985. India.
ceylonicum Gregg, 1956. Sri Lanka.
iriodum Moffett, 1985. Kalimantan, Sarawak, W-Malaysia.
mjoebergi Wheeler (in Creighton, 1930). Borneo (Sarawak?).
scabrum Moffett, 1985. India.

Myagroteras subgenus
arcoelinae new species. Sabah
bakeri Wheeler, 1919. Sabah, W-Malaysia.
brigitteae new species. Bali, Lombok
chondrogastrum Moffett, 1985. Sarawak.
danieli new species. Sabah.
diastematum Moffett, 1985. Sabah, Sarawak.
donisthorpei Wheeler, 1916. Kalimantan, Sabah, Sarawak.
elfeorum new species. Sulawesi.
estrudae new species. Sumatra.
indicum Moffett, 1985. India.
insulcatum Moffett, 1985. Luzon.
ivani new species. Sulawesi.
jacquelineae new species. Sulawesi.
karnyi Gregg, 1954. Mentawai Archipelago.
marianneae new species. Sulawesi.
maudeae new species. Sulawesi
morowali Moffett, 1985. Sulawesi.
nicoletteae new species. Sulawesi.
susanneae new species. Sulawesi.
tonboli new species. Sabah.
toro Moffett, 1985. Sulawesi.
williamsi Wheeler, 1985. Phillipines.
wolasi Moffett, 1985. Sulawesi.

KEY TO WORKERS OF *Myrmoteras* OF THE MALAY ARCHIPELAGO

M. karnyi is not keyed out, as the holotype has not been found in the Zoological Museum in Bogor.

The abbreviation 'Mo' refers to the figures in MOFFETT 1985, i.e. 'Mo.25' refers to his figure 25.

1. Trigger hairs present, at least one fourth as long as mandible (Fig. 3); the labrum coneshaped, in full frontal view, the insertions of the trigger hairs visible between the bases of the mandibles (Mo5); the apical part of the mandible (last apical tooth) bent ventrally (Fig. 3) ..... 2 (*Myrmoteras*)
– Trigger hairs not present; labrum flat (Mo4); teeth of mandible in the same plain, the apical tooth not bent ventrally (Fig. 4) ..... 5 (*Myagroteras*)
2 4 maxillary palps; mesonotum smooth, with only two lateral rugae (Mo18) *mjoebergi*

– 5 or 6 maxillary palp segments; mesonotum laterally with reticulate sculpture (Mo15-17) which includes at least some dorso ventral rugae (Fig. 41) 3

3 Dorsal surface of head and pronotum smooth and shining with an iridescent shine; body chestnut, coxae and basal parts of femora brighter ..... *baslerorum*

– Dorsal surface of head and pronotum smooth or granulate, and matt; body reddish to yellowish brown; coxae and femora of the same color as alitrunk 4

4 6 maxiliary palp segments; dorsal surface of head and alitrunk granular; mesonotum strongly constricted (Mo15) ..... *barbouri*

– 5 maxillary palp segements; dorsal surface of head and alitrunk smooth and matt; mesonotum as in Mo17. ..... *iriodum*

5 Frontal sulcus lacking (Mo33)..... *insulcatum*

– Frontal sulcus present (Fig. 1) 6

6 Occiput of head smooth and shining, at least at the margin of the occiput a distinct change in the sculpture, from distinct sculpture very weak, which is almost impercepatable (in donisthorpei sometimes the dorso median part with some granular sculpture, but never the lateral parts of the declivitous face) (Fig. 1); sculpture on the dorsum and lateral parts of alitrunk varying from absent to elaborate; in lateral view the dorsal outline of the propodeum anteriorly not angulate (Fig. 12) 11

– Posterior face of occiput and pronotum sculptured; in lateral view, alitrunk always with distinct sculpture; the dorsal outline of the propodeum anteriorly with a distinct step (Fig. 6) 7

7 Head in full frontal view longitudinally sculptured, sometimes mixed sculpture but the longitudinal rugae visible in dorso lateral view (Fig. 7); yellowish brown. 10

– Head in full frontal view finely granulate sculptured (Fig. 1) 8

8 Dorsum of pronotum granulate; dorsum of propodeum in lateral view convex and smooth with at most some granular sculpture (Mo44) ..... *williamsi*

– Dorsum of pronotum longitudinally sculptured (Fig. 5); dorsum of alitrunk in lateral view flat with longitudinal sculpture (Fig. 6) 9

9 Frontal triangle smooth and shining (Mo38); dorsum of pronotum with broad longitudinal rugae; alitrunk with granular sculpture and longitudinal rugae (Mo42); yellow ..... *morowali*

– Frontal triangle granulate (Fig. 1); dorsum of pronotum with reticulate to longitudinal sculpture (Fig. 5); dark redish brown; ..... *jacquelineae*

10 Posterior face of occiput longitudinally sculptured (Mo39); head in full frontal view with distinct longitudinal sculpture (Mo39); dorsum of pronotum with reticulate sculpture ..... *toro*

– Posterior face of occiput coarsely sculptured (Fig. 7); head in frontal view with longitudinal sculpture which is obscured by granular sculpture (Fig. 7); dorsum of pronotum with a semicircular longitudinal sculpture (Fig. 11) ..... *elfeorum*

11 Head in full frontal view with frons shining and smooth 12

– Head in full frontal view with frons sculptured 16

12 Dark chestnut brown, coxae and femora bicoloured; TL > 1.50 mm; propodeum smooth and shining, only sometimes with a few low soft transversal rugae on the dorsum of the propodeum (Figs 14, 16, Mo29) 13

– Yellowish, coxae and femorae all one colour; TL 1.50 < mm; propodeum distinctly sculptured (Figs 18, Mo28) 15

13 Head in full frontal view between the antennal insertions smooth and shining (Mo26); erect hairs up to 0.25 mm ..... *diastematum*

– Head in full frontal view with longitudinal sculpture between the antennal insertions (Figs 8, 9); hairs on alitrunk shorter than 0.20 mm. 14

14 Dorsum of pronotum smooth and shining (Fig. 13) ..... *tonboli*
– Dorsum of pronotum sculptured as in Fig. 15 ..... *arcoelinae*
15 Genae (part ventral of eyes) sculptured, dorsum of mesonotum and propodeum smooth ..... *ivani*
– Genae not sculptured or at most few short dorsoventral rugae adjacent to the eye; dorsum of mesonotum coriaceous, dorsum of propodeum with transversal sculpture (Mo28) ..... *bakeri*
16 Dorsum of pronotum smooth and shining (Figs 23, 25) 17
– Dorsum of pronotum sculptured (Figs 27, 29) 18
17 Genae (part ventral of the eye) with longitudinal sculpture; dorsaly of the propodeal spiracles transversally sculptured (Fig. 24) ..... *marianneae*
– Genae at most with some dorsoventral short sculpture adjacent to the eye; dorsum of propodeum without transversal sculpture (Fig. 26) ..... *estrudae*
18 Gastral tergites coriaceous ..... *chondrogastrum*
– Gastral tergites smooth and shining (sometimes obscured by an oily layer) 19
19 Head in frontal view granulate, giving the impression of a longitudinal sculpture, but the lines are built up by individual small granules (Mo32). Dorsum of pronotum and mesonotum granulate (Mo35); dorsum of propodeum smooth and shining or slightly granulate (Mo35) ..... *donisthorpei*
– Head in frontal view with longitudinal sculpture, the rugae are long and not interrupted (Figs 21, 22) 20
20 Whole body yellow to orange red 21
– Whole body dark brown to chestnut 23
21 Head in full frontal view distinctly, longitudinally sculptured (Figs 22, 31) 22
– Head in full frontal view very finely, longitudinally sculptured. This is very shiny and is best seen in dorsolateral view (Fig. 21); gula smooth and shining; dorsum of pronotum as in Fig. 27 ..... *brigitteae*
22 On gula few longitudinal rugae; clypeus longitudinally sculptured (Fig. 22); dorsum of pronotum shining and with three circular sculptural elements (Fig. 29); ventral part of the declivity of the propodeum without sculpture ..... *nicoletteae*
– On gula no longitudinal rugae; clypeus with granular sculpture (Mo41); declivitous face of propodeum without sculpture ..... *wolasi*
23 Dorsum of pronotum anteriorly with convergent longitudinal sculpture (Fig. 35) ..... *danieli*
– Dorsum of pronotum anteriorly without longitudinal sculpture but with a spacious undulating surface (Figs 37, 39) 24
24 Dorsum of pronotum with erect hairs which are shorter than a third of the maximum diameter of the front femora (Fig. 37); ventral part of the lateral parts of the mesonotum with a metallic blue shine ..... *maudeae*
– Dorsum of pronotum with erect hairs which are of the same length as the maximum diameter of the front femora (Fig. 39); ventral part of the lateral parts of the mesonotum dark brown ..... *susanneae*

DESCRIPTION OF THE SPECIES

The descriptions of the species are based on types, specimens identified by Moffett deposited in BMNH and MHNG, and new, recently collected material. In cases where no type material could be examined, the descriptions follow those of MOFFETT 1985 and the SEMs he provided, which show the characters used in this study.

The range of variation is only known for a few species where sufficient specimens are available. As far as it can be concluded at this moment, the variation is low. Therefore, in the following descriptions only the standard measurements of the holotypes as approximate figures are given.

SUBGENUS **Myrmoteras** Forel

Myrmoteras Forel, 1893: 607. Type species *Myrmoteras binghami* Forel, by monotypy.

Diagnosis. *Myrmoteras* ant with the following diagnostic characters.

1 Labrum coneshaped (Mo5), in full frontal view only the basal part with the most raised point with the insertions of the trigger hairs visible.
2 Trigger hairs present (Fig. 3, Mo5).
3 Mandibles with the apical part bent ventral (Fig. 3).
4 Frontal sulcus absent or at most feably developed (Fig. 34).
5 Body with an iridescent shine.

Characters 1 and 2 are autopomorphies of this subgenus (Moffett,, 1985)

barbouri Creighton

Myrmoteras barbouri Creighton, 1930: 185, fig. 2, pl. 11 fig. 6, Holotype 1 worker, JAVA, Singdanglalia [=Sindanglaja?], T. Barbour, MCZC. [See also MOFFETT, 1985: figs 2, 11, 15.]

Diagnosis: Holotype TL 1.86, HL 1.25, HW 1.28, CI 102, SL 1.56, SI 122, EL 0.76, EI 59, ML 1.58, MI 126, PF 5/3.

This species is the only species of this subgenus with granulate sculpture on the dorsum of the head, seen in full frontal view.

baslerorum new species
(Figs 3, 34, 41, 42)

HOLOTYPE WORKER. TL 1.88, HL 1.14, HW 1.12, CI 98, SL 1.28, SI 114, EL 0.70, EI 63, ML 17.6, MI 153, PF 5/3. Head in full frontal view and occiput and dorsum of alitrunk smooth and shining. Around the antennal insertions few longish engravings. Dorsum of mesonotum and propodeum transversally sculptured. Metanotal tubercle rugae reduced and lower then the dorsoventral rugae; few short longitudinal rugae on the posterior dorsal part of the lateral parts of the mesonotum. Ventrolateral part of mesonotum and lateral parts of metanotum and propodeum smooth and shining. Gaster with silky and finely iridescent shine.

The palp formula (PF 5/3), the shining body, and the bicoloured body with the head, alitrunk and gaster chestnut and the legs yellowish, are unique within this subgenus.

Material examined: Holotype worker, Indonesia, Sumatra, Jambi, W Mt. Tujuh Lake, 1400 m, 14.xi.1989 (D. Agosti. D.H. Burckhardt & I. Löbl), sifting of vegetational debris, montane *Lithocarpus-Castonopsis* forest; MBBJ on long term loan in MHNG.

Paratypes: 4 workers, same series as holotype; 1 worker, Indonesia, Sumatra, Jambi, G. Kerinci, 1750-1850 m, 11.-12.xi.1989 (D. Agosti, D.H. Burckhardt & I. Löbl), sifting of vegetational

debris, montane *Lithocarpus-Castanopsis* forest; 1 worker, Indonesia, Sumatra, Jambi, km 15 from Sungaipenuh to Tapan, 1450 m, 9.xi.1989 (D. Agosti, D.H. Burckhardt & I. Löbl), sifting of vegetational debris, degraded montane *Lithocarpus-Castanopsis* forest. BMNH, DAAC, MBBJ, MCZC, MHNG.

iriodum Moffett

Myrmoteras iriodum Moffett, 1985: 24, figs 13, 17. Holotype 1 worker, Indonesia, Kalimantan, 17-46 km W Batulitjin, 28.vi.-2.vii.1972, W.L. Brown, lowland rainforest, hollow stick in litter, #B18, MCZC. Partypes 6 workers and 1 dealate female, same locality, MCZC, BMNH [examined].

Diagnosis. Holotype and five paratypes TL 1.80-1.82, HL 1.17-1.22, HW 1.14-1.20, CI 97-99, SL 1.36-1.40, SI 115-120, EL 0.72-0.76, ML 1.68-1.74, MI 142-145, PF 5/3.

Whole body yellowish brown, dull with some iridescent shine. Lateral part of mesonotum with spacious reticulate sculpture.

mjoebergi Wheeler

Myrmoteras mjoebergie Wheeler, in Creighton 1930: 188, fig. 2, pl. 11, fig. 1. Syntypes 3 workers, E-MALAYSIA, Sarawak, Mt. Tobangs, top, 1700 m [= Bukit Tobang ?], E. Mjoeberg, MCZC.

Diagnosis. Three syntypes TL 1.60-1.70, HL 1.12-1.18, HW 1.02-1.08, CI 91-92, SL 1.21-1.27, SI 116-119, EL 0.66-0.71, ML 1.26-1.31, MI 111-112, PF 4/3.

This species is separated from all other malaysian species of the subgenus *Myrmoteras* by the palp formula 4/3.

SUBGENUS **Myagroteras** Moffett

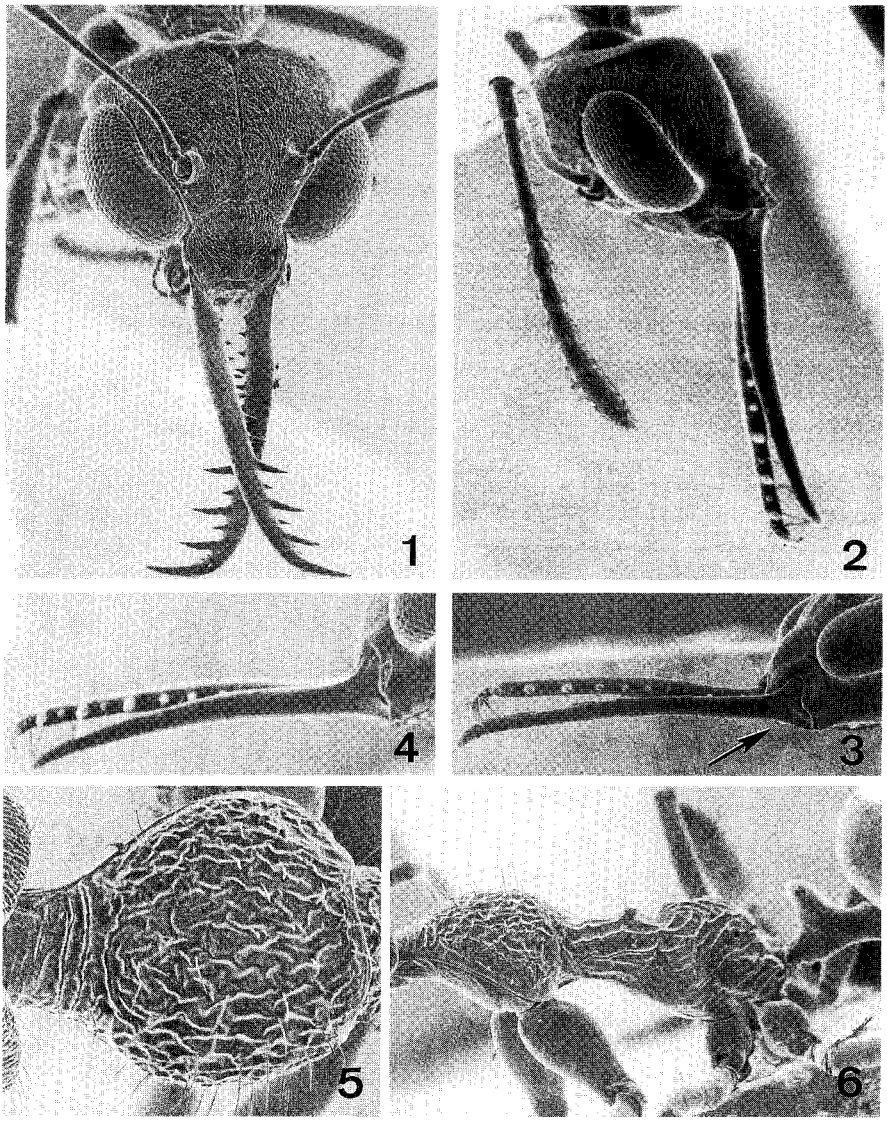
Myagroteras Moffett, 1985:31. Type species *Myrmoteras donisthorpei* Wheeler, by original designation.

Diagnosis. *Myrmoteras* ant with the following diagnostic characters.
1 Labrum flat (Mo4), not coneshaped, ie. with the median part distinctly raised.
2 Mandibles with the dentition in the same plane (Fig. 4).
3 Frontal sulcus distinct (Fig. 1), with the exception of *insulcatus* where it is not present, but then PF = 3/3.

Characters 2 and 3 are autapomorphies of this subgenus (Moffett, 1985).

arcoelinae new species
(Figs 9, 15, 16)

HOLOTYPE WORKER. TL 1.66, HL 1.00, HW 1.04, CI 104, SL 1.16, SI 112, EL 0.61, EI 59, ML 1.64, MI 164, PF 5/3. In full frontal view, head and occiput smooth and shining, with the exception of three to four rugae originating posterio-medially of the torulus. Alitrunk shining, dorsum of pronotum and propodeum with a smooth and spacious curvilinear



FIGS 1-6.

Head in full frontal (Fig. 1) and in lateral view (Fig. 2) of *Myrmoteras jacquelineae*. CL = Clypeus; EY = Eye; FS = Frontal sulcus; FT = Frontal triangle; G = genae; L) occipital lobe; M = mandible; OS = occular sulcus; T = torulus. Figs 3-4. Lateral view of the head of *Myrmoteras* species. Trigger hairs indicated by an arrow. 3. *Myrmoteras baslerorum* with trigger hairs, and the apical part of the mandible bent ventrally. 4. *Myrmoteras jacquelineae* without trigger hairs and the apical part of the mandible in line with the remaining parts of the mandible. Fig. 5. Dorsal view of pronotum of *Myrmoteras jacquelineae*. Fig. 6. Alitrunk in lateral view of *Myrmoteras jacquelineae*.

sculpture; pronotum, anteriorly and posteriorly transversally, and in between convergent rugose.

The sculpture is rather variable in this species, i.e. the sculpture can be reduced but the basic pattern is still visible; on the anterior part of the head, the sculpture can be extended beyond the antennal insertions. The sculpture is not variable on the occiput, the occipital lobe, and on the propodeum.

M. arcoelinae might include two species, as from the same localities two different distinct forms are recognizable. One with smooth lateral parts of the pronotal dorsum, the second with the whole pronotal dorsum spacious and flat rugously sculptured. The colour is variable from dark brown to chestnut. See also below *tonboli*.

Material examined: Holotype worker, E-Malaysia, Sabah, G. Kinabalu, Liwagu Trail, 1560-1660 m, 27.iv.1987 (D.H. Burckhardt & I. Löbl), #5b, leaf litter; MHNG.

Paratypes: 1 worker same locality as holotype; 2 workers, E-Malaysia, Sabah, G. Kinabalu, 1750 m, 24.iv.1987 (D.H. Burckhardt & I. Löbl); #2a, leaf litter; 3 workers E-Malaysia, Sabah, G. Kinabalu, Liwagu Trail, 22.v.1987 (D.H. Burckhardt & I. Löbl); #3b, leaflitter; BMNH, DAAC, MCZC, MHNG.

Additional material examined: 2 workers, E-Malaysia, Crocker Range, km 51-52 from Kota Kinabalu to Tambunan, 1600 m, 18.v.1987 (D.H. Burckhardt & I. Löbl), sifting of vegetational debris in a wet gully and in a gap, humide forest of *Lithocarpus-Castanopsis* with tree ferns.

bakeri Wheeler

Myrmoteras bakeri Wheeler, 1919: 145. Syntypes 1 queen and 3 males, E-Malaysia, Sabah, Sandakan, Baker, MCZC [not examined]. [See MOFFETT, 1985: figs 25, 28.]

Diagnosis (two workers). TL 1.23-1.25, HL 0.88, HW 0.86-0.89, CI 98-102, SL 0.94-0.92, SI 107-109, EL 0.56-0.58, ML 1.33-1.34, MI 152-153, PF 5/3.

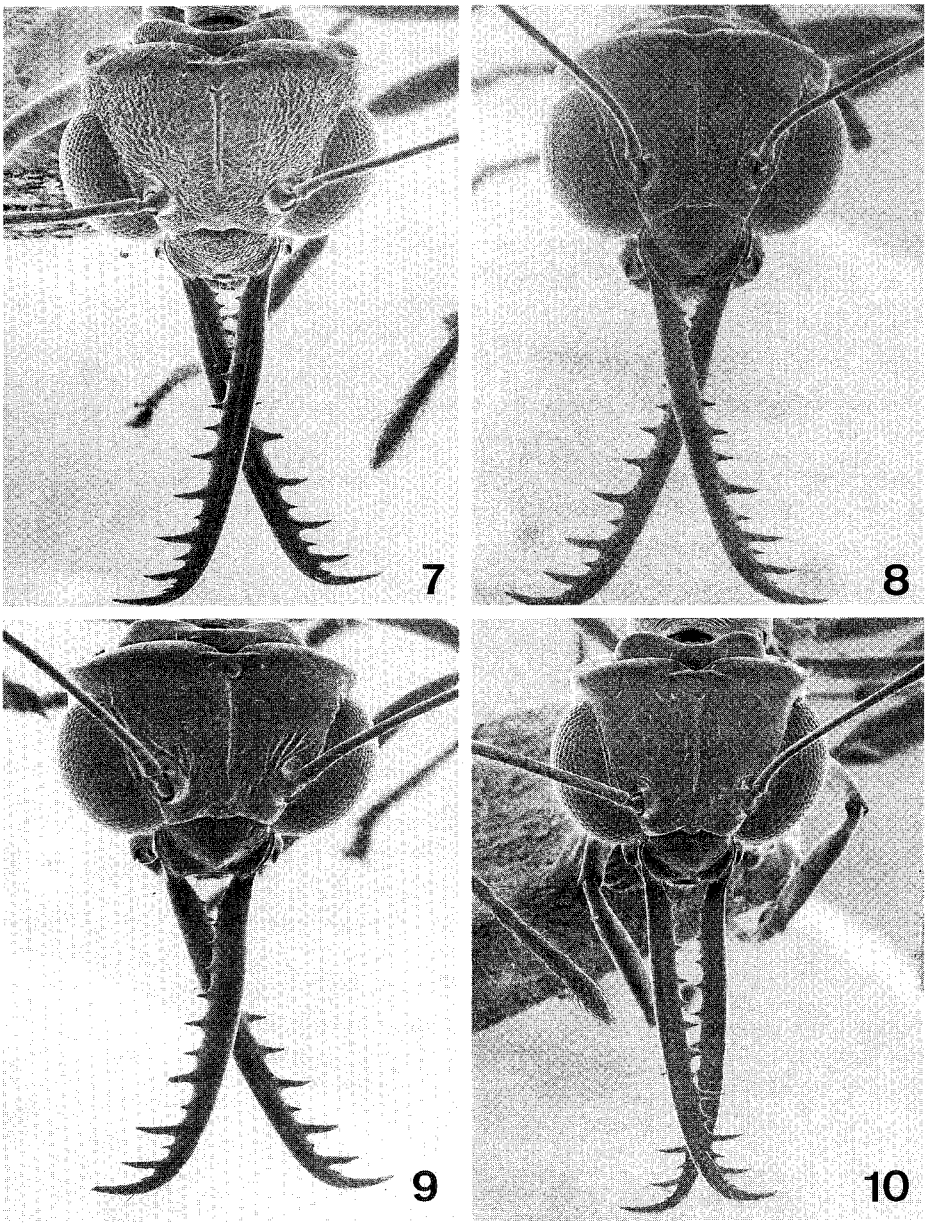
Yellowish brown species, head in full frontal view, occiput and dorsum of alitrunk smooth and shining. Frontal sulcus distinct, one carina parallel to the inner margin of the eyes up to the occipital corners.

M. bakeri differs from *ivani* by the sculpture or the dorsal parts of pronotum and the mesonotum.

Material examined: 3 workers, E-Malaysia, Sabah, Poring Hot Springs, 500 m, 6.v.1987 (D.H. Burckhardt and I. Löbl), Dipoterocarpaceae forest, sifting of rotting logs with mushrooms in a gap of the forest and dead leaves at the base of trees within the forest: 12 workers, 2 deleate queens, E-Malaysia, Sabah, Poring Hot Springs, 550-600 m, 9.v.1987 (D.H. Burckhardt and I. Löbl). Dipterocarpaceae forest, sifting of dead leaves and rotten log; E-Malaysia, Sabah, Poring Hot Springs, 500 m, 11.v.1987 (D.H. Burckhardt and I. Löbl), Dipterocarpaceae forest, sifting at the base of old trees and on mushrooms near a stream; E-Malaysia, Sabah, Poring Hot Springs, 500 m (D.H. Burckhardt and I. Löbl), sifting of dry leaf litter at the base of old trees; E-Malaysia, Sabah, Kibongol Valley, 20.v.1987 (D.H. Burckhardt and I. Löbl), sifting under bomboo. BMNH, DAAC, MHNG.

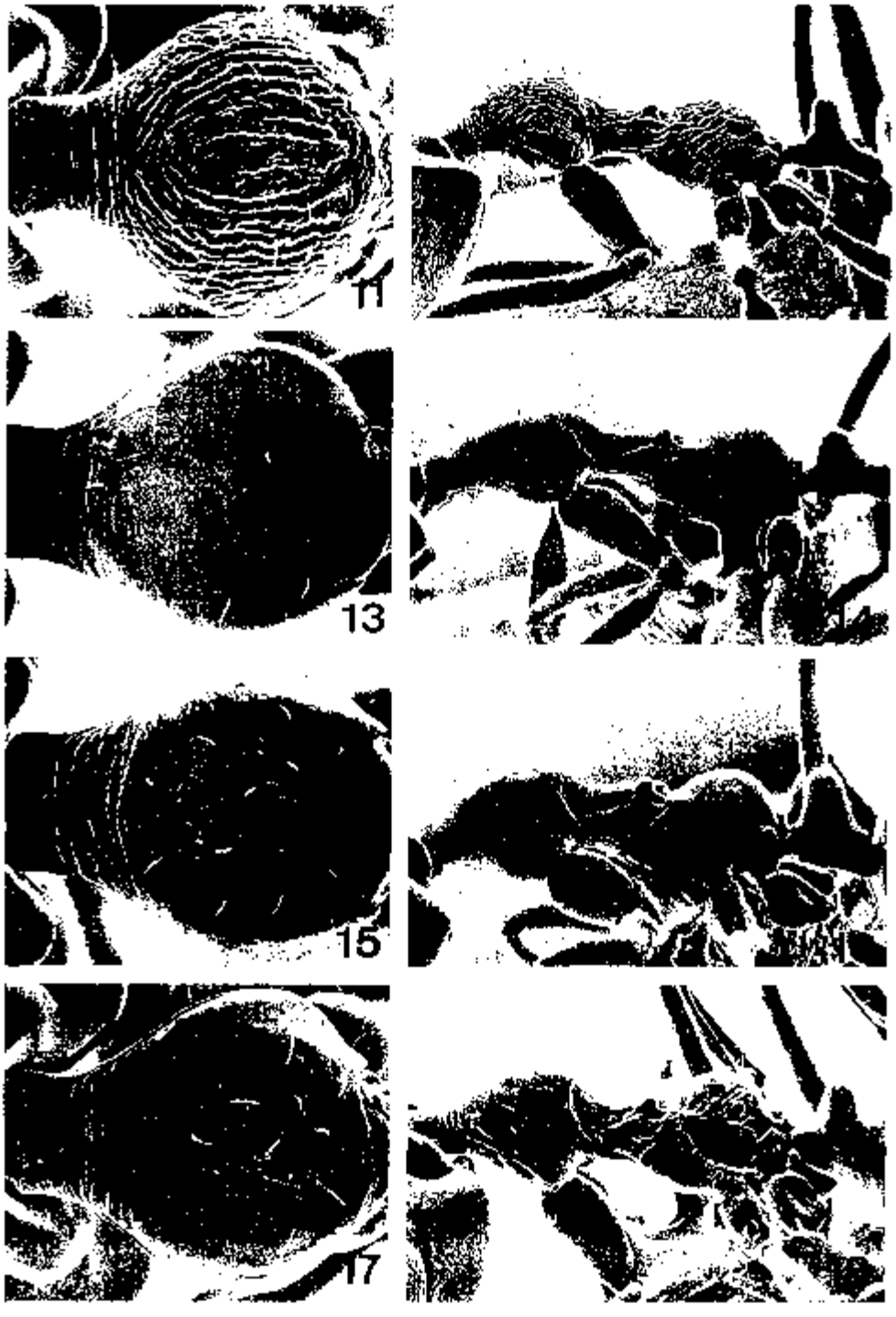
brigitteae new species
(Figs 21, 27, 28)

HOLOTYPE WORKER. TL 1.58, HL 0.96, HW 1.02, CI 106, SL 1.08, SI 106, EL 0.62, EI 61, ML 1.46, MI 152, PF 5/3. Head in full frontal view smoothly, longitudinally sculptured, velvet shine, declivitous face of occiput shining and smooth. Frontal sulcus and sulcus



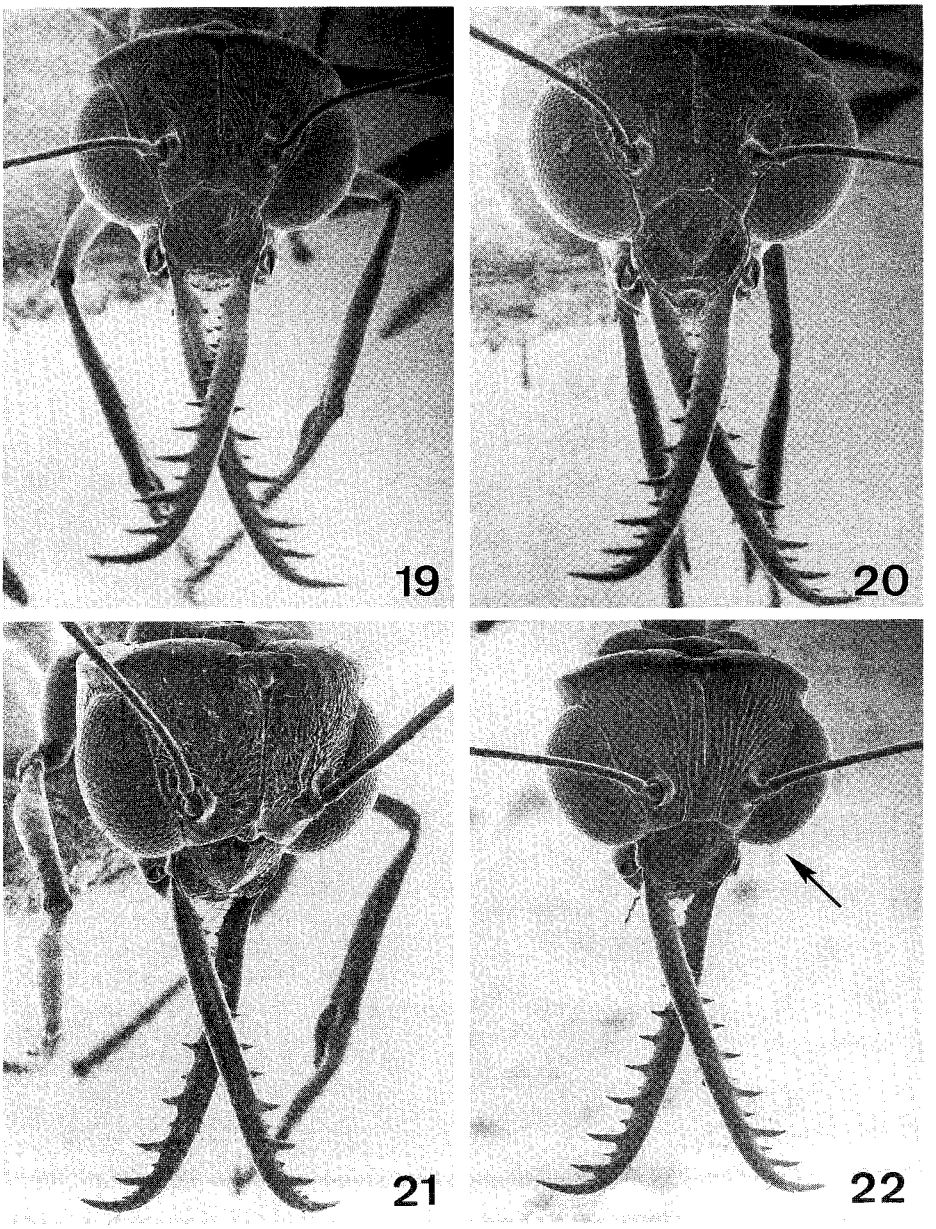
FIGS 7-10.

Head in full frontal view. 7. *M. elfeorum*; 8. *M. tonboli*; 9. *M. arcoelinae*; 10. *M. ivani*.



FIGS 11-18.

Dorsal view of pronotum (left) and lateral view of alitrunk (right). 11-12, *M. efferum*; 13-14, *M. tenuis*; 15-16, *M. arcuatum*; 17-18, *M. ivani*.

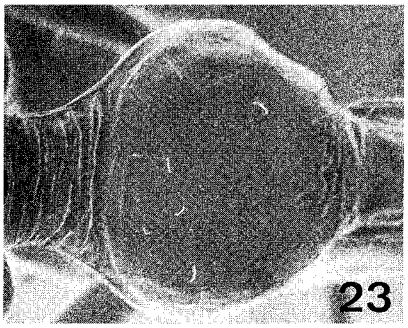


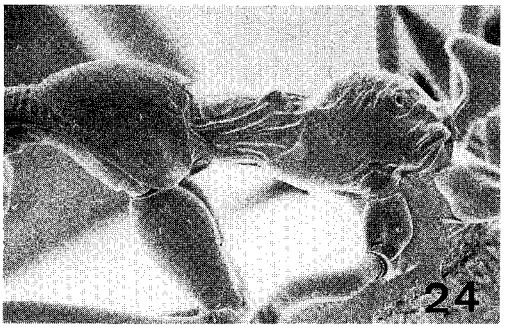
FIGS 19-22.

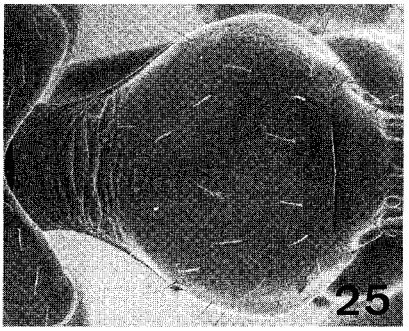
Head in full frontal view. 19. *M. marianneae*; 20. *M. estrudae*; 21. *M. brigitteae*; 22. *M. nicoletteae*, arrow indicating the long. erect hair below the eye.

FIGS 23-30.

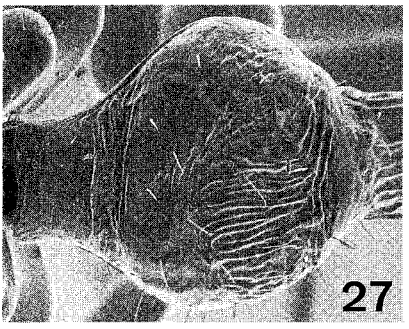
Dorsal view of pronotum (left) and lateral view of alitrunk. 23-24. M. *marianneae*; 25-26. *M. estrudae*; 27-28. *M. brigitteae*; 29-30. *M. nicoletteae*.

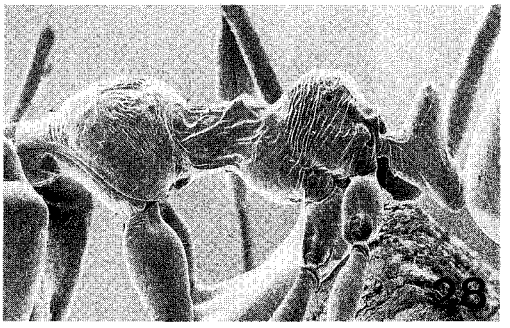

23

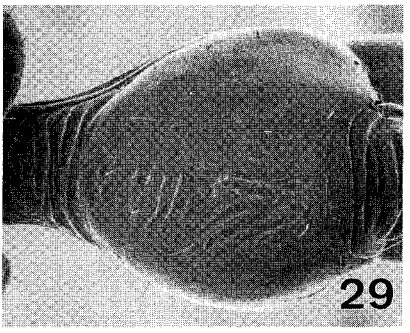

24

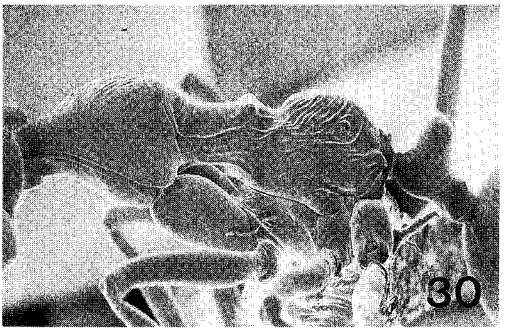

25

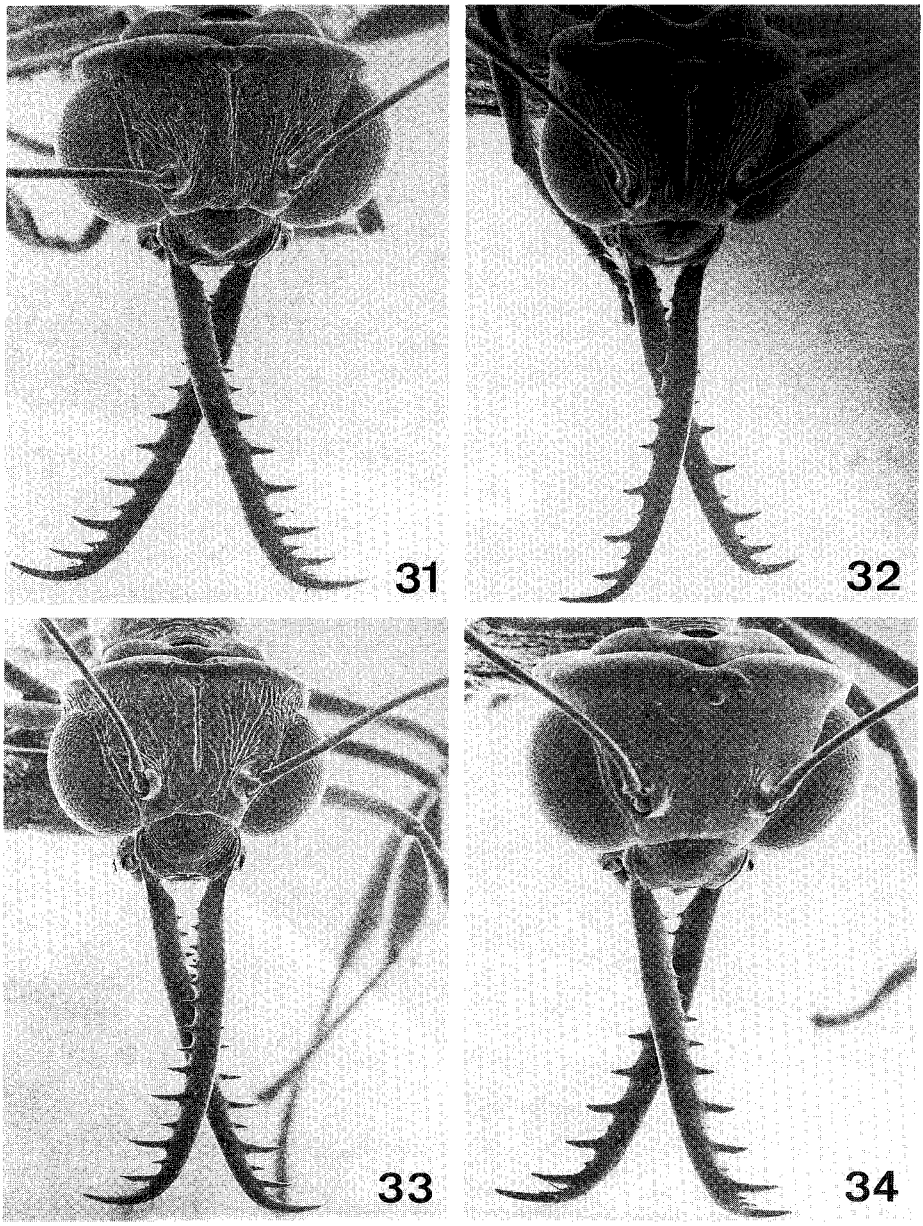

26


27


28


29


30

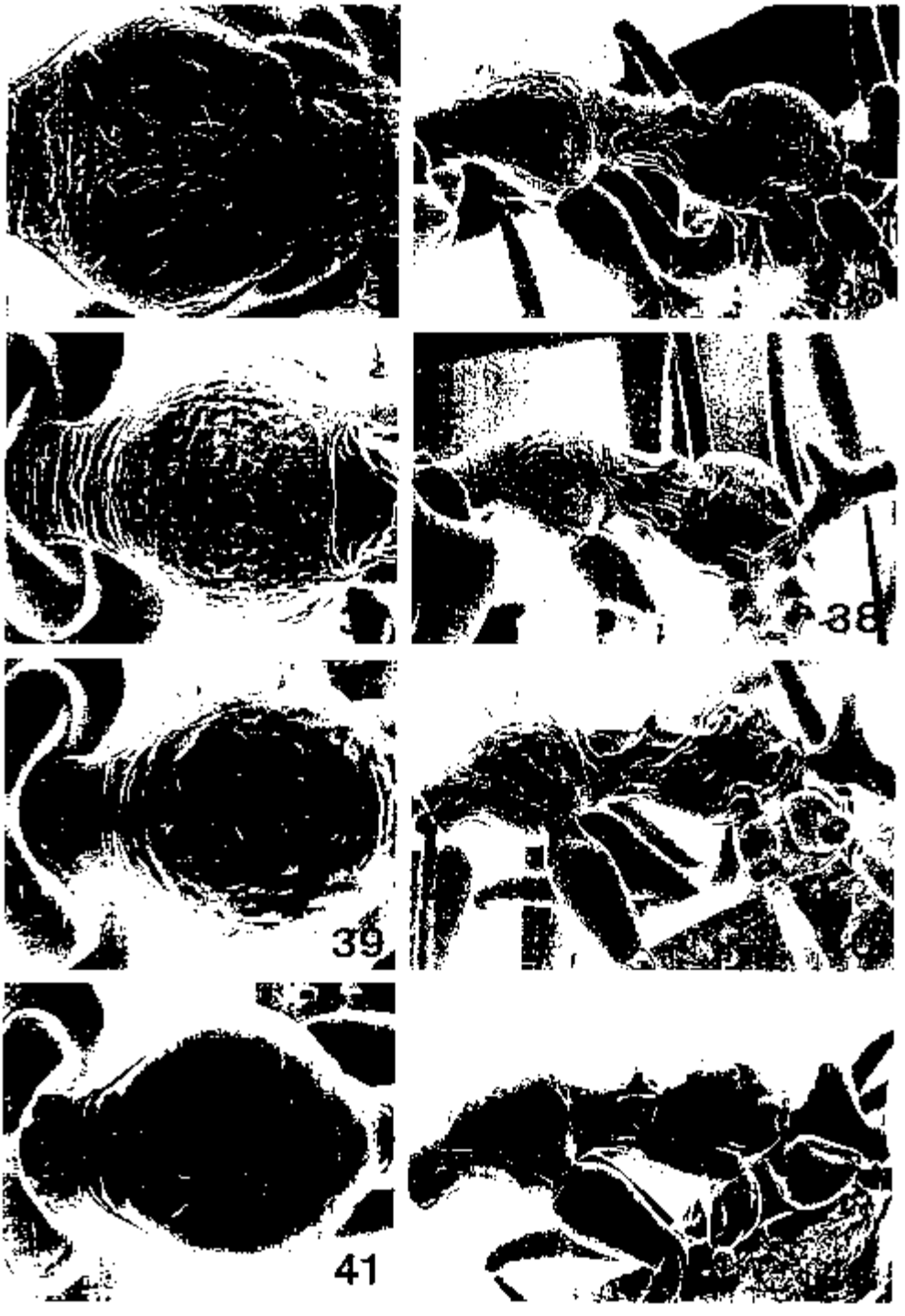


FIGS 31-34.

Head in full frontal view. 31. *M. danieli*; 32. *M. maudeae*; 33. *M. susanneae*; 34. *M. baslerorum.*

FIGS 35-42.

Dorsal view of pronotum (left) and lateral view of alitrunk. 35-36. *M. danieli*; 37-38. *M. maudeae*; 39-40. *M. susanneae*; 41-42. *M. baslerorum.*


39
41

anterior the clypeus and along the inner margin of the eye distinct and broad. Dorsum of pronotum anteriorly and posteriorly with transversal sculpture, median part with convergent sculpture; mesonotal sculpture with few large longitudinal rugae, dorsum of propodeum transversally rugose. Body, including the appendages uniform yellowish brown.

The specimens from Bali are all smaller and paler as the conspecific from Lombok.

Material examined: Holotype worker, Indonesia, Lombok, Batu Koq, 500 m, 12.iii.1991 (D. Agosti), leaf litter; MBBJ, on long term loan in MHNG.

Paratypes: 3 workers, same locality as holotype, BMNH, MCZC, MHNG.

Additional material examined: 1 female, Indonesia, Lombok, Pusuk, Monkey forest, 550 m, 11.iii.1991 (D. Agosti), leaf litter, secondary forest; 5 workers, Indonesia, Bali, Yehbua (E of Mendaya), 250 m, 25.iv.1991 (D. Agosti), leaf litter, secondary forest; DAAC, MBBJ, MHNG, MCZC.

chondrogastrum Moffett

Myrmoteras chondrogastrum Moffett, 1985: 38, figs 31, 34. Holotype worker, E-Malaysia, Sarawak, 4th Division, Gunung Mulu National Park, v.-viii.1978 (P.M. Hammond and J.E. Marshall) #49; BMNH [examined].

Diagnosis. TL 1.72, HL 1.10, HW 1.02, CI 93, SL 1.22, SI 120, EL 0.70, EI 69, ML unknown, tips broken, PF 5/4.

The granulate sculpture of the gaster is unique within *Myrmoteras*; slightly bicoloured with the alitrunk yellowish brown and the gaster and head darker.

danieli new species
(Figs 31, 35, 36)

HOLOTYPE WORKER. TL 1.70, HL 1.04, HW 1.08, CI 104, SL 1.18, SI 109, EL 0.68, EI 63, ML 1.70, MI 163, PF 5/3. The longitudinal sculpture of the head in full frontal view, fading towards the occiput; frons with three to four distinct rugae on each side, originating medially to the torulus; frontal triangle indicated, frontal sulcus distinct, occiput shining and smooth; dorsum of pronotum and mesonotum sculptured (see Fig. 35); on mesonotum metapleural tubercle ruga not present, but ventrally two distinct longitudinal rugae present; ventral part of the mesopleurae and propodeum with continuous longitudinal rugose sculpture, which is on the dorsum of the propodeum transversal. Frontal coxae with dorsal half brown and ventral half yellowish white.

Material examined: Holotype worker, WEST MALAYSIA, Sabah, Mt. Kinabalu, Liwagu Trail, 1500 m, 21.v.1987, (D.H. Burckhardt & I. Löbl), *Lithocarpus Podocarpus*-forest, sifting of vegetational debris on a partially deforested slope; MHNG.

Paratypes: 1 dealate queen, 1 male,17 workers, same series as holotype; 7 workers, E-Malaysia, Sabah, M. Kinabalu, between Ranau and Kota Kinabalu, 1150 m, 24.v.1987 (D.H. Burckhardt and I. Löbl) sifting of rotting wood with mushrooms and vegetational debris near a plantation and of forested gully; 2 dealate queens, 11 workers, E-Malaysia, Sabah, Mt. Kinabalu, 1540 m, 29.iv.1987 (D.H. Burckhardt andI. Löbl), sifting of vegetational debris in a small gully and the bases of old trees. 1 worker, E-Malaysia, Mt. Kinabalu, 1750 m, 21.iv.1987 (D.H. Burckhardt and I. Löbl), sifting of bark, rotten wood and vegetational debris at the base of a log and tree stumps; BMNH, DAAC, MCZC, MHNG.

Additional material examined: 8 workers, E-Malaysia, Sabah, Crocker Range National Park, Kota Kinabalu – Tambunan km 60, 1270 m (D.H. Burckhardt and I. Löbl), secondary forest with big *Agathis*, sifting of vegetational debris at the base of old trees and along a large log in a gap close to a burnt field; 1 worker, E-Malaysia, Sabah, Crocker Range National Park, Kota Kinabalu - Tambunan km 63, 19.v.1987 (D.H. Burckhardt and I. Löbl), secondary *Lithocarpus-Castanopsis* forest, sifting of vegetational debris in a humid gully; BMNH, DAAC, MHNG.

diastematum Moffett

Myrmoteras diastematum Moffett, 1985: 36, figs 26, 29. Holotype worker, E-Malaysia, Sarawak, 4th Division, Gunung Mulu National Park, camp 2, v.-viii.1978 (P.M. Hammond and J.E. Marshall), BMNH [examined].

Diagnosis. TL 1.76, HL 1.12, HW 1.07, CI 96, SL 1.28, SI 1.20, EL 0.68, EI 64, ML 1.84, MI 164, PF 5/4.

The conspicuous sulcus between the clypeus and the frontal triangle and on the frons, and the long erect hairs (up to 0.25 mm) are unique to this species.

Material examined: 9 workers, E-Malaysia, Kibongal Valley, 700 m, 20.v.1987 (D.H. Burckhardt and I. Löbl), sifting of vegetational debris in a wooded gully close to fields, BMNH, DAAC, MHNG.

donisthorpei Wheeler

Myrmoteras donisthorpei Wheeler, 1916: 14, fig. 3. Holotype dealate queen, E-Malaysia, Sarawak, Mt. Matang, 16.1.1914 (G.E. Bryant); MCZC [Not examined; for description of worker see MOFFETT, 1985: 42 and figs 32, 35.].

Diagnosis. TL 1.19-1.28, HL 0.82-0.91, HW 0.83-0.90, CI 97-101, SL 0.84-0.98, SI, EL 0.56-0.61, ML 1.20-1.38, MI 146-154, PF 5/4 or 5/3.

The following combination of characters is unique for *donisthorpei*. Sculpture of head in full frontal view, including the frontal sulcus and clypeus, and the dorsum of pronotum and mesonotum granulate, occiput smooth and shining; trochanter and femora much brighter then the remaining body.

elfeorum new species
(Figs 7, 11, 12)

HOLOTYPE WORKER. TL 1.48, HL 0.99, HW 0.94, CI 95, SL 1.06, SI 113, EL 0.56, EI 60, ML 1.46, MI 147, PF 6/4. Head in full frontal view, including declivous face of occiput, glabrous, giving the impression of a longitudinal sculpture; dorsum of pronotum with a symmetric, fine longitudinal rugose sculpture in form of a U with the opening posterior; lateral parts of mesonotum and propodeum longitudinally rugose, rugae more distinct than on pronotum. Few scattered erect hairs on the eyes. Whole animal a uniform yellowish brown.

Material examined: Holotype worker, Indonesia, Sulawesi Selatan, Punjak (W of Palopo), 600 m, 21.iv.1991 (D. Agosti), forest in gully with stream, steep slopes and few leaf scattered on a clayey soil, sifting of vegetational debris; MBBJ, on long term loan in MHNG.

Paratype: 1 worker, INDONESIA, Sulawesi Selatan, Punjak (W of Palopo), 1000 m, 20.iv.1991 (D. Agosti), heath forest on top of a ridge with a very thick leaf litter layer with many roots, sifting of vegetational debris, MHNG.

estrudae new species
(Figs 20, 25, 26)

HOLOTYPE WORKER. TL 1.50, HL 0.96, HW 0.99, CI 103, SL 1.04, SI 105, EL 0.65, EI 66, ML 1.76, MI 163, PF 5/4. Head in full frontal view with discontinuous sculpture, clypeus granulate, the anterior part of the frons finely spaciously longitudinal sculptured, confluent with the chagrination on the posterior part. Declivitous face of occiput smooth and shining. Frontal sulcus and the sulcus posterior of the clypeus and sulcus medially of the eyes of about the same width. Dorsum of pronotum and propodeum chagrinated, the prododeum with some additional transversal spacious sculpture. Lateral parts of mesonotum laterally with few distinct rugae, including a straight metanotal tubercule ruga, ventral parts smooth and shining. Coxae and femorae bicolored with the apical parts of coxae and basal parts of femorae distinctly paler. The coloration is variable from castaneous to yellowish brown.

Material examined: Holotype worker, Indonesia, Sumatra, Aceh, G. Leuser NP., Ketambe research station, 500 m, 23.-30.xi.1989 (D. Agosti, D.H. Burckhardt & I. Löbl), lowland dipterocarp rainforest, sifting of vegetational debris, MBBJ, as long term loan in MHNG.

Paratypes: 15 workers, 6 females same series as holotype; BMNH, DAAC, MBBJ, MCZC, MHNG.

Additional material examined: 3 females, 1 worker, Indonesia, W-Sumatra, Panti, 250 m, 19.xi.1989 (D. Agosti, D.H. Burckhardt, I. Löbl), swamp forest, sifting of vegetational debris; 3 females, 4 workers, Indonesia, W-Sumatra, Palopo Nature Reserve, N of Bukittingi, 900 m, 18.-20.1989 (D. Agosti, D.H. Burckhardt & I. Löbl), secondary forest on steep slope, sifting of vegetational debris; 1 worker, 1 female, Indonesia, W-Sumatra, Padangpanjan, 600 m, 17.xi.1989 (D. Agosti, D.H. Burckhardt and I. Löbl), sifting of rotten bamboo. BMNH, DAAC, MBBJ, MCZC, MHNG.

insulcatum Moffett

Myrmoteras insulcatum Moffett, 1985: 45, figs 33, 36, 37. Holotype dealate queen, PHILIPPINES, Luzon, Lagunas, Mt. Makiling, ca. 150 m below summit, litter, ii.1968 (R.A. Morse); MCZC [not examined].

Diagnosis. The worker caste of this species is unknown. The following characters, which normally do not vary between worker and queen, are unique within *Myagroteras*. The lack of a frontal sulcus and the low palp formula (PF 3/3).

ivani new species
(Figs 10, 17, 18)

HOLOTYPE WORKER. TL 1.26, HL 0.86, HW 0.82, CI 95, SL 0.89, SI 109, EL 0.53, EI 65, ML 1,34, MI 159, PF 6/4. Small yellow species with head in full frontal view and dorsum of pronotum, with the exception of the anteriomost part with few transverse rugae, smooth and shining. Mesonotum laterally rugose which are continues on the dorsal region of the propodeum. Frontal sulcus posterior the clypeus and median of the eyes narrow. Mid and hind tibiae very wide.

The two populations are slightly different. The Palopo population has shorter hairs on the dorsum of the alitrunk and is paler then the Larompang population.

This species differs from *bakeri* by the absence of sculpture on the head in full frontal view.

Material examined: Holotype worker, Indonesia, Sulawesi Selatan, 30 km NE of Palopo, 50 m, 21.iv.1991 (D. Agosti), sifting of vegetational debris at the base of a *Ficus* in cacao plantation, MHNG.

Paratypes: 1 female and 1 worker, Indonesia, Sulawesi Selatan, between Larompang and Temboe, S of Palopo, 50 m, 20.iv.1991 (D. Agosti), secondary lowland rainforest, sifting of vegetational debris out of a thick leaf litter layer heavily infested with funghi, MHNG.

jacquelineae new species
(Figs 1, 2, 4-6)

HOLOTYPE WORKER. TL 1.30, HL 0.89, HW 0.86, CI 97, SL 0.90, SI 105, EL 0.55, EI 64, ML 1.42, MI 160, PF 6/4. Head in full frontal view, including the declivous face of the occiput which is additionally finely longitudinally rugose, glabrous. Frontal sulcus, and the sulcus posterior of the clypeus and along the inner margin of the eyes, distinct and narrow. The dorsum of the pronotum reticulate, the lateral parts of the mesonotum and propodeum longitudinally rugose. Body including appendages castaneous.

The combination of the glabrous head sculpture, the reticulate sculpture on the dorsum of the pronotum, the small size and the castaneous color is unique among the *Myagroteras*. From the similar *morowali* separted by the absence of a granular sculpture on the alitrunk and the dark brown to reddish colour.

Although only known by the holotype, this species is outstanding, unmistakable and with the most beautiful appearance.

Material examined: Holotype worker. Indonesia. Sulawesi Selatan, Punjak (W of Palopo), 1000 m, 20.iv.1991 (Agosti), heath forest on the top of a ridge with a thick leaf litter layer with many roots, sifting of vegetational debris, MBBJ, as long term loan in MHNG.

marianneae new species
(Figs 19, 23, 24)

HOLOTYPE WORKER. TL 1.62, HL 1.08, HW 1.04, CI 96, SL 1.24, SI 120, EL 0.65, EI 63, ML 1.80, MI 167, PF 6/4. Head in full frontal view longitudinally, separating rugose, occiput with dorsal and posterior face shining. Clypeus separated posteriorly from the frons by a distinct sulcus which is laterally continuing medially the eyes up to their posterior end. Frontal sulcus present, narrow. Dorsum of pronotum shining. Mesonotum shining, laterally dorsally with few distinct rugae, ventral part smooth. Metanotum smooth, separated by a serially arranged row of impressions from the mesonotum. Propodeum with longitudinal, continuous sculpture.

Separated from all the other *Myrmoteras* species by the distinct sulcus posterior of the clypeus, and the sculpture of the alitrunk, especially by the arrangement on the pleurae.

Material examined: Holotype worker, Indonesia, Sulawesi Selatan, Ulumambi (W of Momasa), 1000 m, 11.iv.1991 (D. Agosti), remnants of rainforest and coffee plantation, sifting of vegetational debris, as long term loan in MHNG.

maudeae new species
(Figs 32, 37, 38)

HOLOTYPE WORKER. TL 1.96, HL 1.24, HW 1.28, CI 103, SL 1.42, SI 111, EL 0.72, EI 36, ML 2.00, MI 161, PF 6/4. Head in full frontal view with longitudinal, diverging sculpture which ends well before the declivitous face of the occiput; occiput smooth and shining. Frontal sulcus distinct but very narrow. Frontal triangle indicated. Pronotum with spacious, large, round to elongate punctation, and has a shining surface. Dorsum of mesontoum anteriorly with transverse sculpture; posteriorly and laterally with a longitudinal sculpture. Propodeum and metanotum with continuous shallow spacious longitudinal sculpture. Propodeum separated from the metanotum by a narrow carina, crossing the longitudinal sculpture almost in a right angle, dorsum of mesonotum and propodeum continous in later view. Few, very short hairs on alitrunk (< 0.05 mm); head, alitrunk and gaster dark chestnut, legs yellowish brown.

The dorsal outline, in lateral view, and the short hairs on the alitrunk are unique within *Myagroteras*.

Material examined: Holotype worker, Indonesia, Sulawesi Selatan, Penanang, 1600 m, 13.iv.1991 (D. Agosti), montane rainforest, #19, leaf litter, MHNG.

morowali Moffett

Myrmoteras morowali Moffett, 1985: 48, figs 38, 42. Holotype worker, Indonesia, Central Sulawesi, near Morowali, Ranu river area, 27.i.-20.iv.1980 (M.J.D. Brendell), #B.M.1980-280 [Holotype not in BMNH, not examined].

Diagnosis. (Holotype and four paratypes) TL 1.15-1.20, HL 0.83-0.85, HW 0.80-0.82, CI 96-97, SL 0.87-0.90, SI 108-112, EL 0.49-0.50, ML 1.13-1.19, MI 140-144, PF 6/4.

Distinguished from closely related *wolasi* and *toro* by the finely granulate sculpture dorsally on head and pronotum; very smooth and shining frontal area; granulate clypeus; presence of transverse rugae across declivity of propdeum, which is smooth only near base; and light yellow colour with the petiole concolourous with trunk and gaster (Moffett, 1985).

nicoletteae new species
(Figs 22, 29, 30)

HOLOTYPE WORKER. TL 1.64, HL 1.04, HW 1.06, CI 102, SL 1.24, SI 117, EL 0.64, EI 60, ML 1.62, MI 156, PF 6/4. Head in full frontal view with a spacious, distinct longitudinal diverging sculpture; clypeus and occiput smooth. Dorsum of pronotum with a blurred converging sculpture, often alternating with smooth and shining patches, anterior part with transversal sculpture. Dorsum of mesonotum smooth, laterally with one distinct ruga. Metanotum and propodeum with spacious, flat longitudinal sculpture which is somewhat interrupted at the segmental transition from the metanotum to the mesonotum. Few short erect hairs on the genae. Large propodeal spiracle. Whole body yellow.

The spacious longitudinal sculpture on the head is unique among *Myagroteras* species.