Zootaxa 3608 (1): 001–025
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3608.1.1
http://zoobank.org/urn:lsid:zoobank.org:pub:FC91A0F2-BB61-4D4E-AD7D-9D9BFF5DC93E

Review of potter wasps with a petiolate metasoma excluding so-called "Zethinae" (Hymenoptera: Vespidae: Eumeninae) in the Lesser Sunda Islands of the Indonesian Archipelago

HARI NUGROHO[1,3], JUN-ICHI KOJIMA[2] & ROSICHON UBAIDILLAH[1]

[1]*Museum Zoologicum Bogoriense, Research Center for Biology, Indonesian Institute of Sciences, Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor, Indonesia. E-mail: hntawon@gmail.com; ubaidillah003@yahoo.com*
[2]*Natural History Laboratory, Faculty of Science, Ibaraki University, Mito, 310-8512 Japan. E-mail: jkrte@mx.ibaraki.ac.jp*
[3]*Corresponding author. E-mail: hntawon@gmail.com*

Abstract

Twenty species and six subspecies of nine genera of eumenine wasps with a petiolate metasoma occurring in the Lesser Sunda Islands are listed. New synonymies are proposed for *Delta campaniforme campaniforme* (Fabricius 1775) (=*D. campaniforme gracilior* Giordani Soika 1986, **syn. nov.**) and *D. nigriculum* Giordani Soika 1986, **stat. nov.** (=*D. campaniforme rendalloide* Giordani Soika 1993, **syn. nov.**). *Eumenes piriformis* de Saussure and *E. inconspicuus* Smith are newly recorded from the Lesser Sunda Islands; *E. pius* Giordani Soika, *D. nigriculum* Giordani Soika, *D. pyriforme* (Fabricius), *D. sciarum* (van der Vecht), *Pareumenes nigerrimus* van der Vecht, and *Labus vandervechti* Giordani Soika, are newly recorded from some islands of the Lesser Sunda. Hitherto unknown male of *P. nigerrimus* is described.

Key words: Vespidae, Eumeninae, petiolate metasoma, new status, new record, new synonymy, Lesser Sunda Islands, potter wasps

Introduction

With extremely high biodiversity characterized by a high level of endemism and a complex geological history, the Malay Archipelago, the islands between the continental Southeast Asia and Australia, has long attracted the attention of biologists from evolutionary and biogeographical points of view. The Lesser Sunda Islands are a group of small islands in the East Malay Archipelago, which consists of several island arcs formed from fragments of Australian-New Guinean origin, which broke off about 50 million years ago (Turner *et al*. 2001). The Lesser Sunda Islands consist of the northern volcanic-origin archipelago (including Bali, Lombok, Sumbawa, Flores and Wetar) and the southern non-volcanic archipelago (including Sumba, Timor and Babar). This view of the Lesser Sunda Islands is from a geological perspective, and in the present paper, as is usually the practice in faunal studies, the Lesser Sunda Islands refer to the islands east of Wallace's line or the Lombok Strait, by which the Ice Age continent of the Sundaland including current Bali was separated from a long island including present-day Lombok, Sumbawa, Komodo, Flores, Solor, Adonara and Lembata.

Up to the present, 41 taxa (31 species) in 18 potter wasp genera have been recorded from the Lesser Sunda Islands (Nugroho *et al*. 2012). Of them 17 species are endemic to the Lesser Sunda Islands and 12 species are distributed widely in Oriental region (14 subspecies are known as the Lesser Sunda's local forms). Thus, the eumenine fauna of the Lesser Sunda Islands is characterized by a high degree of endemicity. Therefore the subfamily Eumeninae should be a key group in understanding zoogeography of the Lesser Sunda Islands.

Nevertheless, the eumenine fauna in the islands is yet poorly known simply because no intensive research on it has ever been carried out. As the first part of a series of faunal and taxonomic study on potter wasps in the Lesser Sunda Islands, the present paper deals with the taxonomy of nine genera of potter wasps with a petiolate metasoma excluding *Zethus* of the so-called "Zethinae".

Accepted by A. Lelej: 21 Dec. 2012; published: 16 Jan. 2013

Material and methods

A total of 128 specimens we examined are 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 color characters was made on the pinned-and-dried specimens under a stereoscopic dissecting microscope. Apical parts of the metasomata of males of the *Delta campaniforme* species complex were dissected for the genitalia. They were put in 10% potassium hydroxide solution for several hours, washed in distilled water, and observed in glycerin under a stereoscopic dissecting microscope. Drawings were made by using the drawing tube attached to the microscope.

The parts measured for the morphometric characters referred to in the descriptions are defined as follows: body length, the lengths of head, mesosoma and the first two metasomal segments combined; the width and height of the clypeus, the distance between the apices of the lateral lobes and the distance from the level of dorsal-most points to the level of the ventral-most points, respectively; the length and width of the mesosoma, measured in dorsal view perpendicular to the mesoscutum; the length of metasomal tergum 1, the distance in lateral view from the posterior end of the basal slit for the reception of the propodeal suspensory ligament to the posterodorsal end of the tergum.

The detailed character descriptions for the species and subspecies for which such descriptions are not available (*Eumenes blandus sumbanus* Giordani Soika, *E. piriformis* de Saussure, *E. pius pius* Giordani Soika, *E. p. nigrorufus* Giordani Soika, *Delta nigriculum* Giordani Soika, and *Pareumenes nigerrimus* van der Vecht) are given under "Redescription". New locality record are asterisked (*). Distributional data are summarized under "Distribution" by country, except for Timor Island; distributional data from the island are often given without specific localities, and the data from Timor Island are summarized under "Indonesia" but may actually include localities in Timor-Leste. "Papua" refers to the Indonesian part of New Guinea, formerly known as Irian Jaya. "Borneo" refers to Borneo Island, including Indonesian Kalimantan, Sabah, Sarawak and Brunei.

Genera of potter wasps with a petiolate metasoma

Beside the following nine eumenine genera treated in the present paper, *Zethus* Fabricius has been, as potter wasps with a petiolate metasoma, recorded in the Lesser Sunda Islands. The genus *Zethus*, together with several other genera such as *Australozethus* Giordani Soika and *Calligaster* de Saussure, seems to form a clade that could be independent of other eumenine "groups" (Bohart & Stange 1965, Carpenter & Cumming 1985, Vernier 1997, Pickett & Carpenter 2010), and the genus is not treated in this paper. We tentatively divide the nine genera into the following three groups based on their morphological similarities.

1. The *Eumenes* group, including *Eumenes* Latreille, *Delta* de Saussure and *Phimenes* Giordani Soika. The three genera share the following characters: mesosoma globular, as high as long; cephalic fovea absent; epicnemial carina absent; axillary fossa oval; propodeum without dentiform projections.

2. The *Pareumenes* group, including *Pareumenes* de Saussure, *Ectopioglossa* Perkins, *Coeleumenes* van der Vecht, *Pseudozumia* de Saussure and *Pseumenes* Giordani Soika. These genera share the following characters: mesosoma depressed dorso-ventrally; axillary fossa slit-like; metanotum non-dentiform; propodeum with propodeal valvula short and rounded, and with submarginal carina not produced.

3. The *Labus* group, including only the genus *Labus* de Saussure, wasps of which are small-sized and restricted to the Oriental region.

Key to genera

1. Mesosoma globular, as wide as high. Propodeum without dentiform projections. Axillary fossa oval 2
- Mesosoma more or less flattened dorso-ventrally, distinctly longer than high. Propodeum usually with dentiform projections. Axillary fossa slit-like 4
2. Body length usually less than 15 mm. Pretegular carina absent. Metasomal tergum 1 in dorsal view pear-shaped or slightly slender (Figs 4–8); apical margin of tergum 2 distinctly lamellate (Figs 1–3, 15, 16); sternum 2 in lateral view hardly convex (Figs 1–3, 15, 16) . . . . . *Eumenes* Latreille
- Body length usually more than 20 mm. Pretegular carina present. Metasomal tergum 1 in dorsal view more or less elongate and usually slender (Figs 23, 24, 40–42, 49, 50); apical margin of tergum 2 not lamellate; sternum 2 convex (Figs 17, 18) 3

3. Metasomal segment 1 less than 1.5 × mesosomal length; in dorsal view variable in shape (Figs 23, 24, 40–42) . . . . . *Delta* de Saussure
- Metasomal segment 1 1.5 × or more mesosomal length; in dorsal view only weakly widened posteriorly (Figs 49, 50) . . . . . *Phimenes* Giordani Soika
4. Propodeal valvula elongate, or more or less rectangular; submarginal carina produced. Metanotum dentiform. Second submarginal cell of fore wing basally truncate . . . . . *Labus* de Saussure
- Propodeal valvula rounded, short; submarginal carina not produced. Metanotum non-dentiform. Second submarginal cell of fore wing basally acute 5
5. Epicnemial carina present 6
- Epicnemial carina absent. 8
6. Metasomal tergum 1 basally with transverse carina; ventral margins of tergum 1 touching each other except for posterior diverging part, thus sternum 1 visible only in posterior triangular part . . . . . *Ectopioglossa* Perkins
- Metasomal tergum 1 without transverse carina; ventral margins of tergum 1 basally close to each other, but not touching . . . 7
7. Metasomal sternum 1 smooth basally, with transverse striae in apical two thirds. Prescutal grooves on mesoscutum weak, often faint . . . . . *Coeleumenes* van der Vecht
- Metasomal sternum 1 transversally striate basally, rugose in apical two thirds. Mesoscutum with deep prescutal grooves . . . . . *Pseudozumia* de Saussure
8. Fore wing with prestigma longer than pterostigma. Female with cephalic foveae. Mesoscutum with deep prescutal grooves. . . . . *Pareumenes* de Saussure
- Fore wing with prestigma shorter than pterostigma. Female without cephalic foveae. Mesoscutum without prescutal grooves . . . . . *Pseumenes* Giordani Soika

Genus *Eumenes* Latreille 1802

Eumenes Latreille 1802: 360, as genus. Type species: "*Eumenes coarctata* Fab." [=*Vespa coarctata* Linnaeus 1758], by subsequent designation of Latreille (1810: 438).

Alpha de Saussure 1855: 128, 137, name for division I of genus *Eumenes* Latreille 1802 in de Saussure 1852 (invalid homonym of *Alpha* de Saussure 1854). Type species: *Vespa coarctata* Linnaeus 1758, by subsequent designation of Bequaert (1926: 485).

Eumenidion von Schulthess 1913: 2, as subgenus of *Eumenes* Latreille 1802. Type species: "*Eumenes coarctatus* L." [=*Vespa coarctata* Linnaeus 1758], by original designation.

Key to species

(The characters of *E. koriensis* taken from Giordani Soika 1992).

1. Metasomal segment 1 long and slender, in lateral view only slightly swollen dorsally (Figs 15, 16), or depressed dorsally . . 2
- Metasomal segment 1 shorter, in lateral view more or less distinctly swollen dorsally (Figs 1–3) 3
2. Metasomal tergum 1 in lateral view slightly swollen dorsally (Figs 15, 16); tergum 2 with punctures regularly arranged, as large as and less dense than those on tergum 1. Female clypeus occasionally with sub-rectangular yellow spot in dorsal part; pronotum with short yellow band along posterior margin (ssp. *pius*) or nearly entirely reddish orange (ssp. *nigrorufus*); metanotum entirely yellow . . . . . *E. pius* Giordani Soika
- Metasomal tergum 1 in lateral view distinctly depressed dorsally; tergum 2 with punctures slightly larger than those on tergum 1. Female clypeus with paired basal yellow spots; pronotum with narrow yellow anterior band submedially interrupted; metanotum black, with anterior yellow band medially interrupted . . . . . *E. koriensis* Giordani Soika
3. Metasomal tergum 1 in lateral view evenly convex, with dorsal margin more or less smoothly curved, or barely swollen dorsally before the mid-length (Fig. 3). Body punctures small and superficial. Body black, with bright markings less extensive; yellow band along pronotal carina interrupted submedially, thus divided into three; apical yellow band of metasomal tergum 2 narrow . . . . . *E. inconspicuus* Smith
- Metasomal tergum 1 in lateral view distinctly swollen dorsally behind the mid-length (Figs 1, 2). Body punctures larger and stronger. Body black, with bright markings more extensive; band along pronotal carina not interrupted; apical band of metasomal tergum 2 wide, incised medially 4
4. Metasomal tergum 2 in lateral view strongly gibbous (Fig. 1), with strong preapical depression. Ventral side of metasomal tergum 1 ferruginous; apical bands on metasomal segments 3–6 pale ferruginous . . . . *E. blandus sumbanus* Giordani Soika
- Metasomal tergum 2 in lateral view moderately convex dorsally (Fig. 2), with weak preapical depression. Metasomal segment 1 without ferruginous marking; apical bands on metasomal segments 3–6 yellow or pale ferruginous . . . . . *E. piriformis* de Saussure

Eumenes blandus sumbanus Giordani Soika 1992
(Figs 1, 4, 11, 12)

Eumenes blandus sumbanus Giordani Soika 1992: 65, ♀, holotype, Central Sumba: Lukojengo, [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. SUMBA I.: 1 ♂ (MZB), 09°43'S 120°02'E, alt. 500 m, Makaminggit, Nggahariango, Sumba Timur, J. Kojima & R. Ubaidillah, 30 Jan.2003; 1 ♀ (MZB), 10°01.107'S 120°03.385'E, alt. 320 m, Laiwanggi, A. Perrard, 15–19 Jun.2010.

Redescription. FEMALE. Body length 11 mm; fore wing length 9 mm. Clypeus in lateral view strongly convex anteriorly, in frontal view as long as wide (Fig. 11). Mandible with dorsalmost tooth short and blunt. Scutellum moderately convex. Propodeum in lateral view strongly convex; longitudinal median furrow superficial; posterior face barely depressed medially in dorsal half, more or less distinctly depressed medially in ventral half. Metasomal tergum 1 in lateral view convex dorsally in apical two thirds (Fig. 1). Tergum 2 strongly gibbous (Fig. 1), with strong preapical depression; sternum 2 in lateral view barely convex (Fig. 1).

Body covered with dense silvery hairs; clypeus with silky pubescence. Body black but: clypeus entirely yellow; labrum, mandible except black basal part, antenna beneath, paired posterolateral spots on pronotum, tegula, parategula, ferruginous; markings on propodeum, paired lateral spots and apical band on tergum 1, orange; area behind black base part of tergum 1, extending posteriorly to orange lateral spots, ferruginous; medially incised wide apical band on tergum 2, yellow; apical bands on metasomal segments 3–6 (sometimes absent on segment 6), pale ferruginous. Wings fusco-hyaline, with greenish or purplish iridescence.

MALE. Body length 10 mm; fore wing length 8 mm. Similar to female, but clypeus in frontal view proportionally narrower (Fig. 12) than in female; mandible with dorsalmost tooth long and sharp; antenna dark brown, basal one fifth of scape and flagellomeres 1–3 and 8–10 ferruginous beneath, terminal flagellomere pale-ferruginous; ferruginous part of metasomal tergum 1 more extensive, reaching the apical part.

Remarks. *Eumenes blandus* shows a disjunct distribution; it has been recorded in Moluccas as the nominotypical subspecies *E. b. blandus* and on Sumba Island as subspecies *E. b. sumbanus*. They can be distinguished only in the marking pattern, the former having more extensive but darker markings than the latter. Their taxonomic status, whether diagnosable species or local color forms, can be decided only after further intensive studies are carried out.

Distribution. Indonesia: Sumba.

Eumenes koriensis Giordani Soika 1992

Eumenes koriensis Giordani Soika 1992: 64, ♀, holotype "Sumba: Mata Kori, Waimangura" [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. No specimen examined.

Distribution. Indonesia: Sumba.

Eumenes piriformis de Saussure 1862
(Figs 2, 5, 13, 14)

Eumenes piriformis de Saussure 1862: 177, ♀, "Java, Sumatra", [lectotype (designated by van der Vecht 1981) "Java", Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. LOMBOK I.: 1 ♀ (MZB), Pasugulan, Mt. Rinjani, A. Suyanto, 19 Jan.1980; 1 ♀ (MZB), Gendongan, Pindana, alt. 775 m, 6 Nov.1981; 1 ♂ (MZB), Gendongan, Pindana, alt. 800 m, 6 Nov.1981; 1 ♂ (MZB), Sembalun Lawang, Lombok Timur, alt. 1125 m, 9 Nov.1981. SUMBAWA I.: 1 ♀ (MZB), 08°50'E 117°18'S, alt. 100–140 m, Melake forest, Ropang, Sumbawa Besar, J. Kojima, 9 Nov.2000.

Redescription. FEMALE. Body length 12 mm; fore wing length 9 mm. Clypeus in lateral view moderately convex, in frontal view as long as wide (Fig. 13). Mandible with dorsalmost tooth short and blunt. Pronotal carina strongly produced anteriorly at humeral angles, weakly produced medially. Scutellum and propodeum strongly convex. Metanotum nearly flat. Propodeum in lateral view evenly convex; median longitudinal furrow superficial; posterior face barely depressed medially in dorsal half, more or less distinctly depressed medially in ventral half. Metasomal tergum 1 in lateral view broadly convex dorsally in apical two thirds (Fig. 2), slenderer than that of *E. blandus sumbanus*. Metasomal tergum 2 in lateral view more or less evenly convex dorsally (Fig. 2), with weak preapical depression; sternum 2 hardly convex.

Body covered with dense silvery hairs; hairs on gena denser and longer than those in other parts of head. Head strongly punctured; clypeus with sparse minute punctures. Punctures on mesosoma slightly larger than those on head. Punctures on metasomal tergum 1 similar to but sparser than those on head; tergum 2 with sparse minute punctures. Body black, with following bright markings: labrum, tegula, parategula, ferruginous; clypeus entirely, large interantennal spot, ventral side of antennal scape, spot at posterolateral corner of pronotum, wide band along pronotal carina, paired lateral spots on dorsal part of propodeum, paired lateral spots and apical band on metasomal tergum 1, large lateral spots and wide apical band on tergum 2, yellow; apical bands on metasomal segments 3–6 (sometimes absent on segment 6) yellow to pale ferruginous. Wings fusco-hyaline; fore wing slightly darker along outer margin; pterostigma dark brown.

MALE. Body length 9–11 mm; fore wing length 7–8 mm. Clypeus in frontal view proportionally narrower (Fig. 14) than in female; mandible with dorsalmost tooth long and sharp. Clypeus entirely, band along outer margin of mandible, yellow; ventral part of antennal flagellomeres 8–10, apex of antenna, pale-ferruginous.

Distribution. Indonesia: Sumatra, Java, Sulawesi, *Lesser Sunda Islands (*Lombok, *Sumbawa).

Eumenes inconspicuus Smith 1858

(Figs 3, 6)

Eumenes inconspicua Smith 1858: 109, ♀, holotype "Sarawak- Borneo", [Oxford University Museum, Oxford].
Eumenes conformis Smith 1864: 38, ♀, holotype "Ceram [Moluccas]", [Oxford University Museum, Oxford].

Material examined. SUMBAWA I.: 1 ♂ (MZB), 08°54'53.5"S 116°44'34.8"E, alt. 34 m, Pasir Putih, Maluk, Sumbawa Barat, H. Nugroho & C. Rahmadi, 10 Apr.2010; 1 ♂ (IUNH), 08°35'S 117°17'E, alt. 800 m, Batudulang, Batulanteh, Sumbawa Besar, J. Kojima, 10 Nov.2000.

Remarks. The male specimens from Sumbawa Island have the following differences in marking pattern from specimens from other localities (see Nugroho *et al.* 2010): clypeus yellow, except for black margins and ferruginous subapical median spot; yellow band along pronotal carina submedially interrupted; anterior and posterior parts of tegula yellow; narrow apical bands on metasomal segments 3–6 ferruginous.

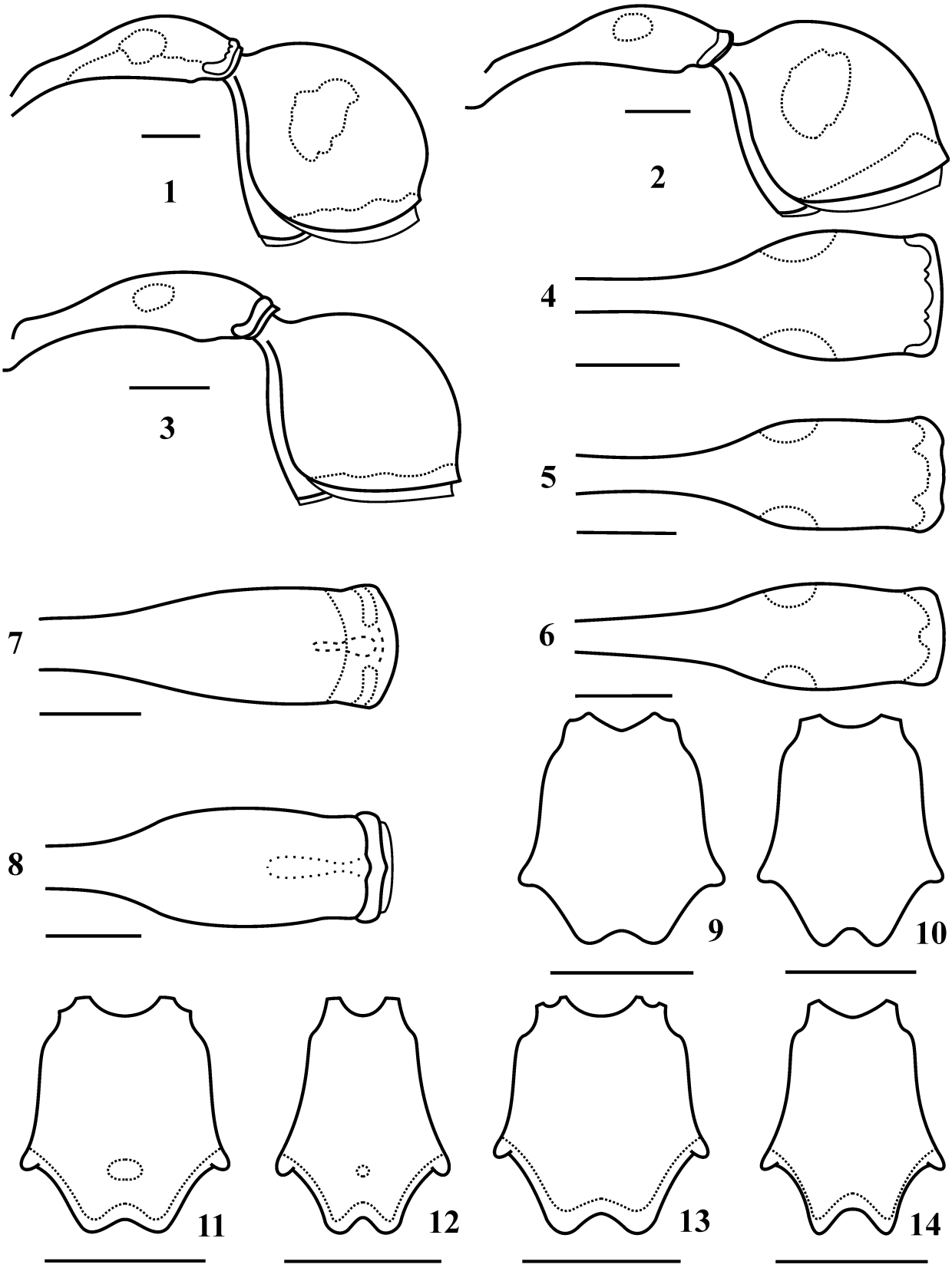
Distribution. Thailand; Malaysia: Peninsular Malaysia, Sarawak; Indonesia [Sumatra, Kalimantan, Krakatau Islands, Java, Bali, *Lesser Sunda Islands (*Sumbawa), Sulawesi, Ceram, Papua].

Eumenes pius Giordani Soika 1986

Eumenes pius Giordani Soika 1986: 81, ♀, holotype "Timor" [Museo Civico di Storia Naturale, Venice].

Giordani Soika (1986) described this species from Timor Island, and later (Giordani Soika 1992) described *E. p. nigrorufus* from Sumba Island. Our specimens from Timor and Komodo and the female from Sumba more or less agree with the original descriptions of *E. p. pius* and *E. p. nigrorufus*, respectively. Although the specimen from Sumba is different from those from Timor and Komodo in some morphological characters, we tentatively treat them as the two subspecies of *E. pius* until we reach a more robust idea on their taxonomic status based on examination of further specimens including the type material of both taxa.

Distribution. Indonesia: Sumba, *Komodo, Timor.



FIGURES 1–14. *Eumenes* species. 1, 2, 4, 5, 7–11, 13. ♀. 3, 6, 12, 14. ♂. 1, 4, 11, 12. *E. blandus sumbanus*. 2, 5, 13, 14. *E. piriformis*. 3, 6. *E. inconspicuus*. 7, 10. *E. pius nigrorufus*. 8, 9. *E. pius pius*. 1–3. Metasomal segments 1–2, lateral view. 4–8. Metasomal tergum 1, dorsal view. 9–14. Clypeus. Scale 1 mm.

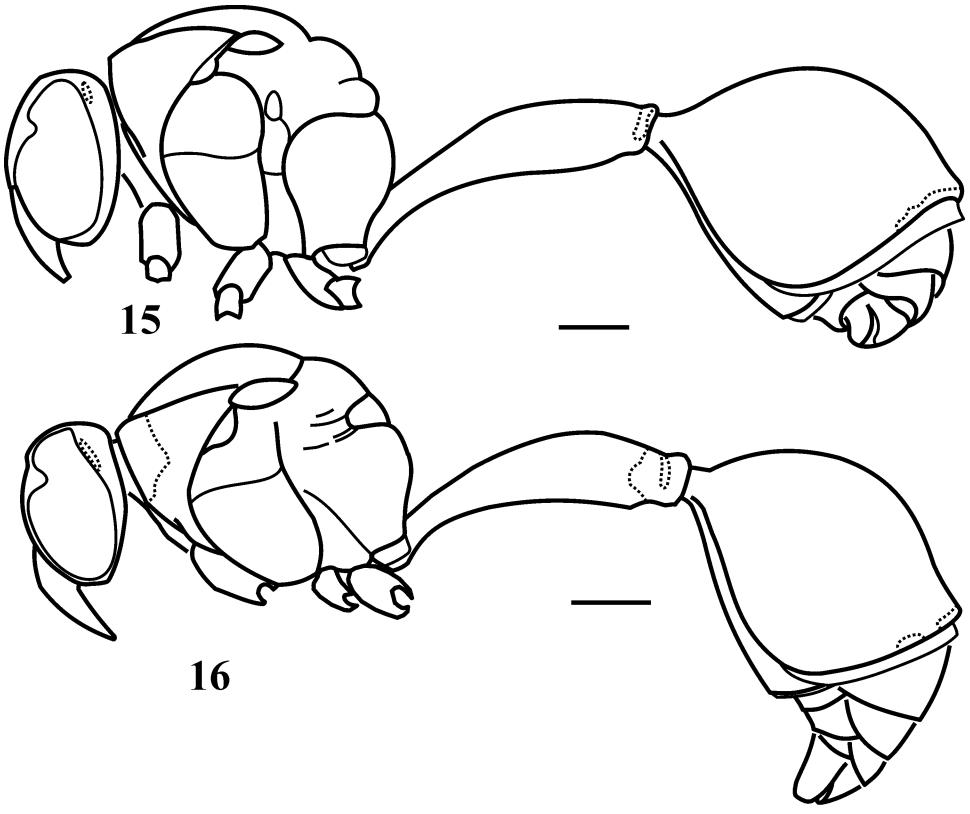
***Eumenes pius pius* Giordani Soika 1986**
(Figs 8, 9, 15)

Material examined. TIMOR I.: 2 ♀ (MZB), Camplong, Kupang, Pollen NTT, Sudarman H.K., 21 Feb.1985. KOMODO I.: 1 ♀ (MZB), Pulau Komodo, S. Kadarsan, 1 Nov.1961.

Redescription. FEMALE. Body length 13.5–14.5 mm; fore wing length 9.5–10 mm. Head in frontal view subcircular, 1.2 × wider than high. Clypeus in lateral view weakly convex, with anterior margin smoothly curved (Fig. 15); in frontal view 1.2 × as high as wide, with dorsal and ventral margins both deeply emarginate medially (Fig. 9). Labrum broadly rounded apically. Mandible with dorsalmost tooth short and blunt. Antennal scape 3.5 × as long as its maximum width; flagellomere 1 2.4 × as long as wide.

Mesosoma globular (Fig. 15), 1.1 × as long as high in lateral view, slightly longer than wide in dorsal view. Pronotal carina strongly produced anteriorly at humeral angle, slightly weaker dorsally. Mesoscutum in lateral view weakly convex, smoothly curved dorsally, in dorsal view as long as wide. Tegula convex. Scutellum convex, with median longitudinal depression. Metanotum nearly flat. Propodeum moderately convex; posterior face in lateral view smoothly curved (Fig. 15); median longitudinal groove very shallow; posterior face barely depressed medially in dorsal half, more or less distinctly depressed medially in ventral half.

Metasomal segment 1 long and slender, in lateral view slightly swollen dorsally, nearly 1.25 × as long as mesosoma length (Fig. 15); tergum in dorsal view swollen posteriorly in basal half, then nearly parallel-sided, slightly constricted subapically, with apical width 2.25 × the basal width (Fig. 8) and one fourth maximum width of tergum 2, with median longitudinal shallow depression in apical one third (Fig. 8); tergum and sternum separated by distinct furrow. Metasomal tergum 2 with well-developed apical lamella, with preapical depression nearly absent; sternum 2 in lateral view hardly convex (Fig. 15).



FIGURES 15, 16. *Eumenes pius*, ♀, body, lateral view. 15. *E. p. pius*. 16. *E. p. nigrorufus*. Scale 1 mm.

Body densely covered with long silvery hairs. Head strongly punctured, covered with long erect hairs in ocular sinus, frons and vertex; hairs in occiput sparser and shorter; clypeus covered with short dense silky hairs; gena covered with long erect hairs. Pronotum and mesoscutum with punctures similar to those on head, covered with dense hairs shorter than those on head; scutellum and metanotum with punctures similar to but sparser than those on mesoscutum; propodeum with puncture similar to preceding parts of mesosoma, with erect hairs longer than

those on other body parts. Metasomal segment 1 strongly punctured from base to apex, punctures smaller and sparser than those on mesosoma; tergum 2 densely covered with silky pubescence, punctured as in tergum 1.

Head and mesosoma black, with following bright markings: large interantennal spot, oval spot (specimens from Timor) or narrow band (Komodo) on gena, yellow; narrow band along apical margin of labrum, mandible except black basal part, ventral faces of antennal flagellomeres 9–10, median spot on pronotum, narrow band along outer margin of tegula, propodeal valvula, ferruginous; specimen from Komodo with following additional yellow markings: rectangular basal spot on clypeus, irregularly margined wide band along pronotal carina, minute spot at posterolateral corner of pronotum, dorsal spot on mesepisternum, paired small posterior spots on scutellum, entire part of metanotum. Metasoma black, with following yellow markings: narrow apical band on tergum 1, short narrow apical band on tergum 2 (in one specimen reduced to a spot). Coxae and trochanters black; femora and tibiae dark ferruginous; tarsi dark brown. Wings fusco-hyaline; fore wing slightly darker along outer margin.

Distribution. Indonesia: *Komodo, Timor.

Eumenes pius nigrorufus Giordani Soika 1992

(Figs 7, 10, 16)

Eumenes pius nigrorufus Giordani Soika 1992: 65, ♀, holotype "Sumba: Lokojengo" [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. SUMBA I.:1 ♀ (MZB), Laiwanggi, 320 m asl, 10°01.197'S 120°03.385'E, A. Perrard, 15-19 Jun.2010.

Redescription. FEMALE. Body length 13 mm; fore wing length 11 mm. Head in frontal view nearly circular, 1.1 × wider than height. Clypeus in lateral view strongly convex (Fig. 16); in frontal view proportionally slightly narrower than in *E. p. pius*, 1.25 × as high as wide; ventral margin emarginate medially (Fig. 10). Labrum rounded apically. Antennal scape 4.2 × as long as its maximum width. Mesosoma slightly longer than that of *E. p. pius*, 1.2 × as long as high in lateral view, 1.1 × as long as wide in dorsal view. Pronotal carina strongly produced anteriorly at humeral angle, weak dorsally and interrupted medially. Mesoscutum convex; scutellum hardly convex; metanotum nearly flat. Metasomal segment 1 1.1 × longer than length of mesosoma (Fig. 16); tergum in dorsal view gradually swollen apically, with apical width 2.1 × the basal width (Fig. 7).

Punctures and hairs as in *E. p. pius*, but punctures on metasomal segments 1 and 2 superficial and sparse.

Body black, with following markings: interantennal spot, orange; oval dorsal spot on gena, anterior wide band on pronotum, metanotum excluding black posterior margin, reddish-brown; tegula entirely, tip of parategula, propodeal valvula, narrow band beneath axillary fossa, ferruginous; apex of mandible, labrum, antenna, dark brown; medially-incised wide apical band on metasomal tergum 1, faint apical bands on metasomal segments 3–5, ferruginous; short narrow apical band on tergum 2, orange. Legs as in *E. p. pius*. Wings fusco-hyaline, with purplish iridescence; fore wing darker along outer margin.

Distribution. Indonesia: Sumba.

Genus *Delta* de Saussure 1855

Delta de Saussure 1855: 130, 132, 143, name for divisions II and III of genus *Eumenes* Latreille 1802 in de Saussure 1852: 44, 60; raised to the generic rank by Giordani Soika (1961). Type species: *Vespa maxillosa* De Geer 1775 [= *Vespa emarginata* Linnaeus, 1758], by subsequent designation of Bequaert 1925: 137 [erroneously as *Sphex maxillosus* De Geer, correctly in Bequaert 1926: 487].

Erinys Zirngiebl 1953: 173 (as subgenus of *Eumenes* Latreille 1802), nom. praeocc., nec *Erinys* Rye 1876 (Coleoptera: Staphylinidae). Type species: *Vespa unguiculata* Villers 1789, by monotypy.

We tentatively adopt in this paper six species of genus *Delta* which are recorded from the Lesser Sunda Islands (Carpenter, pers. comm.; Nugroho *et al*. 2012). However, the generic affilliations of *D. eremnum, D. sciarum* and *D. wieneckei*, are yet arguable. That is, van der Vecht (1959) grouped *D. sciarum* and *D. wieneckei* in the "*Eumenes curvatus*" (=*Phimenes curvatus*) group, which is characterized by the long and thin digitus of the male volsella, and *D. eremnum* is very similar to *D. sciarum*.

Key to species
(The characters of *D. wieneckei* are based on van der Vecht 1959).

1. Metasomal tergum 1 in dorsal view abruptly swollen laterally at spiracles (Figs 23, 24, 40) 2
- Metasomal tergum 1 in dorsal view gradually weakly widened posteriorly from base (Figs 41, 42) 4
2. Body length more than 21 mm. Metasomal tergum 1 in dorsal view widened posteriorly after spiracles; apical width slightly more than 3 × its basal width (Fig. 40). Body black, with reddish-brown markings . . . . . *D. pyriforme* (Fabricius)
- Body length less than 21 mm. Metasomal tergum 1 in dorsal view only weakly widened posteriorly after spiracles; apical width 2.4–2.8 × its basal width (Figs 23, 24). Body black, with yellow and/or reddish-brown markings 3
3. Body extensively marked with reddish-brown. Metasomal segment 2 slender, distinctly petiolate basally; tergum 2 in lateral view slightly convex dorsally (Fig. 17) . . . . . *D. nigriculum* Giordani Soika
- Body extensively marked with yellow. Basal petiolate part of metasomal segment 2 short; tergum 2 in lateral view more distinctly convex dorsally(Fig. 18) . . . . . *D. c. campaniforme* (Fabricius)
4. Wings fusco-hyaline. Pronotum reticulately punctured; interspaces between punctures slightly raised to form oblique striae . . . . . *D. wieneckei* (van der Vecht)
- Wings dark brown, with greenish or purplish iridescence. Pronotum densely punctured 5
5. Lateral faces of propodeum nearly unpunctured. Apical part of male volsella thick and short . . . . *D. eremnum* (van der Vecht)
- Lateral faces of propodeum with very sparse and shallow puncture, at least near the border with posterior face. Apical part of male volsella long and slender . . . . . *D. sciarum* (van der Vecht)

Delta campaniforme campaniforme (Fabricius 1775)

(Figs 18, 20, 22, 24, 26, 28, 30)

Vespa campaniformis Fabricius 1775: 371, ♀, holotype "Nova Hollandia [New Guinea]", [The Natural History Museum, London].

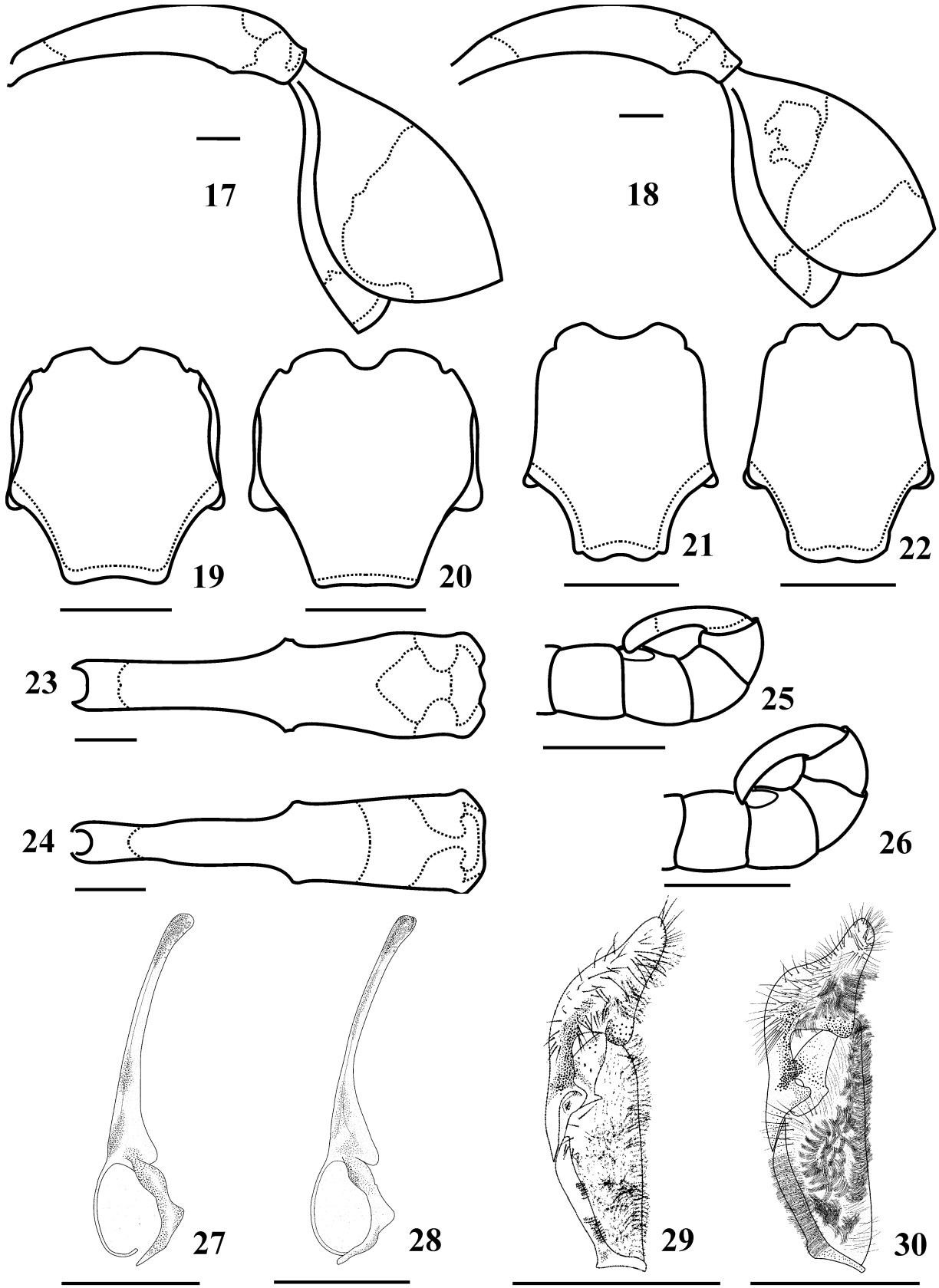
Delta campaniforme gracilior Giordani Soika 1986: 88, ♀, holotype "Luzon: Matnog, Sorsogon", [Natural History Collection at Ibaraki University, Mito]. **New synonymy.**

This species, represented by many color forms, is widely distributed throughout the Oriental and Papuan (including northern Australia) regions. Currently more than ten forms are formally recognized as subspecies, but several of them are known to occur sympatrically and thus decision of their taxonomic status, whether they are only color variants or diagnosable species, needs further intensive comparative studies.

Based on the examination of the types of *D. campaniforme gracilior* and material mainly from the Lesser Sunda Islands, we have reached the conclusions, as detailed below, that *D. c. gracilior* Giordani Soika 1986 is a synonym of *D. c. campaniforme* (Fabricius 1775); *D. c. nigriculum* Giordani Soika 1986 is a good species and *D. c. rendalloide* Giordani Soika 1993 is a synonym of *D. nigriculum*.

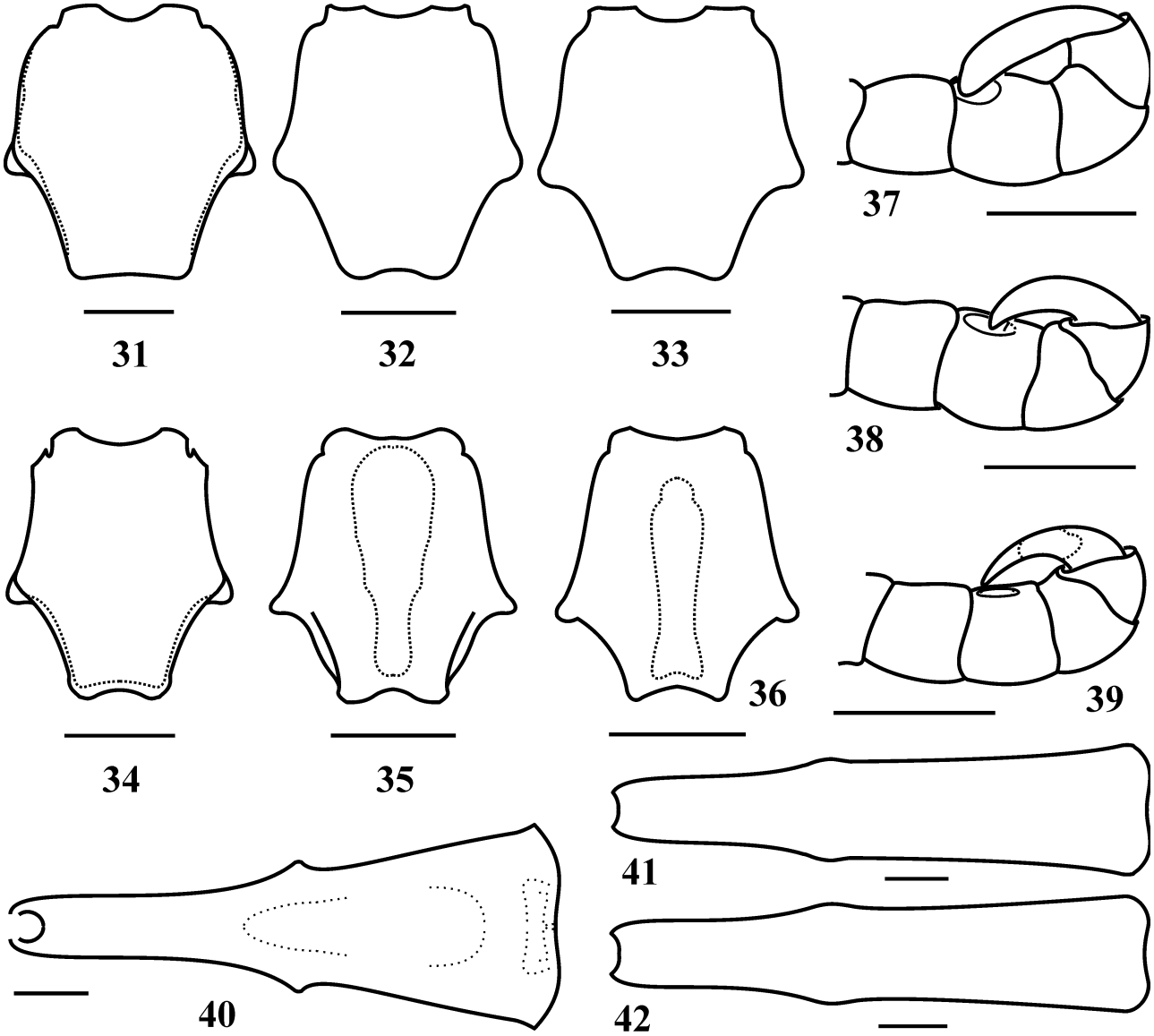
Material examined. LOMBOK I.: 1 ♂ (MZB), 08°29'S 116°40'E, Labuhan Lombor, Lombor, Pringgabaya, J. Kojima, 8 Nov.2000. SUMBAWA I.: 1 ♀ (MZB), 08°37'33.3"S 117°10'42.6"E, alt. 916 m, Tepal, Batu Lanteh, H. Nugroho & Y.R. Suhardjono, 14 Apr.2010. TIMOR I.: 1 ♀ (MZB), Camplong Barat Daya, 26 Feb.1982; 1 ♀ (MZB), Camplong, A. Hana, 23 Feb.1982; 1 ♂ (MZB), Camplong, A. Hana, 20 Feb.1982; 1 ♂ (MZB), Benlutu, Sudarman HK, 27 Mar.1982; 1 ♀ (MZB), Sillu, A. Hana, 27 Oct.1982; 1 ♂ (MZB), Sillu, A. Hana, 27 Oct.1982; 1 ♀ (MZB), 10°13'S 123°50'E, alt. 360m, Oekabiti, Amarasi, Kupang, J. Kojima, 2 Feb.2003; 1 ♀ (IUNH), 10°11'S 123°35'E, Kupang, J. Kojima, 3 Feb.2003; 3 ♂ (MZB), 09°57'S 124°09'E, Boentuka, Batuputih, Timur Tengah Selatan, J. Kojima, 1 Feb.2003. PHILIPPINES: 1 ♀ and 1 ♂ (IUNH; respectively holotype and paratype - allotype of *D. c. gracilior*), Matnog, Sorsogon, Luzon I., J. Kojima, 5 Jun.1980.

Remarks. The last three females from Timor have a black longitudinal band dividing the basal ferruginous area of metasomal tergum 2; the lack of such a black longitudinal band is the character distinguishing *gracilior* from the nominotypical subspecies (Giordani Soika 1986). Our other specimens from the Lesser Sunda Islands including those from Timor agree well with the holotype and paratype (allotype) of *D. c. gracilior*, with the following variations in marking pattern [states in the holotype and paratype of *D. c. gracilior* are given in the brackets]: mesoscutum occasionally with paired lateral yellow bands [mesoscutum entirely black]; mesepisternum sometimes nearly entirely covered by yellow markings [yellow spots covering only dorsal half]. We do not find any grounds to consider *D. c. gracilior* even as a local color form and *D. c. gracilior* Giordani Soika, 1986 is synonymized under the nominotypical species.



FIGURES 17–30. *Delta* species. 17–20, 23, 24. ♀. 21, 22, 25–30. ♂. 17, 19, 21, 23, 25, 27, 29. *D. nigriculum*. 18, 20, 22, 24, 26, 28, 30. *D. c. campaniforme*. 17, 18. Metasomal segments 1–2, lateral view. 19–22. Clypeus. 23, 24. Metasomal tergum 1, dorsal view. 25, 26. Apical part of antenna. 27, 28. Aedeagus, lateral view. 29, 30. Volsella. Scale 1mm.

Distribution. India, Nepal, Myanmar, Thailand, Malaysia (Peninsular Malaysia), Singapore, Philippines, Indonesia [Kalimantan, Sumatra, Java (including Bawean Island and Kangean Islands), Bali, Sulawesi, Moluccas, Lesser Sunda Islands: Lombok, Sumbawa, Sumba, Timor, Papua], Papua New Guinea, Australia; adventives in USA: Hawaii.



FIGURES 31–42. *Delta* species. 31–33, 40–42. ♀. 34–39. ♂. 31, 34, 37, 40. *D. pyriforme circinale*. 32, 35, 38, 41. *D. eremnum*. 33, 36, 39, 42. *D. sciarum*. 31–36. Clypeus. 37–39. Apical part of antenna. 40–42. Metasomal tergum 1, dorsal view. Scale 1 mm.

Delta nigriculum Giordani Soika 1986, stat. nov.

(Figs 17, 19, 21, 23, 25, 27, 29)

Delta campaniforme nigriculum Giordani Soika 1986: 77, ♀, holotype "Sumba: Mellolo [9°54'S 120°40'E]", [Museo Civico di Storia Naturale, Venice].

Delta campaniforme rendalloide Giordani Soika 1993: 162, ♀, holotype "Sumba: Laluku [10°09'S 120°30'E]", [Nationaal Naturhistorisch Museum - Naturalis, Leiden]. **New synonymy.**

Diagnosis. *Delta nigriculum* can be distinguished from *D. campaniforme* by metasomal segment 2 that is distinctly petiolate basally and slenderer and in lateral view less convex (Fig. 17 *vs*. Fig. 18), and by slenderer volsella of male genitalia (Fig. 29 *vs*. Fig. 30).

Material examined. LOMBOK I.: 1 ♀ (MZB), 08°29'S 116°40' E, Labuhan Lombor, Lombor, Pringgabaya, J. Kojima, 8 Nov.2000. SUMBAWA I.: 1 ♀ (MZB), 08°32'S 118°18'E, alt. 100-150 m, Banggo, Manggalawa, Dompu, J. Kojima, 13 Nov.2000; 2 ♀ (MZB), 08°30'S 118°33'E, Tolonggeru, Bolo, Bima, J. Kojima, 11 Nov.2000; 1 ♀ (MZB), 08°37'33.3"S 117°10'42.6"E, alt. 916 m, Tepal, Batu Lanteh, Sumbawa, H. Nugroho & Y.R. Suhardjono, 14 Apr.2010; 1 ♀ (MZB), 08°54'53.5"S 116°44'34.8"E, alt. 34 m, Pasir Putih, Maluk, Sumbawa Barat, H. Nugroho & C. Rahmadi, 10 Apr.2010. FLORES I.: 1 ♀ (MZB), 08°51'S 121°41'E, Nanganesa, Ndona, Ende, J. Kojima, 21 Jan.2003; 1 ♂ (MZB), 08°29'32.9"S 119°52'52.6"E, alt. 21 m, Labuan Bajo, E. Cholik, 2 Nov.2010. SUMBA I.: 2 ♀ (MZB), Laiwanggi, alt. 320 m, A. Perrard, 15–19 Jun.2010. RINCA I.: 1 ♀ (MZB), Rinca Island, alt. 18m, E. Cholik, 3–7 Nov.2010.

Redescription. FEMALE. Body length 16–20 mm; fore wing length 13–14 mm. Head in frontal view subcircular, 1.25 × as long as wide. Clypeus (Fig. 19) similar to that of *D. campaniforme* (Fig. 20), in frontal view as high as wide; dorsal margin emarginate medially (Fig. 19); ventral margin slightly emarginate or nearly straight. Labrum broadly rounded apically. Mandible with dorsalmost tooth long and sharp; second to fourth teeth blunt. Antennal scape 4.4 × as long as its maximum width; flagellomere 1 longer than wide, 1.5–1.8 × as long as its maximum wide.

Mesosoma globular, in lateral view 1.25 × as long as high. Pronotal carina weakly produced anteriorly at humeral angle, moderately produced dorsally. Mesoscutum 1.2 × longer than wide. Tegula convex, pointed posteriorly. Scutellum and metanotum moderately convex. Propodeum in lateral view weakly convex; posterior face barely depressed medially in dorsal half, more or less distinctly depressed medially in ventral half; apical lamella rounded.

First metasomal segment long and slender, 1.1 × longer than length of mesosoma; metasomal tergum 1 in dorsal view (Fig. 23) nearly parallel-sided in basal half, swollen at spiracles, then narrowed behind spiracles and again slightly widened posteriorly, with apical width 2.4 × the basal width of the segment. Metasomal segment 2 in lateral view (Fig. 17) slenderer than in *D. campaniforme* (Fig. 18); sternum 2 in lateral view with ventral margin slightly concave basally, then weakly convex apically.

Fore wing with pterostigma 1.25 × longer than prestigma.

Body covered with silvery hairs. Vertex, frons and ocular sinus strongly punctured; hairs on vertex and frons longer than those in other parts of head. Clypeus with very sparse and superficial punctures, covered with silky pubescence. Punctures on mesosoma larger and deeper than those on head, but lateral faces of propodeum with sparse and shallow punctures; pronotum, mesoscutum and mesepisternum with hairs shorter than those on head; hairs on metanotum and propodeum as long as those on the head. Metasoma with only sparse and superficial punctures as on clypeus; covered with silky pubescence.

Head and mesosoma black, with following yellow markings: band along lower part of ocular sinus reaching dorsal margin of clypeus, supraclypeal area, clypeus except narrow black band along margin of apical free part (sometimes with central reddish-brown stain), labrum (often ferruginous), narrow long band on gena along posterior margin of eye, short medio-dorsal band on pronotum (sometimes absent), band along outer margin of axillary fossa, band on metanotum, apical tip of propodeum (sometimes absent); mandibles ferruginous except its black base; antenna reddish-brown or pale-ferruginous (specimens from Sumbawa with scape dorsally having dark brown band); pronotum except black posterior margin, paired subquadrate spots on mesepisternum, scutellum except black anterior and posterior margins, metanotum except black anterior margin, paired wide lateral bands on propodeum, reddish-brown (occasionally yellow); posterior tip or posterior half of outer margin of tegula, yellow to ferruginous. Metasoma black, with following markings: metasomal segment 1 except black base, ferruginous; irregular-shaped apical spot on tergum 1, yellow; basal one third to half of metasomal tergum 2, basal two thirds of sternum 2, apical band on metasomal segments 3–6 (sometimes absent in terga 3–4), ferruginous. Coxae and trochanters dark brown to black; mid and hind coxae with longitudinal reddish-brown band; femora, tibiae and tarsi ferruginous, but fore femur and tibia with apical yellow spot. Wings fusco-hyaline, slightly darker basally.

MALE. Body length 17 mm; fore wing length 13 mm. Clypeus in frontal view proportionally narrower than in female, 1.2 × as high as wide (Fig. 21; proportionally wider than in *D. campaniforme*, Fig. 22). Apical part of flagellum hooked, with rounded apex of terminal flagellomere reaching the base of flagellomere 8 (Fig. 25; apex of terminal flagellomere more or less pointed in *D. campaniforme*, Fig. 26). Genitalia: Aedeagus (Fig. 27) slightly thicker than that of *D. campaniforme* (Fig. 28); digitus of volsella short, thick, with bluntly rounded apex, gradually narrowed apically (Fig. 29; abruptly narrowed in *D. campaniforme*, Fig. 30), covered with long hairs (Fig. 29); base of volsella with short and dense pubescences.

Color and marking pattern as in female, but: yellow markings on head more extensive; antennal scape reddish-brown dorsally, dark yellow ventrally; antennal flagellomeres 1–3 reddish-brown; flagellomeres 4–6 reddish-brown ventrally, dark brown dorsally; flagellomeres 7–10 dark brown; apex of the antenna yellow, with dark brown tip; labrum yellow; mid and hind tarsi dark brown; metasomal terga 2–7 with apical yellow band (absent in the male from Flores).

Distribution. Indonesia: *Lombok, *Sumbawa, Flores, *Rinca I., Sumba.

Remarks. Giordani Soika (1986) described *D. c. nigriculum* based on a single female (holotype) and a male from East Sumba. Later he (Giordani Soika 1993) described another subspecies, *D. c. rendalloide*, from a single female also from East Sumba, based on slight differences in color pattern from *D. c. nigriculum*. The specimens we examined include those that show color patterns intergrading between *D. c. nigriculum* and *D. c. rendalloide*, suggesting that *D. c. rendalloide* should be synonymized under *D. nigriculum*. The sympatric occurrences and differences not only in color patterns but also in morphological characters have revealed that *D. nigriculum* and *D. campaniforme* are distinct species.

Delta pyriforme (Fabricius 1775)

Vespa pyriformis Fabricius 1775: 371, "China" [type depository unknown].

Delta pyriforme is a tropical and subtropical Asian and Papuan species occurring widely from Pakistan in the west, throughout southern parts of the Continental Asia and the Malay Archipelago, to New Guinea. Currently eight color forms in this species are formally recognized as subspecies, of which seven are known from the Malay Archipelago; of the seven subspecies only *D. p. nigrocinctum* Giordani Soika and *D. p. novaeguineae* Giordani Soika are known to occur without co-occurrence of other subspecies, being endemic respectively to Sumba Island and New Guinea Island. Sympatric occurrent of two or more subspecies shows that further intensive studies based on more material and/or molecular analyses are necessary to know whether these "subspecies" are color variants in a species or diagnosable species. In the present paper, we tentatively list the specimens from the Lesser Sunda Islands under subspecific names *D. p. circinale* and *D. p. nigrocinctum*. *Delta p. pyriforme* and *D. p. butonense* (Schulz) have also been recorded in the continental Asia, *D. p. malayanum* (Giordani Soika) is also known from Sumatra, and *D. p. rufonigerrimum* Giordani Soika has been recorded from Ambon and Ceram in the Moluccas; *D. p. philippinense* (Bequaert) occurs in the Philippines and is adventive in Hawaii.

Distribution. Pakistan, India, Sri Lanka, Bhutan, Nepal, China, Myanmar, Thailand, Malaysia (Peninsular Malaysia), Philippines, Indonesia [Sumatra, Java, Krakatau, Bawean Island, Kangean Islands, Bali, Borneo, Sulawesi (including Buton Island), Lesser Sunda (*Lombok, *Sumbawa, *Komodo, *Flores, Sumba, Timor), Tanimbar Islands, Moluccas, Papua], Papua New Guinea; adventive in USA: Hawaii.

Delta pyriforme circinale (Fabricius 1804)
(Figs 31, 34, 37, 40)

Eumenes circinalis Fabricius 1804: 286, holotype "Sumatra", [Universitets København, Zoologisk Museum, København].

Material examined. LOMBOK I.: 1 ♀ (MZB), 08°33.5'S 116°25'E, alt. 540 m, Tetebatu, Sikur, Lombok Barat, J. Kojima, 5 Nov.2000; 2 ♀ (MZB), 08°41'S 116°07'E, alt. 50 m, Mesanggok, Gerung, Lombok Barat, J. Kojima, 7 Nov.2000; 2 ♂ (MZB), 08°41'S 116°07'E, alt. 50 m, Mesanggok, Gerung, Lombok Barat, J. Kojima, 7 Nov.2000. SUMBAWA I.: 2 ♀ (MZB), 08°50'S 117°18'E, alt. 100-140 m, Hutan Melake, Ropang, Sumbawa Besar, J. Kojima, 9 Nov.2000; 2 ♀ (MZB), 08°36'S 118°17'E, Nangatumpuh, Manggalewe, Dompu, J. Kojima, 13 Nov.2000; 1 ♀ (IUNH), 08°31'S 118°42'E, Panda, Rasanae, Bima, J. Kojima, 12. Dec.2000. KOMODO I.: 1 ♀ (MZB), Waeliang, Djafar, Jan.–Jul.1962. FLORES I.: 3 ♀ (MZB), West Flores, J.K. de Jong. Jun.–Jul.1937. TIMOR I.: 1 ♀ (MZB), Camplong, A. Suyanto, 23 Jul.1980; 1 ♀ (MZB), Hutan Hau Baat, A. Hana, 22 Feb.1982; 1 ♀ (MZB), Hutan Hau Baat, A. Hana, 28 Feb.1982; 1 ♀ (MZB), Oelkuku, alt. 60 m, A. Hana, 2 Mar.1982; 1 ♀ (MZB), Kampung Sabu, Sudarman H.K., 20 Feb.1985; 1 ♀ (MZB), Takari, Sudarman H.K., 19 Mar.1985; 1 ♂ (MZB), Benlutu, Sudarman

H.K., 23 Mar.1985; 1 ♀ (MZB), Timor, Pollen NTT, Sudarman H.K., 28 Mar.1985; 1♀ (IUNH), 10°06'S 123°50'E, Naibonat, Kupang Timur, Kupang, J. Kojima, 1 Feb.2003.

Remarks. Although the specimens from the Lesser Sunda Islands listed above agreed in their color and marking patterns better with *D. p. circinale* than other "subspecies" of *D. pyriforme*, they showed the following variations in marking patterns: pronotum reddish-brown entirely or only anteriorly (black posteriorly); scrobal spot together with spot below it occupying nearly entirely mesepisternum, or mesepisternum with only scrobal spot varying in size from small dorsal spot to large enough to occupy upper half of mesepisternum; paired lateral spots on propodeum, sometimes united to occupy nearly entire propodeum, but usually in dorsal spots, and sometimes absent; metasomal tergum 1 only sometimes entirely black, usually with reddish-brown paired lateral spots and apical band, sometimes fused to make apical two thirds of the tergum ventrally reddish-brown.

Distribution. India, Myanmar, Thailand, Malaysia (Peninsular Malaysia, Sarawak), Indonesia [Sumatra, Java (including Krakatau, Bawean Island, Kangean Islands), Bali, Sulawesi, Moluccas, Lesser Sunda Islands (*Lombok, *Sumbawa, *Komodo, *Flores, Timor)]; Philippines.

Delta pyriforme nigrocinctum Giordani Soika 1993

Delta pyriforme nigrocinctum Giordani Soika 1993: 161, ♀, holotype "Sumba: Melolo", [Naturhistorisches Museum, Basel].

Material examined. SUMBA I.: 1 ♂ (IUNH), 09°41'S 120°12'E, Kambajawa, Waingapu, Sumba Timur, J. Kojima & R. Ubaidillah, 30 Jan.2003.

Distribution. Indonesia: Sumba.

Delta eremnum (van der Vecht 1959)

(Figs 32, 35, 38, 41)

Eumenes eremnus van der Vecht 1959: 51, ♀, holotype "Labuan Badjo, Flores", [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. SUMBA I.: 1 ♀ (MZB, paratype of *E. eremnum*), alt. 100 m, Laora, N.W Soemba (=Sumba), Dammerman, Apr.1925; 1 ♀ (MZB, paratype of *E. eremnum*), Mau Marru, E. Sumba, Bühler & Sutter, 22 Jul.1949; 1 ♀ (MZB, paratype of *E. eremnum*), Mao Marroe (=Mau Marru), 450 m, Dammerman, May 1925; 1 ♀ (MZB), 10°01.197'S 120°03.385'E, alt. 320 m, Laiwanggi, A. Perrard, 15–19 Jun.2010; 1 ♀ (MZB), Laiwanggi, alt. 567 m, A. Perrard, 16 Jun.2010; 1 ♂ (MZB), 10°01.061'S 120°04.163'E, alt. 567 m, Laiwanggi, A. Perrard, 16 Jun.2010. FLORES I.: 1 ♀ (MZB, paratype of *E. eremnum*), Labuan Badjo, JK de Jong, Jun.1937.

Remarks. This species is very similar to *D. sciarum* and they may have sometimes been confused with each other. Next characters distinguish *D. eremnum* from *D. sciarum* [states for *D. sciarum* are given in the brackets]: lateral faces of propodeum barely punctured [propodeum entirely with superficial punctures]; posterior face of propodeum with paired narrow longitudinal pale-yellow bands [without such yellow bands]; apical part of volsella of male genitalia short and thick (see van der Vecht 1959: fig. 3f) [long and slender (van der Vecht 1959: fig. 2c)]. Further the following characters may help distinguishing *D. eremnum* from *D. sciarum*: female clypeus in frontal view (Fig. 32) slightly higher than wide, 1.1 × as high as wide [proportionally wider, as wide as high (Fig. 33)]; male clypeus 1.1 × as high as wide (Fig. 35) [proportionally slightly wider (Fig. 36)]; apex of male antenna without spot [with ferruginous spot]; metasomal tergum 1 in dorsal view (Fig. 41) gradually and weakly widened posteriorly, with apical width 1.9 × the basal width [only slightly widened posteriorly, with apical width 1.7 × the basal width (Fig. 42)].

Distribution. Indonesia: Sumba, Flores.

Delta sciarum (van der Vecht 1959)

(Figs. 33, 36, 39, 42)

Eumenes sciarus van der Vecht 1959: 20, ♀, holotype "Labuan Badjo, Flores", [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. LOMBOK I.: 1 ♀ (MZB), Sekotong Tengah, Lombok Barat, 19 Mar.1991. SUMBAWA I.: 2 ♂ (MZB), 08°54'53.5"S 116°44'34.8"E, alt. 34 m, Pasir Putih, Maluk, Sumbawa Barat, H. Nugroho & C. Rahmadi, 10 Apr.2010. KOMODO I.: 1 ♂ (MZB, paratype of *D. sciarum*), JK de Jong, Jul.1937; 1 ♂ (MZB, paratype of *D. sciarum*), A. Hoogerwerf, Jun.1953; 1 ♀ (MZB), Waeliang, Djafar, 4 Aug.1962. FLORES I.: 1 ♂ (MZB, paratype of *D. sciarum*), Mboera, JK de Jong, Jun.1937. 1 ♀ (MZB, paratype of *D. sciarum*), Laboean Badjo (= Labuan Bajo), JK de Jong, Jun.1937. SUMBA I.: 1 ♀ (MZB, paratype of *D. sciarum*), Mau Marru, O. [= East] Sumba, Bühler & Sutter, 22 Jul.1949; 1 ♀ (MZB, paratype of *D. sciarum*), Waimangura, W. Sumba, Bühler & Sutter, 22 Aug.1949; 1 ♀ (MZB), Eldorado, O. Efendy, 19 Apr.2010.

Remarks. This species is very similar to and co-occurs with *D. eremnum*, but it can be distinguished from the latter by the characters mentioned in the key and the remarks for *D. eremnum*.

Distribution. Indonesia: *****Lombok, Sumbawa, Komodo, Flores, Sumba.

Delta wieneckei (van der Vecht 1959)

Eumenes wieneckei van der Vecht 1959: 22, ♀, holotype "Timor" [Nationaal Naturhistorisch Museum-Naturalis, Leiden].

Material examined. No specimen examined.

Distribution. Indonesia: Timor.

Genus *Phimenes* Giordani Soika 1992

Phimenes Giordani Soika 1992: 41, 66, genus, replacement name for *Phi* de Saussure, 1855, *non* de Saussure, 1854.

Phi de Saussure 1855: 132, name for division IV of genus *Eumenes* Latreille 1820 in de Saussure 1852: 63, 145, nom. praeocc., nec *Phi* de Saussure, 1854). Type species: *Vespa arcuata* Fabricius 1775, by subsequent designation of Bequaert 1926: 487.

Phimenes was proposed by Giordani Soika (1992) as a replacement name for *Phi* de Saussure 1855, *non* de Saussure 1854. Carpenter (1986) pointed out this homonymy and synonymized *Phi* de Saussure 1855 under *Delta* de Saussure 1855, but this nomenclatural act had been overlooked by subsequent authors (Giordani Soika 1987; Giordani Soika & Kojima 1988; Gusenleitner 1988) until van der Vecht and Carpenter (1990) reconfirmed the homonymy and Giordani Soika (1992) proposed the replacement name.

Phimenes flavopictus (Blanchard 1840)

Represented by 16 subspecies, this polytypic species occur throughout the south-eastern part of continental Asia and western half of the Malay Archipelago, from South India in the west to Borneo and Palawan, and the Lesser Sunda Islands, Damma Island and Kei Islands in the east, and also in Taiwan and southern islands in the Ryukyu Islands (van der Vecht 1959). Van der Vecht (1959) gave detailed descriptions of color pattern of all the subspecies. In the Lesser Sunda Islands, *P. f. blanchardi* and *P. f. timorensis* have been recorded.

Distribution. India (including Nicobar and Andaman Is.), Sri Lanka, Nepal, China, Taiwan, Japan (Ryûkyû Is.), Myanmar, Vietnam, Thailand, Malaysia (Peninsular Malaysia, Sarawak), Philippines, Indonesia [Sumatra (including Simalur I., Nias I., Enggano I., Mentawai Is., Batu Is.), Krakatau, Kalimantan, Java (including Panaitan I., Bawean I., Karimunjawa and Kangean Islands), Bali, Lesser Sunda (Lombok, Sumbawa, Sumba, Komodo, Flores, Timor, Wetar I.), Tanimbar (Yamdena I.), Moluccas (Kei Is., Damma I.)].

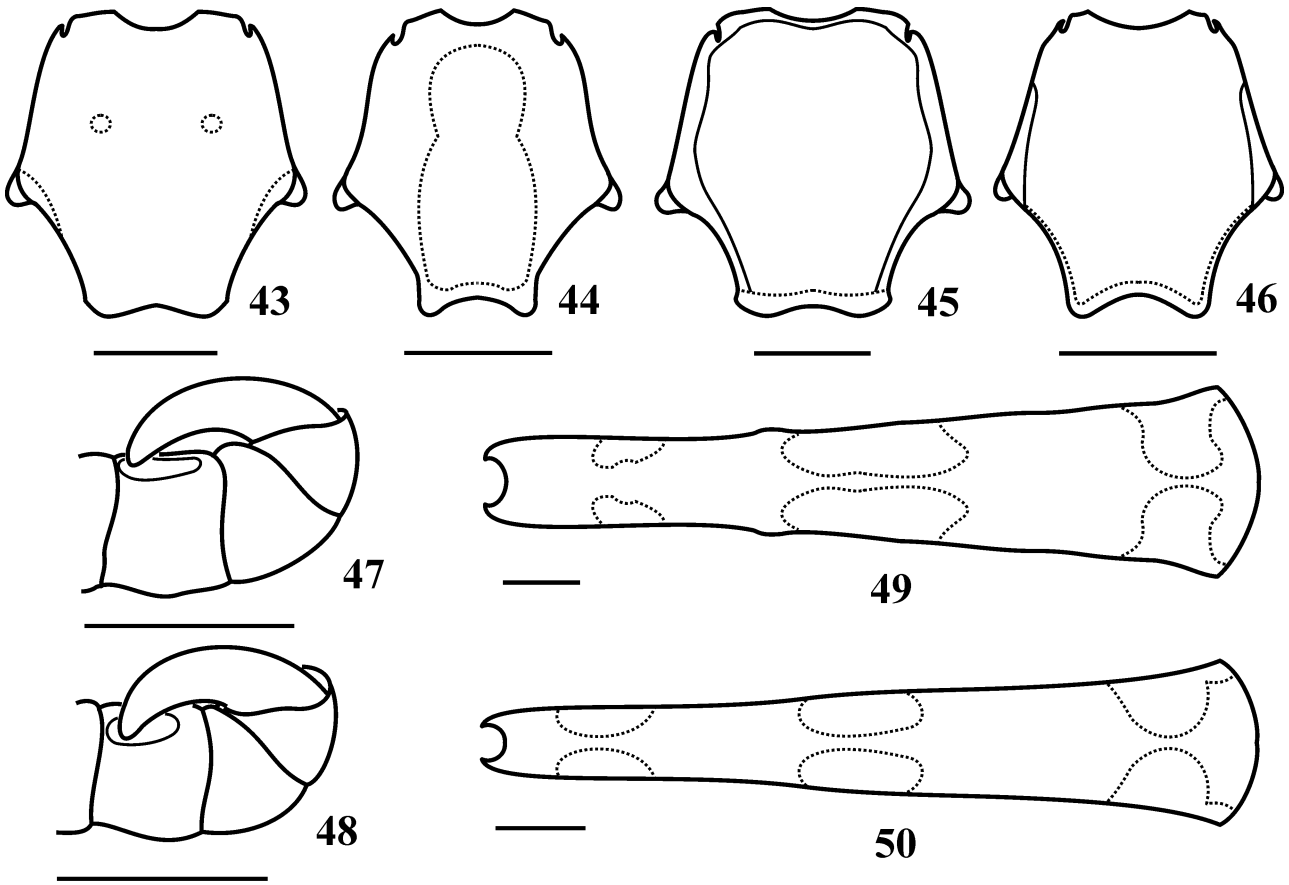
***Phimenes flavopictus blanchardi* (de Saussure 1852)**
(Figs 43, 44, 47, 49)

Eumenes blanchardi de Saussure 1852: 66, ♀, holotype "les Indes-Orientales, Pondichéry" [mislabelled specimen], [Museum National d'Histoire Naturelle, Paris].
Phi flavopictum blanchardi: Giordani Soika 1991: 166.

Material examined. LOMBOK I.: 1 ♀ (MZB), 08°02'S 116°15'E, Sesaot, Narmada, Lombok Barat, J. Kojima, 7 Nov.2000; 1 ♀ (MZB), 08°33'S 116°25'E, alt. 540 m, Tetebatu, Sikur, Lombok Barat, J. Kojima, 5 Nov.2000; 1 ♀ (MZB), 08°21'41.7"S 116°31'18.7"E, alt. 1166 m, Sembalun Lawang, Sembalun, Lombok Timur, H. Nugroho & Y.R. Suhardjono, 1 Apr.2010; 1 ♀ (MZB), 08°33'03.9"S 116°25'14.7"E, alt. 587 m, Tetebatu, Sikur, Lombok Timur, H. Nugroho, 3 Apr. 2010. SUMBAWA I.: 1 ♀ (MZB), 08°35'S 119°00'E, Bugis, Sape, Bima, J. Kojima, 14 Nov.2000; 1 ♀ (MZB), 08°37'33.3"S 117°10'42.6"E, alt. 916 m, Tepal, Batu Lanteh, Sumbawa, H. Nugroho & Y.R. Suhardjono, 14 Apr.2010. SUMBA I.: 1 ♀ (MZB), 09°45'S 120°35'E, forest edge, Wanga, Sumba Timur, J. Kojima, 29 Jan.2003; 1 ♀ (MZB), Rua, West Sumba, Bühler & Sutter, 29 Aug.1949; 1 ♀ (MZB), Pogobina, West Sumba, Bühler & Sutter, 13 Sep.1949; 1 ♂ (MZB), Laluku, East Sumba, Bühler & Sutter, 7 Jul.1949; 1 ♂ (MZB), Laiwanggi, alt. 320 m, A. Perrard, 15–19 Jun. 2010; 1 ♀ (MZB), Laiwanggi, alt. 349 m, A. Perrard, 17 Jun. 2010.

Remarks. The specimens listed above have propodeum nearly unpunctured on the lateral faces but superficially punctured on posterior face. The specimens of *P. f. timorensis* from Timor have propodeum entirely unpunctured. In the male specimens from Sumba, the interantennal spot is smaller and sometimes absent.

Distribution. Indonesia: Java (including Panaitan I., Karimunjawa and Kangean Islands), Bali, Lesser Sunda Islands (Lombok, Sumbawa, Sumba, Komodo, Flores).



FIGURES 43–50. *Phimenes flavopictus*. 43, 45, 49, 50. ♀. 44, 46–48. ♂. 43, 44, 47, 49. *P. f. blanchardi*. 45, 46, 48, 50. *P. f. timorensis*. 43–46. Clypeus. 47, 48. Apical part of antenna. 49, 50. Metasomal tergum 1, dorsal view. Scale 1mm.

Phimenes flavopictus timorensis (van der Vecht 1959)

(Figs 45, 46, 48, 50)

Eumenes flavopictus timorensis van der Vecht 1959: 49, ♀, holotype "Timor", [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. TIMOR I.: 1 ♀ (MZB), Camplong, Kupang, Anita, 26 Feb.1982; 1 ♀ (MZB), Takai, Sudarman HK, 6 Mar.1985; 1 ♀ (MZB), Takai, Sudarman HK, 25 Feb.1985; 1 ♀ (MZB), Kampung Sabu, Sudarman HK, 27 Mar.1985; 1 ♀ (MZB), Tokari, Sudarman HK, 6 Mar.1985; 4 ♀ (MZB), Pollen NTT, Sudarman HK, 21 Feb.1985; 1 ♂ (MZB), Tari, Sudarman HK, 4 Mar.1985; 1 ♂ (MZB), Benlutu, Sudarman HK, 23 Mar.1985; 2 ♂ (MZB), Pollen NTT, Sudarman HK, 21 Feb.1985.

Distribution. Indonesia: Timor, Wetar.

Genus *Pareumenes* de Saussure 1855

Pareumenes de Saussure 1855: 133, division of genus *Eumenes* Latreille 1802. Type species: *Eumenes quadrispinosus* de Saussure 1855, by subsequent designation of Bequaert (1918: 271).

Pareumenes currently includes 17 species which are distributed in Afrotropical, Palearctic and Oriental regions. Three species are known from the Malay Archipelago and *P. nigerrimus* is known from the Lesser Sunda Islands (Nugroho *et al*. 2012).

Pareumenes nigerrimus van der Vecht 1963

(Figs 51–55)

Pareumenes nigerrimus van der Vecht 1963: 24, ♀, Holotype "West Flores, Reo", [Naturhistorisches Museum, Basel].

The collection in the MZB provided us with specimens of this species from Sumbawa and Timor Island, allowing us to describe the male for the first time as well as to give detailed female characters.

Material examined. SUMBAWA I.: 2 ♂ (MZB), 08°54'53.5"S 116°44'34.8"E, Alt. 34 m, Pasir Putih, Maluk, Sumbawa Barat, H. Nugroho & C. Rahmadi, 10 Apr.2010. TIMOR I.: 1 ♀ (MZB), Benlutu, Sudarman HK, 23 Mar.1985; 1 ♀ (MZB), Takari, Sudarman HK, 14 Mar.1985; 1 ♀ (MZB), Tukai, Sudarman HK, 13 Mar.1985; 1 ♀ (MZB), Palem, Sudarman HK, 21 Feb.1985; 1 ♂ (MZB), Benlutu, Sudarman HK, 23 Mar.1985; 1 ♂ (MZB), Lapangan, Sudarman HK, 11 Mar.1985.

Redescription. FEMALE. Body length 15–17 mm; fore wing length 13–15 mm. Head in frontal view nearly circular, as high as wide; cephalic foveae close to each other. Clypeus in lateral view strongly convex anteriorly; in frontal view as high as wide (Fig. 51); paired longitudinal carina extends from apical tip to two third basally; ventral margin emarginate medially. Labrum truncated apically. Mandible short and stout; dorsalmost tooth short and blunt.

Mesosoma distinctly depressed dorsoventrally, in lateral view 1.8 × as long as high (Fig. 54), in dorsal view 1.5 × as long as wide. Pronotal carina strongly produced anteriorly at humeral angle, obliterated dorsally. Tegula pointed posteriorly. Scutellum and metanotum nearly flat. Axillary fossa slit-like. Propodeum in lateral view barely convex anteriorly, flattened posteriorly (Fig. 54); in dorsal view bidentate posteriorly (Fig. 55).

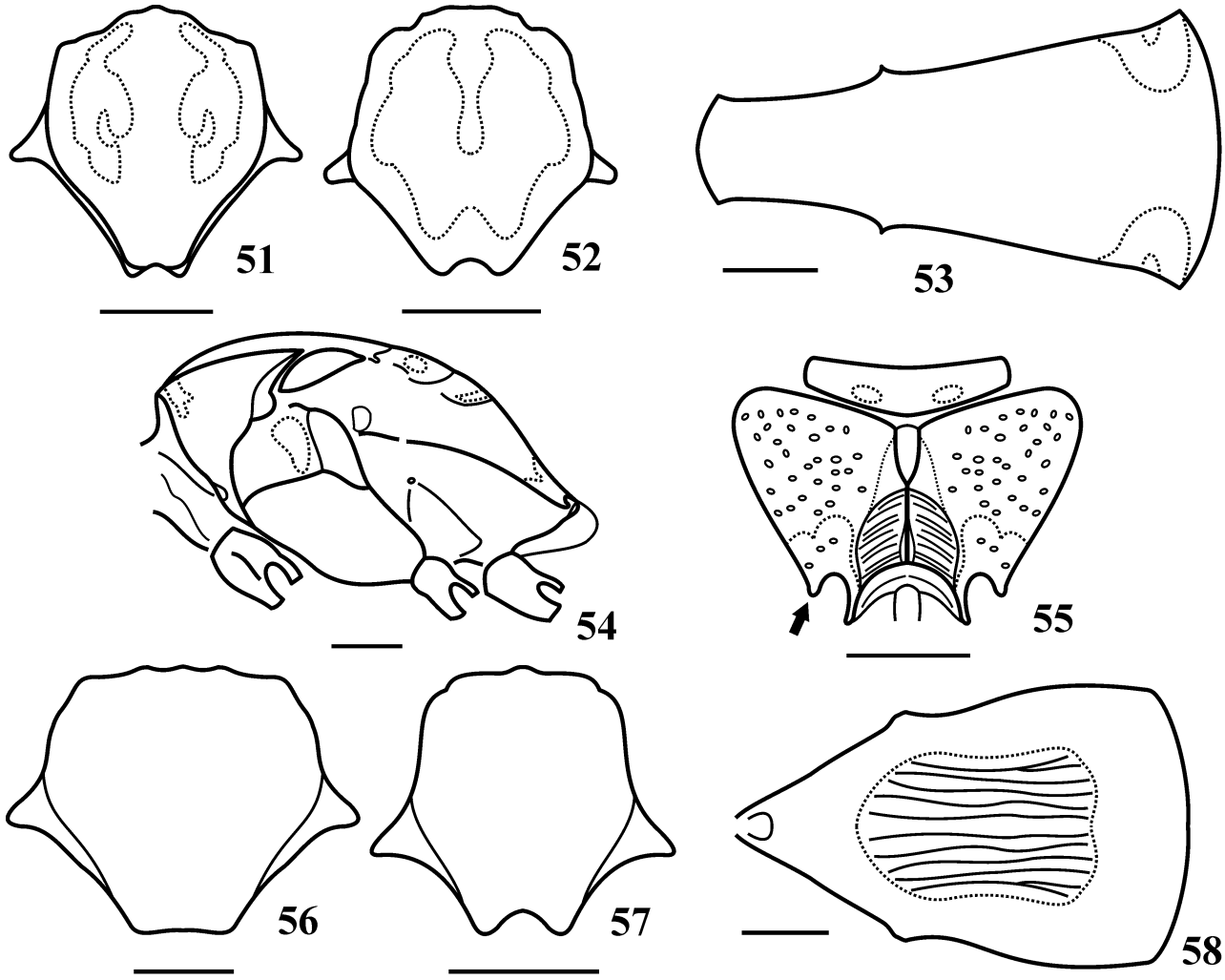
Metasomal tergum 1 slightly shorter than mesosoma; in lateral view gradually thickened from base to apex; in dorsal view with apical width 2.5 × its basal width (Fig. 53); apical longitudinal furrow short and shallow. Metasomal tergum 2 in lateral view convex dorsally, with dorsal margin smoothly curved; sternum 2 in lateral view concave basally, flattened apically. Fore wing with prestigma 1.2 × longer than pterostigma.

Body covered with dense short ferruginous hairs. Frons strongly punctured; vertex with sparse shallow punctures. Pronotum and mesepisternum strongly punctured; mesoscutum, scutellum and metanotum glossy, with small sparse shallow punctures; posterior face of propodeum strongly punctured, with hairs slightly longer than those on other parts of mesosoma, lateral face with regular oblique striae. Metasoma covered with silky

pubescence; tergum 1 glossy, with puncture as those on mesoscutum and scutellum; sternum 1 transversely striated in apical two thirds; tergum 2 glossy, with punctures more intense than those on pronotum and mesepisternum.

Body black but labrum dark brown; following parts and markings yellow: interantennal spot, band on frons running down to interantennal spot, band along lower part of ocular sinus, paired irregular-shaped basal spots on clypeus, narrow genal band along posterior margin of eye, dorsally interrupted band along pronotal carina, outer margin of tegula (sometimes reduced into anterior and posterior spots), parategula, anterior spot on mesepisternum, paired spots on scutellum, band along posterior margin of metanotum, paired spots on posterior face of propodeum, paired apical spots (each with central small ferruginous spot) on metasomal tergum 1, basal spot and paired apical spots on sternum 1, small posterolateral spots on tergum 2 (sometimes absent), minute spots on sternum 2, paired submedian apical spots on tergum 3 (sometimes united to form complete band). Antenna black; ventral side of scape yellow; flagellum ferruginous beneath. Wings fusco-hyaline, with purplish iridescence.

MALE (hitherto unknown). Body length 12–16 mm; fore wing length 11–13 mm. Head as high as wide; cephalic fovea absent. Clypeus similar to that of female, but apical part proportionally wider, in frontal view as high as wide; dorsal margin weakly convex, ventral margin emarginate medially (Fig. 52). Mandible similar to that of female, short and stout; dorsalmost tooth short and blunt. Antennal scape long, 4.5 × as long as its maximum width; flagellomere 10 significantly smaller than preceding segments; apex of the antenna obtuse. Mesoscutum with two pairs of longitudinal notauli; inner pair short and deep, outer pair long and very shallow. First metasomal segment slightly shorter than mesosoma.



FIGURES 51–58. *Pareumenes nigerrimus* and *Pseudozumia indica*. 51, 53–56, 58. ♀. 52, 57. ♂. 51–55. *P. nigerrimus*, from Timor. 56–58. *P. indica*, from Java. 51, 52, 56, 57. Clypeus. 53, 58. Metasomal tergum 1, dorsal view. 54. Mesosoma, lateral view. 55. Propodeum, dorsal view. The arrow indicates the dentiform projection of the propodeum. Scale 1 mm.

Pronotum with sparse and superficial punctures; posterior part barely punctured. Mesoscutum glossy; basal two thirds nearly unpunctured, apical third with sparse and superficial punctures. Striae on lateral faces of propodeum stronger than in female. Color and marking pattern of the male specimens from Timor similar to that of female, but differing as follows: yellow band in ocular sinus more extensive, extending downward to antennal socket; clypeus nearly entirely yellow; genal band sometimes absent; antennal scape ventrally yellow; antennal flagellomeres 1–7 dark brown; flagellomeres 7–10 ventrally and terminal flagellomere ferruginous. The male specimens from Sumbawa darker as follows: frons without longitudinal spot; spots on tegula smaller; mesepisternum, scutellum and propodeum without markings; band on metanotum reduced to small spot; spots on metasomal segment 1 smaller or absent; metasomal segment 2 entirely black; wings darker, with purplish iridescence.

Distribution. Indonesia: *Sumbawa, Sumba, Flores, *Timor.

Genus *Pseudozumia* de Saussure 1875

Pseudozumia de Saussure 1875: 128, as division of genus *Montezumia* de Saussure 1852. Type species: *Montezumia indica* de Saussure 1855, by monotypy.
Pseudozumia: Bequaert 1921: 241, 248 (as subgenus of *Montezumia* de Saussure).
Pseudozumia: Giordani Soika 1941: 162.

Pseudozumia indica indica (de Saussure 1855)

(Figs 56–58)

Montezumia indica de Saussure 1855: 167 (in division *Parazumia*), ♀, holotype "Java" [Museo Regionale di Scienze Naturali, Torino].

Material examined. Any specimen from the Lesser Sunda Islands was not available to us; drawings (Figs 56–58) were made based on specimens from Java.

Distribution. India, Sri Lanka, China, Taiwan, Peninsular Malaysia, Vietnam, Indonesia: Java, Bali, Lesser Sunda Islands (Lombok).

Remarks. Five subspecies of *P. indica* occur in the southern part of continental Asia, Borneo, Sumatra, Java, Bali, and Lombok. The nominotypical subspecies *P. i. indica* is widely distributed while other subspecies occur in a restricted area.

Genus *Coeleumenes* van der Vecht 1963

Coeleumenes van der Vecht 1963: 45. Type species: *Montezumia impavida* Bingham 1897, by original designation.

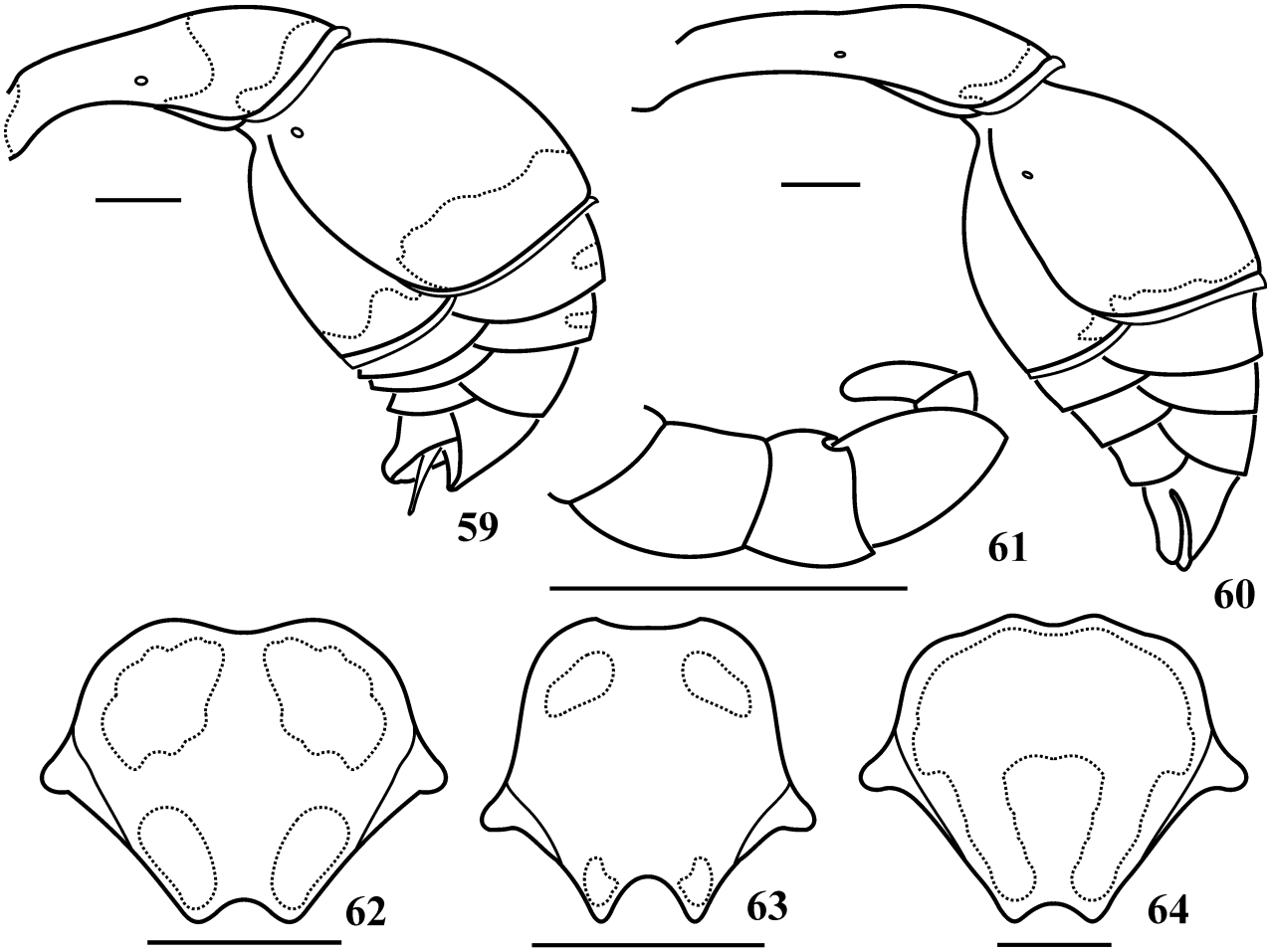
Coeleumenes includes ten species and is known from India, through continental Southeast Asia, to the Moluccas and the Lesser Sunda Islands (two species).

Coeleumenes multicolor (Giordani Soika 1935)

(Figs 59, 61–63)

Pareumenes (*Pareumenes*) *multicolor* Giordani Soika 1935: 138, ♀, holotype "Tambora: Sumbawa" [Museo Civico di Storia Naturale 'Giacomo Doria', Genova].

Material examined. SUMBAWA I.: 1 ♀ (MZB), 08°34'53.7"S 117°34'53.7"E, alt. 452 m, Semongkat, Batu Lanteh, Sumbawa, H. Nugroho, 11 Apr.2010. SUMBA I.: 1 ♂ (MZB), Lokojengo, Central Sumba, Buhler & Sutter, 26 Sep.1949; 2 ♀ (MZB), 10°01'19.7"S 120°03'38.5"E, Laiwanggi, A. Perrard, 15–19 Jun.2010.



FIGURES 59–64. *Coeleumenes* species. 59–60, 62, 64. ♀. 61, 63. ♂. 59, 61–63. *C. multicolor*. 60, 64. *C. timorensis*. 59, 60. Metasoma, lateral view. 61. Apical part of antenna. 62–64. Clypeus. Scale 1 mm.

Remarks. The specimens from Sumbawa and Sumba agree with the original description (Giordani Soika 1935) and that of van der Vecht (1963). Additional characters are: lateral sides of propodeum weakly or faintly striated; metasomal segment 1 in lateral view less than 3 × as long as high (Fig. 59); cephalic fovea present; fore wing with prestigma shorter than pterostigma; ventral margin clypeus moderately emarginate medially in female (Fig. 62), deeply emarginate in male (Fig. 63); flagellomeres 10, 11 of male antenna much smaller than preceding ones (Fig. 61).

Distribution. Indonesia: Sumbawa, Sumba.

Coeleumenes timorensis van der Vecht 1963

(Figs 60, 64)

Coeleumenes timorensis van der Vecht 1963: 52, ♀, holotype "Timor", [Nationaal Naturhistorisch Museum - Naturalis, Leiden].

Material examined. TIMOR I.: 1 ♀ (MZB), 10°13'S 123°50'E, alt. 360 m, Oekabiti, Amarasi, Kupang, J. Kojima, 2 Feb.2003; 1 ♀ (MZB), 09°57'S 124°09'E, Boentuka, Batuputih, Timur Tengah Selatan, J. Kojima, 1 Feb.2003; 1 ♀ (IUNH), 10°15'S 122°50'E, Timor, J. Kojima, 2 Feb.2003.

Remarks. This species can be easily distinguished from *C. multicolor* by mesosoma more strongly flattened; by lateral face of propodeum not striated, nearly unpunctured; by metasomal segment 1 in lateral view more than 4 × as long as high (Fig. 60).

Distribution. Indonesia: Timor.

Genus *Ectopioglossa* Perkins 1912

Ectopioglossa Perkins 1912: 118. Type species: *Ectopioglossa australensis* Perkins 1912 [=*Eumenes australensis* Meade-Waldo 1910 = *Ectopioglossa polita australensis* (Meade-Waldo)], by monotypy.

Ectopioglossa currently includes 13 species which are known in the Oriental and Australian regions, from Sri Lanka to the Malay Archipelago and northern Australia, and four species known from the Afrotropical region (Carpenter, pers. comm.; Carpenter *et al.* 2010). Only *E. sumbana* is recorded from the Lesser Sunda Islands.

Ectopioglossa sumbana van der Vecht 1963

Ectopioglossa sumbana van der Vecht 1963: 36, ♀, holotype "Sumba: West Sumba, Kodi", [Naturhistorisches Museum, Basel].

Material examined. No specimen examined.

Distribution. Indonesia: Sumba.

Genus *Pseumenes* Giordani Soika 1935

Pseumenes Giordani Soika 1935: 145 (as subgenus of *Pareumenes* de Saussure 1855). Type species: *Eumenes eximius* Smith 1861, by original designation.
Pseumenes: van der Vech 1963: 16.

Pseumenes includes five species which are widely distributed in southern parts of continental Asia and the Malay Archipelago. In the Lesser Sunda Islands, only *P. depressus insignis* is known.

Pseumenes depressus insignis van der Vecht 1963

Pseumenes depressus insignis van der Vecht 1963: 27, ♀, holotype "Sumba: Central Sumba, Lindiwatju", [Naturhistorisches Museum, Basel].

Material examined. No specimen examined.

Distribution. Indonesia: Sumba.

Genus *Labus* de Saussure 1867

Labus de Saussure 1867: 3. Type species: *Labus spiniger* de Saussure 1867, by subsequent designation (Bingham 1897: 348).

Oriental genus *Labus* includes 13 species (two in the Lesser Sunda Islands).

Labus rufomaculatus van der Vecht 1963

Labus rufomaculatus van der Vecht 1963: 8, ♀, holotype "Pogobina" [on Sumba], [Naturhistorisches Museum, Basel].

Material examined. No specimen examined.

Distribution. Indonesia: Sumba.

Remarks. Van der Vecht (1963) considered that this species closely related to *L. amoenus* van der Vecht 1935 known from Java, Bangka and South Sumatra. This species can be distinguished from *L. amoenus* by the combination of characters given in Table 1.

TABLE 1. Comparisons of distinguishing characters among *Labus amoenus* van der Vecht, *L. spiniger* de Saussure, *L. vandervechti* Giordani Soika, and *L. rufomaculatus* van der Vecht.

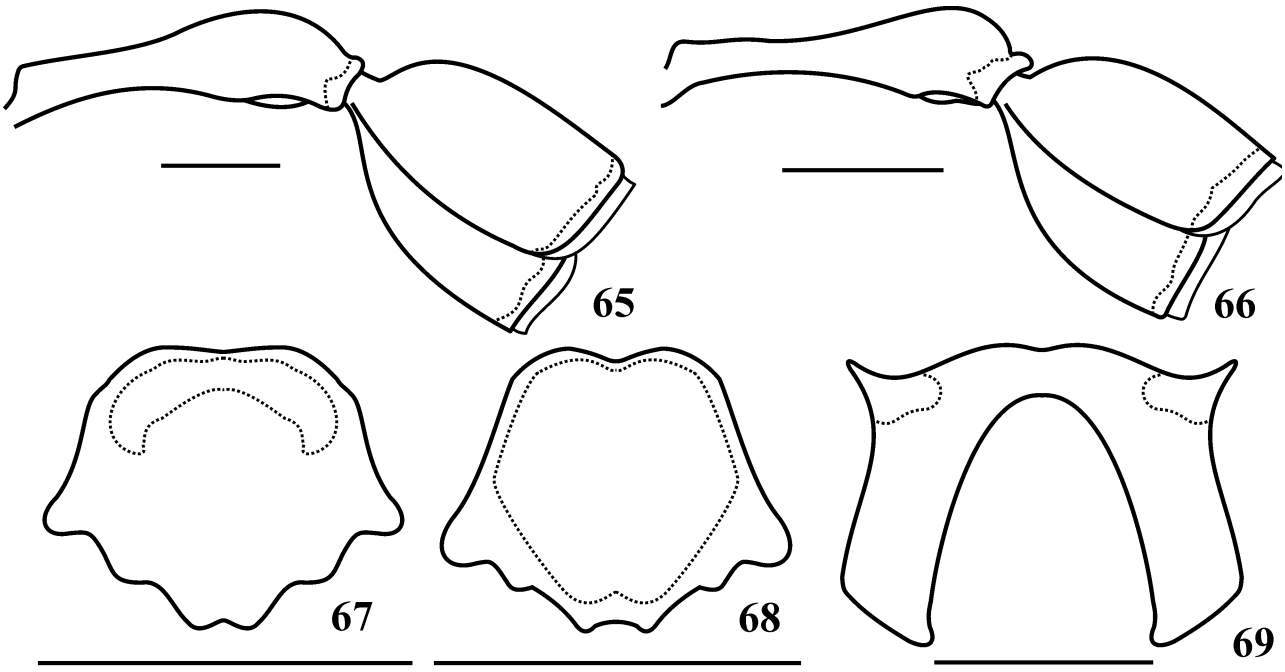
	L. amoenus	*L. spiniger*	*L. vandervechti*	*L. rufomaculatus**
Head	As high as wide.	As high as wide.	As high as wide.	Higher than wide.
Frontal fovea	Shallow; longer than wide; not distinctly defined.	Deep, deeper than *L. vandervechti*; circular.	Deep; circular; not well defined.	Deeper; circular; well defined.
Median disk of scutellum	Posteriorly with prominent and sharp lateral angles.	Without prominent angles.	Without prominent angles.	Without prominent angles.
Propodeal basal tooth	Short and blunt.	Short and blunt.	Long and sharp.	Short and blunt.
Metasomal segment 1	Long and slender; swollen dorsally at apical one third.	Swollen dorsally at apical half.	Swollen dorsally at apical half.	Long and slender; swollen dorsally at apical one third.

* For *L. rufomaculatus*, characters are based on van der Vecht (1963).

Labus vandervechti Giordani Soika 1960

(Figs 65, 67–69)

Labus vandervechti Giordani Soika 1960: 83, ♀, holotype "W. Sumbawa" [type locality and sex of holotype, not indicated], [Zoologisches Museum der Humboldt Universität, Berlin].



FIGURES 65–69. *Labus* species. 65–67, 69. ♀. 68. ♂. 65, 67–69. *L. vandervechti*. 66. *L. amoenus*. 65, 66. Metasomal segments 1–2, lateral view. 67, 68. Clypeus. 69. Pronotum, dorsal view. Scale 1 mm.

Material examined. LOMBOK I.: 1 ♂ (IUNH), 08°44'S 116°05'E, alt. 50 m, Lewdang Andus, Sekotong, Lombok Barat, J. Kojima, 6 Nov.2000; 1 ♀ (MZB), 08°33'03.9"S 116°25'14.7"E, alt. 587 m, Tetebatu, Sikur, Lombok Timur, H. Nugroho, 3 Apr.2010; 3 ♂ (MZB), 08°33'03.9"S 116°25'14.7"E, alt. 587 m, Tetebatu, Sikur, Lombok Timur, H. Nugroho, 3 Apr.2010. SUMBAWA I.: 1 ♀ (IUNH), 08°35'S 117°17'E, alt. 800 m, Batudulang, Batulanteh, Sumbawa Besar, J. Kojima, 10 Nov.2000. FLORES I.: 1 ♂ (IUNH), 08°48'S 121°34'E, Baramari, Ende Selatan, J. Kojima, 25 Jan.2003.

Remarks. Giordani Soika (1960) and van der Vecht (1963) respectively compared *L. vandervechti* with *L. amoenus* and *L. spiniger* de Saussure 1867 distributed in Java. The differences between these species and *L. rufomaculatus* are given in Table 1.

FEMALE. Head in frontal view nearly circular; frontal foveae circular, deep but not well defined (deep and distinctly defined in *L. spiniger*); pronotal spines long, sharp (Fig. 69); metasomal segment 1 relatively stout, in lateral view evenly convex dorsally in posterior half (Fig. 65) (relatively long and slender, in lateral view clavate, swollen dorsally near posterior end in *L. amoenus* (Fig. 66) and *L. rufomaculatus*).

MALE. Clypeus (Fig. 68) more narrowed dorsally, dorsal margin more emarginate medially than in female (Fig. 67).

The female specimen from Lombok slightly differs from Sumbawa and Flores ones by lacking yellow spot on mesepisternum; by black median part of tegula; by lacking apical yellow spot on fore femur.

Distribution. Indonesia: *****Lombok, Sumbawa, Flores.

Acknowledgments

This study was carried out as a part of the HN's RONPAKU (dissertation PhD) program of the Japan Society for the Promotion of Science (LIPI-11114). We thank to Alexander Riedel for the opportunity to collect additional specimens during the research project in Lombok and Sumbawa Islands made in 2010. We thank to James M. Carpenter, Arkady S. Lelej and an anonymous reviewer for valuable comments on the manuscript.

References

Bequaert, J.C. (1918) A revision of the Vespidae of the Belgian Congo based on the collection of the American Museum Congo Expedition, with a list of Ethiopian diplopterus wasps. *Bulletin of the American Museum of Natural History*, 39, 1–384.

Bequaert, J.C. (1921) Description d'une espèce Congolaise du genre "*Montezumia*" (Hyménoptères, Vespides) suivie de remarques taxonomiques sur ce groupe. *Revue Zoologique Africaine*, 9, 235–251.

Bequaert, J.C. (1925) *Eumenes dyscherus* H. de Saussure, a neotropical, not an African wasp, and other notes on synonymy (Hymenoptera). *Bulletin of the Brooklyn Entomological Society*, 20, 134–140.

Bequaert, J.C. (1926) The genus *Eumenes* Latreille, in South Africa, with a revision of the Ethiopian species (Hymenoptera). *Annals of the South African Museum*, 23, 483–577.

Bingham, C.T. (1897) *The Fauna of British India, including Ceylon and Burma: Hymenoptera Vol. 1, Wasps and Bees*. Taylor and Francis, London, 579 pp.

Blanchard, E. (1840) Classe des Insectes. *In:* Orbigny, C., *Dictionnaire universel d'Histoire naturelle. Atlas, Tome II, Zoologie*. Abel, Pilon et Cie, Éditeurs, Paris, pp. 9–22.

Bohart, R.M. & Stange, L.A. (1965) A revision of the genus *Zethus* Fabricius in the Western Hemisphere (Hymenoptera: Eumenidae). *University of California Publications in Entomology*, 40, 1–208.

Carpenter, J.M. (1986) A synonymic generic checklist of the Eumeninae (Hymenoptera: Vespidae). *Psyche*, 93, 61–90.

Carpenter, J.M. & Cumming, J.M. (1985) A character analysis of the North American potter wasps (Hymenoptera: Vespidae; Eumeninae). *Journal of Natural History*, 19, 877–916. http://dx.doi.org/10.1080/00222938500770551

Carpenter, J.M., Gusenleitner, J. & Madl, M. (2010) A Catalogue of the Eumeninae (Hymenoptera: Vespidae) of the Ethiopian region excluding Malagasy subregion. Part II: Genera *Delta* de Saussure 1885 to *Zethus* Fabricius 1804 and species incertae sedis. *Linzer biologische Beiträge*, 42, 95–315.

De Geer, C. (1775) *Memoires pour servir a l'histoire des Insectes, 3*. Pierre Hesselberg, Stockholm, viii + 696, 44 pls.

Fabricius, J.C. (1775) *Systema Entomologiae, Sistens Insectorum Classes, Ordines, Genera, Species, Adiectis Synonymis, Locis, Descriptionibus, Observationibus*. Flensbvrgi et Lipsiae, 832 pp. http://dx.doi.org/10.5962/bhl.title.36510

Fabricius, J.C. (1804) *Systema Piezatorum, secundum: Ordines, Genera, Species adiectis Synonymis, locis, observationibus, descriptionibus*. Carolum Reichard, Brunsvigae, 439 pp.

Giordani Soika, A. (1935) Richerche sistematiche sugli *Eumenes* a *Pareumenes* dell' Arcipelago Malese e della Nuova Guinea. *Annali del Museo civico di storia naturale di Genova*, 57, 114–151, pl. 2.

Giordani Soika, A. (1941) Studi sui Vespidi solitari. *Bollettino della Società Veneziana di Storia Naturale e del Museo Civico di Storia Naturale*, 2(3), 130–279.

Giordani Soika, A. (1960) ["1958"] Notulae Vespidologicae. *Bollettino del Museo Civico di Storia Naturale di Venezia*, 11, 35–102.

Giordani Soika, A. (1961) Les lignées philétiques des *Eumenes s. l.* du globe. *Verhandlungen des XI. Internationalen Kongresses für Entomologie, Wien, 17. bis 25. August 1960*, 240–245.

Giordani Soika, A. (1986) Notulae Vespidologicae-XLVI: Nuovi Eumenidi Indomalesi. *Lavori Società veneziana di Scienze naturali*, 11, 77–83.
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.
Giordani Soika, A. (1991) Eumenidi Raccolti in Indonesia da G. Osella EJ. Klapperich. *Bollettino del Museo Civico di Storia Naturale di Verona*, 15, 163–166.
Giordani Soika, A. (1992) Di alcuni Eumenidi nuovi o poco noti (Hymenoptera Vespoidea). *Lavori Società veneziana di Scienze naturali*, 17, 41–68.
Giordani Soika, A. (1993) Di alcuni nuovi Eumenidi della regione Orientale (Hym. Vespoidea). *Bollettino del Museo Civico di Storia Naturale di Venezia*. 42, 151–163.
Giordani Soika, A. & Kojima, J. (1988) Eumeninae wasps collected in Papua Guinea by J. Kojima (Hymenoptera Vespidae). *Bollettino del Museo Civico di Storia Naturale di Venezia*, 38, 175–182.
Gusenleitner, J. (1988) Über Eumenidae aus Thailand, mit einer Bestimmungstabelle für Orientalische *Labus*-Arten (Hymenoptera, Vespoidea). *Linzer biologische Beiträge*, 20, 173–198.
Latreille, P.A. (1802) *Histoire naturelle, générale et particulière des Crustacés et des Insectes. Ouvrage faisant suite à l'Histoire Naturelle générale et particulière, composée par Leclerc de Buffon, et rédigée par C. S. Sonnini, Membre de plusieurs Sociétés savantes. Tome III.* F. Dufart, Paris, i–xii + 13–467 pp.
Latreille, P.A. (1810) *Considérations Générales sur l'Ordre Naturel des Animaux composant les Classes des Crustacés, des Arachnides et des Insectes; avec un Tableau Méthodique de leurs Genres, disposés en Familles*. F. Schoell, Paris. [2] + 444 pp.
Linnaeus, C. (1758) *Systema Naturae per Regna Tria Naturae, secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis. Tomus I. Editio Decima Reformata.* Laurentii Salvii, Holmiae [=Stockholm]. [4] + 1–823 + [5].
Meade-Waldo, G. (1910). New species of Diploptera in the collection of the British Museum. *The Annals and Magazine of Natural History (8)*, 5, 30–51. http://dx.doi.org/10.1080/00222931008692723
Nugroho, H, Ubaidillah, R. & Kojima, J. (2010) 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. *Raffles Bulletin of Zoology* 58, 179–187.
Nugroho, H, Kojima, J. & Carpenter, J.M. (2012) ["2011"] Checklist of vespid species (Insecta: Hymenoptera: Vespidae) occurring in Indonesian Archipelago. *Treubia*, 38, 71–186.
Perkins, R.C.L. (1912) Notes, with descriptions of new species, on aculeate Hymenoptera of the Australian region. *Annals and Magazine of Natural History* (*8*), 9, 96–121. http://dx.doi.org/10.1080/00222931208693112
Pickett, K.M. & Carpenter, J.M. (2010) Simultaneous analysis and the origin of eusociality in the Vespidae (Insecta: Hymenoptera). *Arthropod Systematics & Phylogeny*, 68, 3–33.
Rye, E.C. (1876) Insecta. The general subject. *In:* Rye, E.C. (ed.), *The Zoological Record for 1874*. John van Vorst, Paternoster Row, London, pp. 239–247.
Saussure, H.de (1852) *Études sur la Famille des Vespides 1. Monographie des Guêpes solitaires ou de la tribu des Euméniens.* V. Masson, Paris and J. Kessmann, Genéve, p. 1–128, pls. 2–5, 7, 10, 14.
Saussure, H.de (1854) *Études sur la Famille des Vespides 2. Monographie des Guêpes sociales ou de la tribu des Vespiens.* V. Masson, Paris and J. Kessmann, Genéve, pp. 97–256, pls. 9–12, 14–34.
Saussure, H.de (1855) *Études sur la Famille des Vespides 2. La Monographie des Masariens et un supplément à la Monographie des Euméniens.* V. Masson, Paris and J. Kessmann, Genéve, p. 49–288, pls. 3–14.
Saussure, H.de (1862) Sur divers Vespides Asiatiques et Africains du Musee de Leyden. *Entomologische Zeitung*, 23, 177-207.
Saussure, H.de (1867) *Reise der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodòre B. von Wüllerstorf-Urbair. Zoologischer Theil. 2 Hymenoptera nebest einem Supplement von Dr. J. Sichel.* Der Kaiserlich-Königlichen Hof- und Staatsdruckerei in Commission bei Karl Gerold's Sohn. 156 pp, 4 plates. (p. 139–156, by Sichel).
Saussure, H.de (1875) Synopsis of American wasps. *Smithsonian Miscellaneous Collection*, 254, 1–392.
Schulthess, A. von (1913) Vespiden aus dem Stockholmer Museum. *Arkiv för Zoologi* 8 (17), 1–23.
Smith, F. (1857–1858) 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 of London, Zoology*, 2, 42–88, pl. 1–2 (1857), 89–130 (1858).
Smith, F. (1861) ["1860"] Catalogue of hymenopterous insects collected by Mr. A.R. Wallace in the Islands of Bachian, Kaisaa, Amboyna, Gilolo, and at Dory in New Guinea. *Journal of the Proceedings of the Linnean Society of London, Zoology*, 5 (as suppl. to vol. 4), 93–143, pl. 1.
Smith, F. (1864) ["1863"] 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 of London, Zoology* 7, 6–48.
Turner, H., Hovenkamp, P. & Welzen, P.C. van (2001) Biogeography of Southeast Asia and the West Pacific. *Journal of Biogeography*, 28, 217–230. http://dx.doi.org/10.1046/j.1365-2699.2001.00526.x
Vecht, J. van der (1935) Notes on Oriental *Labus*, with descriptions of three new species from Java. *Treubia*, 15, 157–167.
Vecht, J. van der (1959) On *Eumenes arcuatus* (Fabricius) and some allied Indo-Australian wasps. *Zoologische*

Verhandelingen, 41, 1–71.
Vecht, J. van der (1963) Studies on Indo-Australian and East-Asiatic Eumenidae (Hymenoptera, Vespoidea). *Zoologische Verhandelingen*, 60, 3–113.
Vecht, J. van der (1981) Studies of Indo-Australian solitary wasps (Hymenoptera, Vespoidea, Eumenidae). *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen. Series C*, 84, 443–464.
Vecht, J. van der. & Carpenter, J.M. (1990) A catalogue of the genera of the Vespidae (Hymenoptera). *Zoologische Verhandelingen*, 260, 3–62.
Vernier, R. (1997) Essai d'analyse cladistique des genres d'Eumeninae (Vespidae, Hymenoptera) représentés en Europe septentrionale, occidentale et centrale. *Bulletin de la Société Neuchâteloise des Sciences Naturelles*, 120, 87–98.
Villers, C. de (1789) *Caroli Linnaei Entomologia, Faunae Suecicae Descriptionibus Aucta : DD. Scopoli, Geoffroy, de Geer, Fabricii, Schrank, &c., Speciebus vel in Systemate non Enumeratis, vel Nuperrime detectis, vel Speciebus Galliae Australis locupletata, Generum Specierumque rariorum iconibus ornata, 3*. Lugduni, Sumptibus Piestre et Delamolliere, 657 pp., pl. VII–X.
Zirngiebl, L. (1953) Zur Wespen-fauna der Pfalzel. *Mitteilungen der Pollichia* (*3*), 1, 160–179.