

POTTER WASPS OF THE GENUS *EUMENES* LATREILLE (HYMENOPTERA: VESPIDAE: EUMENINAE) IN THE WESTERN PART OF THE PAPUAN REGION, WITH DESCRIPTION OF TWO NEW SPECIES AND TAXONOMIC NOTES ON *E. INCONSPICUUS* SMITH

Hari Nugroho

Museum Zoologicum Bogoriense, Research Center for Biology, Indonesian Institute of Sciences,
Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor, Indonesia
Email: harnoeg@gmail.com

Rosichon Ubaidillah

Museum Zoologicum Bogoriense, Research Center for Biology, Indonesian Institute of Sciences,
Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor, Indonesia
Email: ubaidillah003@yahoo.com

Jun-ichi Kojima

Natural History Laboratory, Faculty of Science, Ibaraki University, Mito, 310-8512 Japan
Email: jkrte@mx.ibaraki.ac.jp

ABSTRACT. – A taxonomic study on the solitary vespid wasps in the genus *Eumenes* Latreille, in the western part of the Papuan region is presented. Two new species are described: *E. batantanensis* Nugroho, new species, from Batanta Island and *E. truncatus* Nugroho, new species, from Sentani and Manokwari. *Eumenes conformis* Smith, 1864, known only from Ceram is synonymized under *E. inconspicuus* Smith, 1858, new synonymy; the species is known to occur widely in the Oriental and Papuan regions, from Thailand to Bali, and through Sulawesi and Moluccas to the western part of New Guinea. The male characteristics of *E. inconspicuus* are described for the first time.

KEY WORDS. – Vespidae, Eumeninae, *Eumenes*, new species, new synonymy, Papuan region.

INTRODUCTION

The potter wasp genus *Eumenes* was established by Latreille (1802). While the genus, which consists of more than 100 species-group taxa (species and subspecies), is cosmopolitan, the wasps are mainly known from temperate regions of the Northern Hemisphere. The regionally biased distribution pattern possibly may be due to the fact that research has been more intensive in temperate regions than in the tropics. Nevertheless 39 species have been recorded from the Oriental and Papuan regions and tropical Australia (J. M. Carpenter, pers. comm.). Of them, 31 species are known in the Oriental region, of which one, *E. architectus* Smith, 1859 was recorded also from Ambon by von Schulthess (1932). Six species and only two species have been known respectively from the Moluccas and in the Papuan region.

The first *Eumenes* species recorded from the Papuan region is *E. dorycus*, which was described by Maindron (1882) based on two specimens from Dorey and Andai (both near Manokwari); Giordani Soika (1941), inadvertently

referring to the specimen from Dorey as “olotipo” [= holotype], designated and redescribed the lectotype of this species. Meade-Waldo (1912) recorded a Moluccan species, *E. agillimus* Dalla Torre from Mimika River in South New Guinea, but this record may possibly be based on misidentification. For more than 70 years since Giordani Soika (1935) described another species, *E. simplicilamellatus*, from Kapa Kapa and some other localities in Papua New Guinea and also from Cairns, Australia, no one has worked on Papuan *Eumenes*.

As mentioned above, the Papuan *Eumenes* fauna is yet too poorly studied to know whether it really consists of a few species or such a small number of recorded species is simply because of lack of intensive investigation. A recent research expedition to the westernmost part of the Papuan region (Batanta Island and Manokwari) organized in 2008 by the Indonesian Institute of Sciences brought us several *Eumenes* specimens, which allowed us to increase our knowledge on the Papuan *Eumenes* fauna. In this paper, based on these specimens and those deposited in the Museum Zoologicum

Bogoriense and the Natural History Collection at Ibaraki University, two new species are described and the taxonomy of *E. inconspicuus* Smith, 1858, is revised together with description of characteristics of the male for the first time.

MATERIALS AND METHODS

The materials examined in the present study are those deposited in the collections of the Museum Zoologicum Bogoriense (abbreviated as “MZB”), the Indonesian Institute of Sciences, Bogor, Indonesia and the Natural History Collection at Ibaraki University (IUNH), Mito, Japan. Observation on morphological and colour characters was made on the pinned-and-dried specimens under a stereoscopic dissecting microscope. All drawings were made by using the drawing tube attached to a stereoscopic dissecting microscope. Terminology follows Yamane (1990) and Buck et al. (2008).

Measurements of body parts were made with the ocular micrometer attached to a stereoscopic dissecting microscope. “Body length” indicate the lengths of head, mesosoma and the first two metasomal segments combined; the width of clypeus was measured as the distance between apexes of the lateral lobes; and the mesosomal length and width were measured in view perpendicular to the mesoscutum.

The new species described in this paper are of a single authorship which belongs to the senior author.

TAXONOMY

Eumenes batantanensis Nugroho, new species (Figs. 1–4, 9–10, 13, 15–16)

Material examined. – Holotype: female (MZB), labeled “INDONESIA, West Papua, Raja Ampat, Batanta Island, Yenanas, 00°50'09.8"S 130°53'18.5"E, alt. 9 m, coll. H. Nugroho & R. Ubaidillah”, reared from a nest collected on 27 Apr. 2008, “HOLOTYPE, MZB. HYMN. 19211” and “*Eumenes batantanensis* Nugroho” [second to terminal and seventh to terminal flagellomeres respectively of the left and right antennae missing].

Paratype – 1 male (MZB), INDONESIA, Papua, Raja Ampat, Batanta Island, Samsen, Alt. 29 m, 00°53'44.6"S 130°33'18.0"E, coll. H. Nugroho & R. Ubaidillah, 2 May 2008.

Diagnosis. – This species can be separated from all other known species in the Papuan Region by the following combination of characters: clypeus with dorsal margin slightly emarginate medially and produced on both sides of emargination slightly beyond level of tentorial pits, ventral margin very shallowly emarginate medially; labrum broadly rounded apically; mesosoma short, about as long as high in lateral view; propodeum weakly convex, with posterior face barely depressed medially in dorsal half and more or less distinctly depressed medially in ventral half; first metasomal sternum and tergum fused, leaving suture between them

distinct only posteriorly; body black; female clypeus yellow, with ferruginous spot in each ventrolateral corner.

Female. – Body length about 15 mm; forewing about 10 mm.

Head in frontal view subcircular, slightly wider than high (Fig. 3). Clypeus in lateral view weakly and smoothly convex (Fig. 1), in frontal view about 1.25 times as high as wide, with dorsal margin very shallowly emarginate medially (Fig. 9), produced dorsally slightly beyond tentorial pits and distinctly separated from antennal sockets (Fig. 3); ventral margin shallowly emarginate medially (Fig. 9). Labrum broadly rounded apically (Figs. 3, 9). Mandible with dorsalmost tooth short. Antennal scape about 4 times as long as its maximum width; first flagellomere extremely longer than wide, about 6 times as long as wide.

Mesosoma globular, short and stubby, about 1.25 times as long as high in lateral view (Fig. 1), about 1.25 times as long as wide. Pronotal carina obliterated dorsally, weakly produced at humeral angles. Mesoscutum about as long as wide. Tegula convex. Scutellum strongly convex, with median longitudinal depression. Metanotum nearly flat. Propodeum weakly convex; in lateral view outline of the posterior face weakly and smoothly curved (Fig. 1); median longitudinal groove deep; posterior face barely depressed medially in dorsal half, more or less distinctly depressed medially in ventral half.

First metasomal segment long and slender, nearly 1.5 times longer than length of mesosoma; tergum in dorsal view prominently produced laterally at spiracles, but in general weakly widened posteriorly, with apical width about 2 times its basal width (Fig. 2) and about one third maximum width of second tergum; tergum and sternum fused, leaving suture between them distinct only posteriorly; tergum with weak carinae along its ventral margins. Second tergum with well-developed apical lamella, with preapical impression nearly absent; second sternum flattened (Fig. 1).

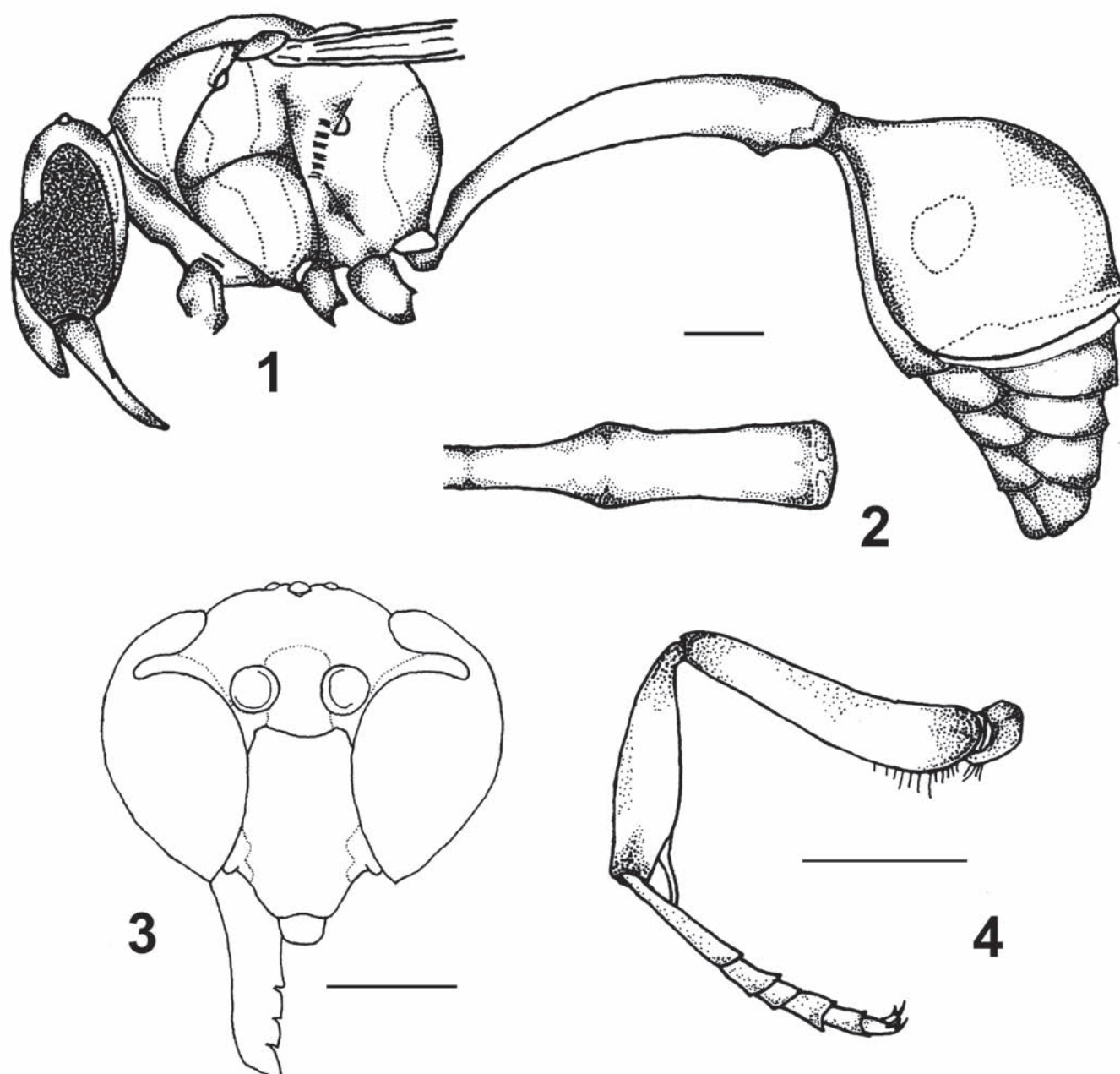
Body densely covered with long, ferruginous hairs. Head strongly punctured, covered with long, erect hairs in ocular sinus, frons and vertex; hairs in occiput sparser and shorter. Pronotum and mesoscutum with punctures similar to those on head; scutellum and metanotum with punctures slightly sparser and larger than those on mesoscutum; propodeum strongly punctured, with erect hairs much longer than those on other body parts. Inner side of fore femur and trochanter with long, erect hairs (Fig. 4). First metasomal tergum and sternum with weaker punctures (Fig. 15) than in other body parts; second tergum densely covered with silky pubescence, with weak punctures (Fig. 16) as in the first tergum.

Head and mesosoma black, with following yellow and ferruginous markings: Band along inner eye margin occupying eye emargination and extending ventrally to clypeus, supraclipeal area, yellow; clypeus yellow, with ill-defined small ferruginous spot on each ventrolateral corner; labrum dark ferruginous, with narrow dark-yellow band along

apical margin; mandibles except for black base ferruginous; narrow band in dorsal half of gena along posterior margin of eye yellow; antenna ferruginous beneath; anterior part of dorsal face of pronotum, narrow band at the posterolateral corner, yellow; ill-defined narrow short band along each anterolateral margin of mesoscutum, parategula, metanotum entirely, large scrobal spot connected with large spot below it to occupy posterior half of mesepisternum, paired large posterolateral spots on propodeum, propodeal valvula, yellow; tegula dark-yellow to ferruginous along outer margin. Wings fusco-hyaline; forewing slightly infuscated along anterior margin. All coxae black, but mid and hind coxae with large yellow spot on the dorsal surface; trochanters and femora dark brown, but ventral part of fore femur largely and apical part of mid-femur, yellow; tibiae and tarsi yellow, but mid-tarsus darker apically and hind tibia and tarsus largely ferruginous.

Metasoma black, with following yellow marks: apical band of first tergum, paired large lateral spots and apical band of second tergum, large irregular-shaped posterior spot of second sternum; apical bands on third to fifth segments ferruginous.

Male. – Body length about 14 mm; forewing length about 10 mm. Similar to female, but clypeus more slender, about 1.1 times as high as wide, more strongly narrowed basally, entirely yellow except for apical semi-transparent lamella coloured ferruginous (Fig. 10); mandible with the dorsalmost tooth longer and more slender, black but ferruginous apically. Antennal scape slightly curved, about 4 times as long as its maximum width (near apex); flagellum weakly thickened apically, thickest at seventh or eighth flagellomere, then tapering apically; first flagellum about 3.75 times as long



Figs. 1–4. *Eumenes batantanensis* Nugroho, new species, holotype female: 1, body, lateral view; 2, first metasomal tergum, dorsal view; 3, head, frontal view; 4, fore femur and trochanter. Scale bar = 1 mm.

as wide, slightly shorter than the length of second and third flagellomeres combined; terminal (eleventh) flagellomere slightly curved, sharply pointed apically, about 2.5 times as long as its basal width (Fig. 13); antenna black, scape with ill-defined small yellow spot at base, first to third and eighth to terminal flagellomeres ferruginous beneath.

Etymology. – The specific name of this species refers to the type locality, Batanta Island.

Remarks. – This species looks structurally similar to the Moluccan species *E. agillimus* in having the short mesosoma and similarly-shaped metasoma (see Giordani Soika, 1935 for characters in *E. agillimus*). However, the new species can be easily distinguished from *E. agillimus* by having a propodeum with the posterior face strongly convex and in lateral view broadly rounded (in lateral view posterior face barely convex in *E. agillimus*), and by the first metasomal tergum and sternum being more or less fused (clearly separated in *E. agillimus*). This species is also similar to *E. truncatus* Nugroho, new species, but they can be distinguished as remarked in the next section.

Distribution. – Known only from Batanta Island.

***Eumenes truncatus* Nugroho, new species**
(Figs. 5–8; 11–12, 14, 17–18)

Material examined. – Holotype – female (MZB), labeled “INDONESIA, Papua, Sentani, forest edge, 100–150 m, I. J. [=Irian Jaya expedition], 26 Mar. 1973” (handwritten), “HOLOTYPE, MZB. HYMN. 19213” and “*Eumenes truncatus* Nugroho”.

Paratype – 1 male (MZB), INDONESIA, Papua, Manokwari, Ambau, 110 m, Irian Jaya expedition, 13 May 1973.

Diagnosis. – This species can be separated from all other known species in the Papuan Region by the following combination of characters: clypeus with dorsal margin distinctly emarginate medially, produced dorsally beyond level of tentorial pits and very close to antennal socket, with ventral margin distinctly emarginate medially; labrum truncate apically; propodeum strongly convex, with deep median furrow; first metasomal sternum and tergum fused, with suture between them distinct only posteriorly; body black; female clypeus yellow dorsally, black ventrally.

Female. – Body length about 17 mm; forewing length about 12 mm.

Similar to *E. batantanensis* except for the following characteristics: clypeus with dorsal margin close to antennal sockets and deeply emarginate medially (Fig. 7), ventral margin distinctly emarginate medially (Fig. 11); labrum truncate apically (Figs. 7, 11); mandibular dorsalmost tooth more obtuse (Fig. 7); mesosoma not so stubby as in *E. batantanensis*, about 1.2 times as long as high in lateral view, about 1.2 times as long as wide; mesoscutum nearly as wide as long; propodeum strongly convex, bulging in

anterior part of posterior face, in lateral view outline of posterior face strongly curved (Fig. 5), median longitudinal groove deeper; first metasomal tergum in dorsal view weakly produced laterally at spiracles; punctures on first and second metasomal segments denser than in *E. batantanensis* (Figs. 17, 18). Antennal scape slender, weakly curved, 4 times as long as its maximum width; first flagellomeres about 3 times as long as wide; second to fourth flagellomere slightly longer than its maximum width; fifth to ninth flagellomeres square in outline, about as long as wide.

Body densely covered with long, ferruginous hairs. Head strongly punctured in frons and vertex. Pronotum and mesoscutum with punctures slightly larger than those on head. Scutellum, metanotum and propodeum with punctures stronger and larger than those on mesoscutum. First metasomal tergum and sternum with punctures sparser and smaller than those on head and mesosoma, but stronger than those on *E. batantanensis*; second sternum with punctures superficial, sparser than those on second tergum.

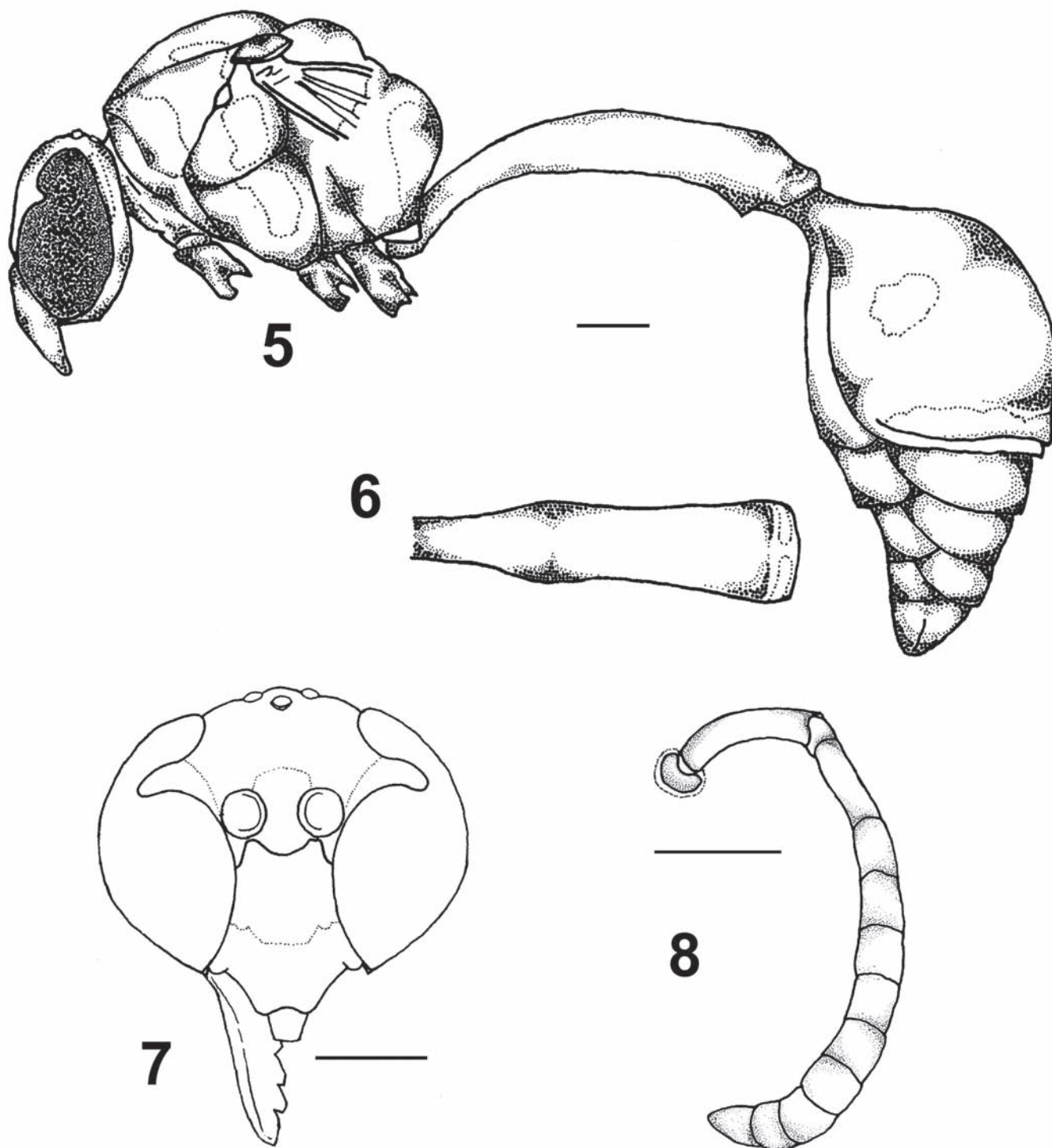
Body black, with following yellow markings: Band along inner eye margin occupying eye emargination and extending ventrally to clypeus; supraclypeal area, dorsal half of clypeus, narrow band along apical margin of labrum, narrow band in dorsal half of gena along posterior margin of eye, anterior part of dorsal face of pronotum, narrow band in each posterolateral corner of pronotum, short lateral band along each anterolateral margin of mesoscutum, parategula, outer margin of tegula, anterior half of metanotum, large scrobal spot connected with large yellow spot below it to occupy posterior half of mesepisternum, paired large posterolateral spots on propodeum, propodeal valvula, apical band of first metasomal tergum, paired large lateral spots and apical band of second tergum, and large irregular-shaped posterior spot on second sternum. Apical margin of clypeus, labrum except for apical yellow band, mandible except for black base, ferruginous. Antenna blackish brown, but ferruginous beneath. Wings fusco-hyaline, darker than in *E. batantanensis*. All coxae black; femora dark brown, but fore femur largely and mid-femur apically yellow; fore and mid-tibiae yellow; hind-tibiae ferruginous; all tarsi ferruginous, darker apically.

Male. – Body length about 15 mm; forewing length about 10 mm. Similar to female, but clypeus more slender, about 1.3 times as high as wide, more strongly narrowed dorsally (Fig. 12), entirely yellow except for apical, semitransparent, ferruginous band; space between clypeus and antennal socket wider than in female; mandible black but ferruginous at apex, with dorsalmost tooth longer and more slender than in female; labrum yellow; punctures on first and second terga sparser and weaker than in female. Antennal scape slightly curved, about 4 times as long as its maximum width (near apex); first flagellomere about 3.5 times as long as its maximum width; second to fifth flagellomeres slightly longer than their maximum width; sixth to tenth flagellomeres square, about as long as wide; terminal flagellomeres slightly curved, sharply pointed apically, about 2.2 times as long as its basal width (Fig. 14).

Etymology. – The specific name, *truncatus*, is a Latin adjective and refers to the apically truncate labrum.

Remarks. – This new species is similar to *E. batantanensis* Nugroho, new species, but can be easily distinguished from the latter in the following characters [states for *E. batantanensis* are given in brackets]: Both dorsal and ventral margins of clypeus rather deeply emarginate medially (Figs. 11–12) [emargination shallow or very shallow (Figs. 9–10)];

female clypeus close to antennal sockets (Fig. 7) [distinctly separated (Fig. 3)]; propodeum more strongly convex (Fig. 5) than in *E. batantanensis* (Fig. 1); base of second tergum slightly flattened (Fig. 5) [barely flattened (Fig. 1)]. This species is also similar to *E. dorycus*, according to the redescription of the lectotype by Giordani Soika (1941), but can be easily distinguished from *E. dorycus* by having the clypeus black in dorsal half (nearly entirely yellow in *E. dorycus*). Furthermore, *E. dorycus* is distinguished from



Figs. 5–8. *Eumenes truncatus* Nugroho, new species, holotype female: 5, body, lateral view; 6, first metasomal tergum, dorsal view; 7, head, frontal view; 8, left antenna. Scale bar = 1 mm.

either *E. truncatus* and *E. batantanensis* by having the first metasomal segment much more elongated than the latter two species (see Giordani Soika, 1941: Fig. 19)

Distribution. – Known from the two localities listed herein, Sentani near Jayapura and Manokwari. This species may occur in northwestern part of New Guinea Island.

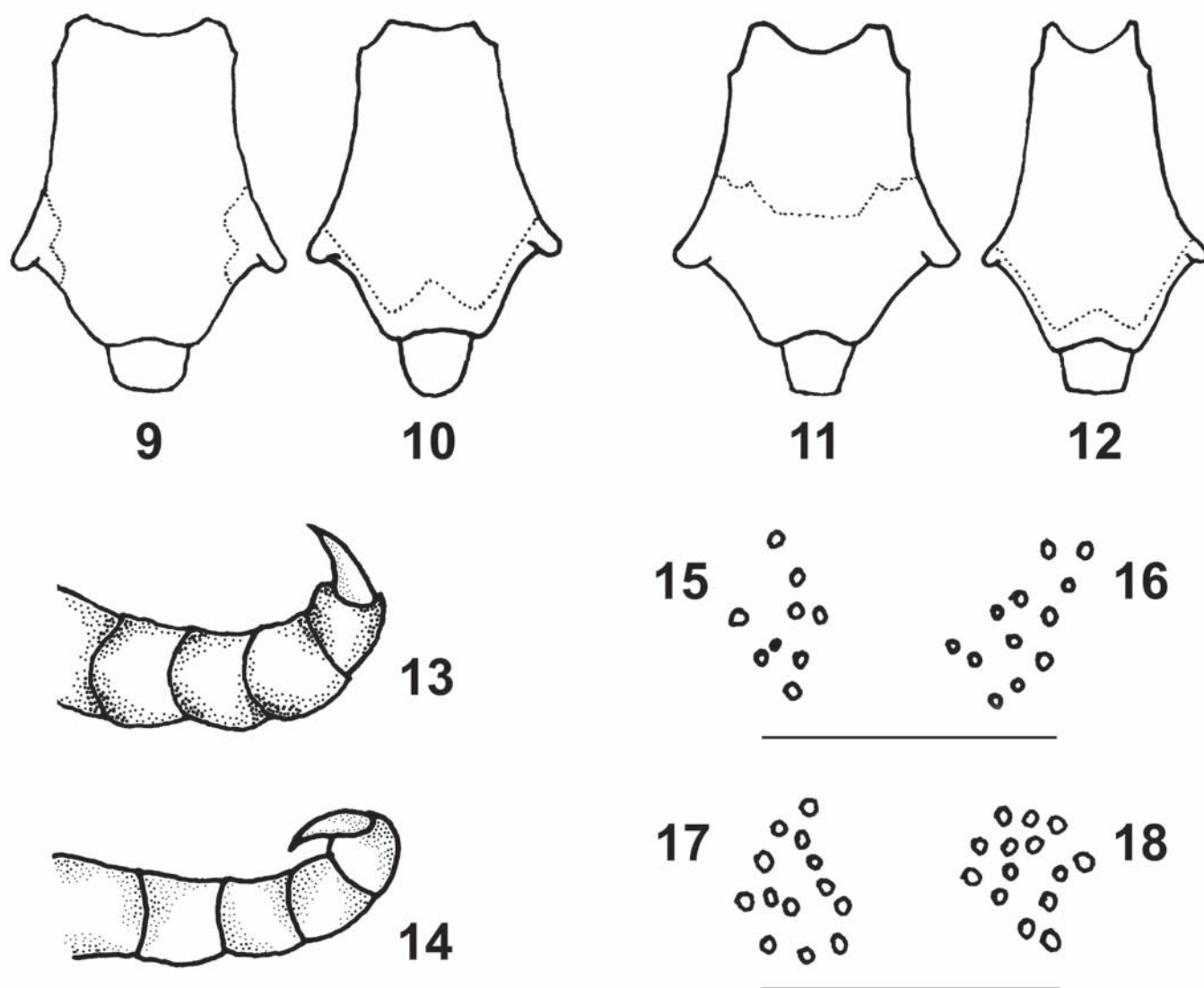
***Eumenes inconspicuus* Smith, 1858**
(Figs. 19–23)

Eumenes inconspicua Smith, 1858: 109.

Eumenes conformis Smith, 1864: 38. **new synonymy**

Material examined. – NEW GUINEA: 1 male (MZB), West Papua, Manokwari, Aimasi, coll. R. Ubaidillah, 15 May 2008. AMBON: 1 female (MZB), Waai, coll. A. M. R. Wegner, 5 Jul.1959. BURU: 1 female (MZB), Wamlana, coll. A. M. R. Wegner, 4 Jun.1959. SULAWESI: North Sulawesi: 2 males (MZB, IUNH), Poigar, coll. J. Kojima, 1 Dec.1999; 1 male (MZB), Maria Lama near Poigar,

coll. J. Kojima, 1 Dec.1999; 1 male (IUNH), Gorontalo, Morogotan, Attingola, 00°56'N 123°01'E, coll. J. Kojima & R. Ubaidillah, 14 Sep.2003; 2 males (MZB, IUNH), Gorontalo, Datahu, Tibawa, 00°40'N 122°51'E, coll. J. Kojima & R. Ubaidillah, 14 Sep.2003; 1 male and 1 female (MZB), Minahasa Peninsula, Remboken, near Tondano, coll. J. Kojima, 27 Nov.1999; Southeast Sulawesi: 5 males (MZB), North Kolaka, Ranteangin, Tinukari, 03°38'S 121°04'E, 98 m asl., coll. R. Ubaidillah, S. Heydon, H. Nugroho & Giyanto, 03 Aug.2009; 4 females (MZB), North Kolaka, Ranteangin, Tinukari, 03°38'S 121°04'E, R. Ubaidillah, S. Heydon, H. Nugroho & Giyanto [1 female, 43 m asl, 02 Aug.2009; 1 female, 98 m asl, 03 Aug.2009; 1 female, 186 m asl, 04 Aug.2009; 1 female, 186 m asl, 07 Aug.2009]; South Sulawesi: 1 female (MZB), 02°58.5'S 120°05'E, 800 m asl., Puncak Palopo, Dusun Tojambu, Desa Battang, Kec. Warateluwanua, Kab. Luwu, J. Kojima, 29 Oct.2000. JAVA: 1 male (MZB), Yogyakarta, Gunung Kidul, Kec. Purwosari, Giritirto, Ploso, H. Nugroho & Giyanto, 19 Jul.2008; 1 male (MZB), West Java, Bogor Botanical Garden, 20 Nov.1999, S. Kahono; 1 female (MZB), West Java, Kuningan, Mandirancan, Seda, 06o80'S 108o27'E, 500-550 m asl., Darmawan, 23 Oct.2008. KRAKATAU ISLANDS: 3 males (MZB), P. Anak Krakatau, Sk. Yamane, 29 Jul.1982; 1 male (MZB), P. Anak Krakatau, J. Yukawa, 6 Nov.1982; 1 female (MZB),



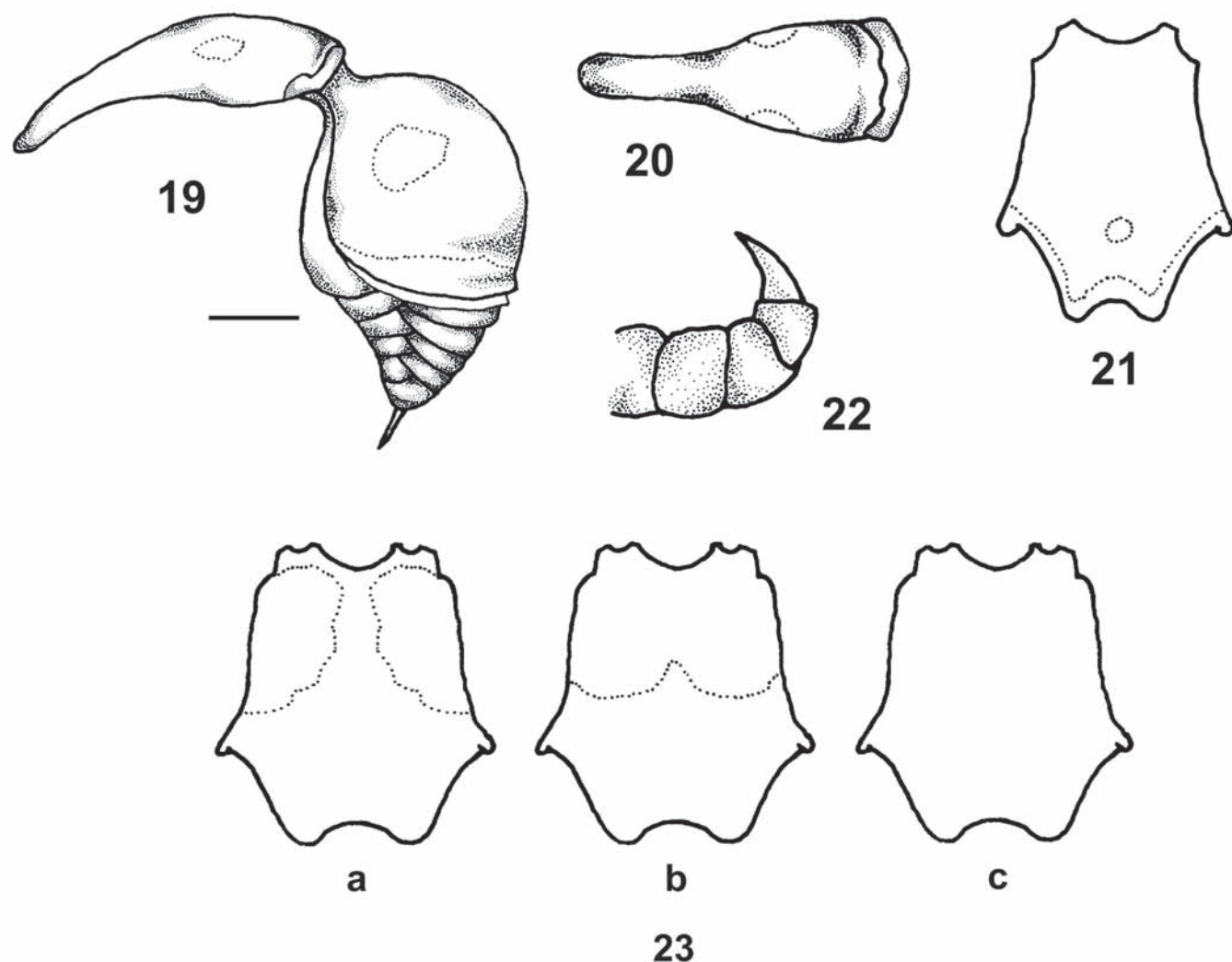
Figs. 9–18. *Eumenes batantanensis* Nugroho, new species (9–10, 13, 15–16) and *E. truncatus* Nugroho, new species (11–12, 14, 17–18). Female, holotype (9, 11, 15–16) and male (10, 12, 13–14). 9–12, Clypeus and labrum, 13–14, apical part of antenna, 15, 17, punctures on first metasomal tergum, 16, 18, punctures on second metasomal tergum. Scale bar (for only Figs. 15–18) = 1 mm.

P. Anak Krakatau, J. Yukawa, 8 Nov.1982; 4 males (MZB), P. Rakata Kecil, Sk. Yamane, 29 Jul.1982; 1 female (MZB), P. Rakata Kecil, Sk. Yamane, 28 Jul.1982; 1 female (MZB), P. Rakata Besar, J. Yukawa, 31 Oct.1982. BORNEO: 1 male (MZB), East Kalimantan, Balikpapan, Mentawir river, A.M.R. Wegner, Oct.1950; 1 female (MZB), East Kalimantan, Kutai, 38 km N. Balikpapan, Samboja, Darling, Rosichon, Sutrisno, Apr.1992.

Remarks. – In the recent on-line checklists, such as Species 2000 & ITIS “Catalogue of Life” (<http://www.catalogueoflife.org/search.php>), *E. conformis* Smith, 1864 is often treated as a subspecies of *E. inconspicuus* Smith, 1858. Such the taxonomic treatment, though it has never been published, is shown in the late J. van der Vecht’s typescript checklist (J. Carpenter, pers. comm.). *Eumenes inconspicuus* has been recorded from, in addition to Borneo in the original description, Thailand (Gusenleitner, 1988), Malay Peninsula, and Sumatra (von Schulthess, 1914, as *E. punctatus* de Saussure, 1852) and Bali (Giordani Soika, 1987), while *E. conformis* has been known only from the type locality, Ceram Island. If such a disjunct distribution pattern is the reality, we would have to assume specific biogeographic events that

explain the absence of *E. inconspicuus* on Java and allow us to treat *conformis* as a subspecies (= formally named local population) of the species *E. inconspicuus*. Our specimens from Krakatau, Java, Sulawesi, Buru and Ambon infill gaps in the distribution records. Examination of above listed female specimens showed that variations in marking pattern are interconnected in every direction even within a local population. Consequently we have concluded to synonymize *E. conformis* Smith, 1864, under *E. inconspicuus* Smith, 1858. As they differ only in the characters that usually show sexual dimorphisms in eumenine wasps such as antennal shape, male and female specimens can be reasonably associated. Male characteristics are described below for the first time.

Diagnosis. – This species can be easily distinguished from other known Papuan species by having the first metasomal segment that is shorter, stubby and strongly swollen in the posterior half. Other diagnostic characters are as follows: clypeus with dorsal and ventral margin deeply emarginated medially; propodeum strongly convex, with median longitudinal groove deep; second metasomal tergum and sternum convex; tergum with preapical impression.



Figs. 19–23. *Eumenes inconspicuus* Smith. Male (19–22) and female (23). 19, metasoma, lateral view, 20, first metasomal tergum, dorsal view, 21, 23, clypeus, 22, apical part of antenna. Scale bar (for only Fig. 19) = 1 mm.

Male. – Body length about 8.5–12.5 mm; forewing length about 5.5–9.0 mm. Head in frontal view subcircular, slightly wider than high. Clypeus in lateral view weakly convex, in frontal view about 1.25 times as high as wide (Fig. 21); dorsal and ventral margin more or less distinctly emarginate medially. Labrum rounded apically. Mandible with the dorsalmost tooth long. Antennal scape about 4 times as long as its maximum width; first flagellomere longer than wide, about 3 times as long as wide.

Mesosoma subglobular, short and stubby, about 1.25 times as long as high in lateral view, about 1.25 times as long as wide. Pronotal carina obliterated dorsally, weakly produced anteriorly at humeral angles. Mesoscutum about as long as wide. Tegula convex, pointed posteriorly. Scutellum weakly convex, with median longitudinal depression. Metanotum nearly flat. Propodeum strongly convex; median longitudinal groove deep.

First metasomal segment not prominently elongate, about 1.2 times longer than length of mesosoma; in dorsal view rather strongly swollen posteriorly near mid-length, then only weakly widening towards posterior end, with apical width about 2.5 times its basal width (Fig. 20) and about half the maximum width of second tergum; tergum and sternum separated by well-developed carinae along ventral margins of the tergum. Second metasomal tergum with well-developed apical lamella, with preapical impression; second sternum convex (Fig. 19).

Body covered with dense silky hairs. Head strongly punctured, covered with long, erect hairs in ocular sinus, frons and vertex; hairs in occiput longer and sparser. Pronotum and mesoscutum with punctures slightly larger than those on head; scutellum and metanotum with punctures similar to those on mesoscutum; propodeum strongly punctured, with hairs much longer than those on other body parts. First metasomal tergum and sternum with punctures similar to those on head, covered with shorter hairs; second tergum covered with shorter hairs, with strong punctures similar to those on first tergum.

Head and mesosoma black, with following yellow and ferruginous markings: supraclypeal area, yellow; narrow band in dorsal half of gena along posterior margin of eye yellow; clypeus entirely yellow, except for semi-transparent apical lamella and small median spot both coloured ferruginous (Fig. 21); labrum ferruginous apically, black basally; mandible ferruginous apically, dark brown to black basally; antenna dark brown to black but eighth to tenth flagellomeres ferruginous beneath, or black but ferruginous beneath; dorsoanterior part of pronotum, irregular-shaped scrobal spot on mesopleuron, band in the outer side of axillary fossa (sometimes absent), entire part of metanotum, paired large lateral spots of propodeum, yellow; tegula yellow, with dark brown band medially; parategula black, with dark yellow to ferruginous apex. All coxae black, but mid coxae with large yellow spot on dorsal face; fore and mid tibia yellow, but extensively marked with dark brown to black;

hind tibia ferruginous; all tarsi ferruginous-yellow, darker apically. Metasoma black, with following yellow markings: medio-lateral spot and apical band of first tergum; paired large lateral spots and apical band of second tergum; apical band of second sternum.

Female. – In addition to the marking pattern given in the original description (Smith, 1858: 109), we have recognized variations among the specimens we examined as given below. The marking pattern often varied even within a given local population. The clypeus is black and has paired yellow spots basally (Fig. 23a), but the size of these yellow spots varies considerably; they are sometimes united to form a large basal spot with a ventro-median incision (Fig. 23b), or completely disappeared (Fig. 23c). The tegula is ferruginous-yellow or yellow with dark-brown median band; colour of parategula varies from yellow to ferruginous. The mid and hind coxae have or do not have a yellow spot dorsally. Paired spots on the lateral surface of the propodeum are sometimes fused to form a large spot occupying nearly entire part of the lateral side of the propodeum, but they are sometimes completely disappeared. In the specimens from Southeast Sulawesi, the apical band of the first metasomal tergum is reduced to narrow, short lateral lines.

Distribution. – Thailand, Malay Peninsula, Sumatra, Borneo, Krakatau Islands (new record), Java (new record), Bali, Sulawesi (new record), Ceram, northwestern New Guinea (Manokwari: new record).

ACKNOWLEDGEMENTS

This study was partly supported by the project of EWIN (Expedition of Widya Nusantara) DIPA, Research Center for Biology (Pusat Penelitian Biologi), LIPI, and by the grant from the Japan Society for the Promotion of Science (no. 21570088 to JK). We thank to ICBG Project (LIPI and University of California-Davis) for additional specimens from Southeast Sulawesi. We thank to James M. Carpenter for providing us with valuable unpublished information and to Wara Asfiya for discussion to improve an earlier draft of the manuscript.

LITERATURE CITED

- Buck, M., S. A. Marshall & D. K. B. Cheung, 2008. Identification Atlas of the Vespidae (Hymenoptera, Aculeata) of the northeastern Nearctic region. *Canadian Journal of Arthropod Identification*, 5: 1–492.
- Giordani Soika, A., 1935. Ricerche sistematiche sugli *Eumenes* a *Pareumenes* dell' Arcipelago Malese e della Nuova Guinea. *Annali del Museo civico di storia naturale di Genova*, 57: 1–38.
- Giordani Soika, A., 1941. Studi sui Vespidi solitari. *Bollettino della Società Veneziana Storia Naturale*, 2: 130–279.
- Giordani Soika, A., 1987. Eumenidi raccolti a Bali e Borneo da T. Hedwiust (Hymenoptera). *Bollettino del Museo Civico di Storia Naturale di Venezia*, 37: 145–150.

- Gusenleitner, J., 1988. Über Eumenidae aus Thailand, mit einer Bestimmungstabelle für orientalische Labus-Arten. *Linzer biologische Beiträge*, **20**: 173–198
- Latreille, P. A., 1802. *Histoire naturelle, générale et particulière des Crustacés et des Insectes III*. F. Dufart, Paris. xii + 467 pp.
- Maindron, M., 1882. Catalogue des *Eumenes* de l'archipel Indien et des îles des Papous. *Annales de la Société Entomologique de France*, Series 6, **2**: 267–286.
- Meade-Waldo, G., 1912. An enumeration of the Hymenoptera (Families Vespidae, Apidae, and Tenthredinidae) collected in Dutch New Guinea by the Expedition of the British Ornithologists' Union. *Annals and Magazine of Natural History*, Series 8, **9**: 446–455.
- Smith, F., 1858. Catalogue of the hymenopterous insects collected at Sarawak, Borneo; Mount Ophir, Malacca; and at Singapore, by A. R. Wallace. *Journal of the Proceedings of the Linnean Society (Zoology)*, **2**: 42–130.
- Smith, F., 1864. Catalogue of Hymenopterous Insects collected by Mr. A.R. Wallace in the Islands of Mysol, Ceram, Waigiou, Bouru and Timor. *Journal of the Proceedings of the Linnean Society—Zoology*, **7**: 6–48.
- von Schulthess, A., 1914. Vespidae aus Ceylon, Malacca, Java und Sumatra. *Zoologische Jahrbücher*, Abteilung für Systematik, Geographie und Biologie der Tiere, **37**: 253–266.
- von Schulthess, A., 1932. Aculeata. Résultats Scientifiques du Voyage aux Indes Orientales Néerlandaises de LL. AA. RR. Le Prince et la Princeses Léopold de Belgique. *Mémoires du Musée royal d'histoire naturelle de Belgique*, **4(5)**: 33–44.
- Yamane, S., 1990. A Revision of the Japanese Eumenidae (Hymenoptera, Vespoidea). *Insecta matsumurana*, **43**: 1–189.