Taxonomy of the *Ropalidia flavopicta*-complex (Hymenoptera: Vespidae: Polistinae)

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Key words: Hymenoptera; Vespidae; Polistinae; *Ropalidia flavopicta*; Southeast Asia.
The taxonomy of the "species" treated as subspecies of *Ropalidia flavopicta* (= *R. flavopicta*-complex) by van der Vecht (1962) were reexamined. Four forms in the complex other than the species in the Philippine Islands are concluded to be valid species: *R. flavopicta* (Smith), *R. javanica* van der Vecht, *R. ochracea* van der Vecht, and *R. ornaticeps* (Cameron). The two subspecies of the Philippine species, *R. flavobrunnea* van der Vecht, namely *lapiniga* Kojima and *iracunda* Kojima, are sunk into the nominate species. A new species is described based on a female listed under "*R. flavopicta flavobrunnea* " by van der Vecht (1962).

Introduction

Van der Vecht (1941, 1962) reviewed the Oriental species of *Ropalidia* Guérin-Méneville, 1831 and recognized nine species in the subgenus "*Icarielia* Dalla Torre, 1904" (van der Vecht, 1962: 41-42). The subgenus, according to him, is defined by the lack of a raised carina on the mesepisternum (= epicnemial carina) morphologically and by enveloped nests behaviourally. The species recognized in "*Icarielia*" by van der Vecht are: *R. aristocratica* (de Saussure, 1853), *R. decorata* (Smith, 1858), *R. flavopicta* (Smith, 1857), *R. scitula* (Bingham, 1897), *R. timida* van der Vecht, 1962, *R. malaisei* van der Vecht, 1962, *R. montana* Carl 1934, *R. lepida* van der Vecht, 1962 and *R. opifex* van der Vecht, 1962. He regarded *copiaria* (de Saussure, 1862) as a subspecies of *R. aristocratica*, while Richards (1978: 58) regarded both as valid species in the subgenus "*Icariola* Dalla Torre, 1904" [but note that earlier he (1978: 55) also treated *copiaria* as a subspecies of *R. aristocratica*].

On the other hand, the subgenera or divisions of the genus *Ropalidia* in the sense of either Bequaert (1918), van der Vecht (1962) or Richards (1978) are not defined well enough to serve as formal taxa (Kojima, 1997). Based on our phylogenetic analysis of *Ropalidia* (Kojima & Carpenter, unpublished), it seems to be better to arrange *Ropalidia* species into monophyletic species-groups, if subdivisions are necessary, rather than to establish a very large number of monophyletic subgenera. In the phylogenetic sense, the species in the subgenus "*Icarielia*" sensu van der Vecht (1962) form a natural species-group; however, this is not the case for "*Icarielia*" sensu Richards (1978). The species-group sensu van der Vecht is called "*R. flavopicta*-group" in this paper.

In this paper I use "*R. flavopicta*-complex" for the eight subspecies of *R. flavopicta* as recognized by van der Vecht (1962) (four from Indo-Malayan areas other than the Philippines, and four in the Philippines). I elsewhere studied the Philippine forms of this complex (Kojima, 1982) and concluded that all of the four forms described as

subspecies of *R. flavopicta* by van der Vecht (1962) (*flavobrunnea* van der Vecht, 1962, *nigrescens* van der Vecht, 1962, *extrema* van der Vecht, 1962, and *bipartita* van der Vecht, 1962) are valid species based on morphological differences, sympatric occurrences and differences in nest architecture. On the other hand, the remaining four subspecies (nominotypical subspecies, *javanica* van der Vecht, 1962, *ochracea* van der Vecht, 1962 and *ornaticeps* (Cameron, 1900)) have been left unexamined taxonomically after van der Vecht (1962), despite sympatric occurrences and differences in nest architecture have been suggesting that some of them are valid species.

According to van der Vecht (1962), distributions of "*R. f. flavopicta*" and "*R. f. ornaticeps*" overlap in the Malaya Peninsula. The nests of "*R. f. flavopicta*" are large and have multiple combs, all of which face in the same direction, and the envelope is expanded when the nest grows (Kojima & Jeanne, 1986). The nest of "*R. f. javanica*" is also multi-layered and the envelope is expanded with the nest development, but alternate combs face opposite directions (van der Vecht, 1940, 1962). Wasps of "*R. f. ornaticeps*" nest in a cut bamboo and close the open end of the bamboo with envelope-like construction (Yoshikawa, 1964; Iwata, 1969), or make a rather small nest on underside of a tree leaf and do not seem to expand the nest envelope from the initial one (Yoshikawa et al., 1969).

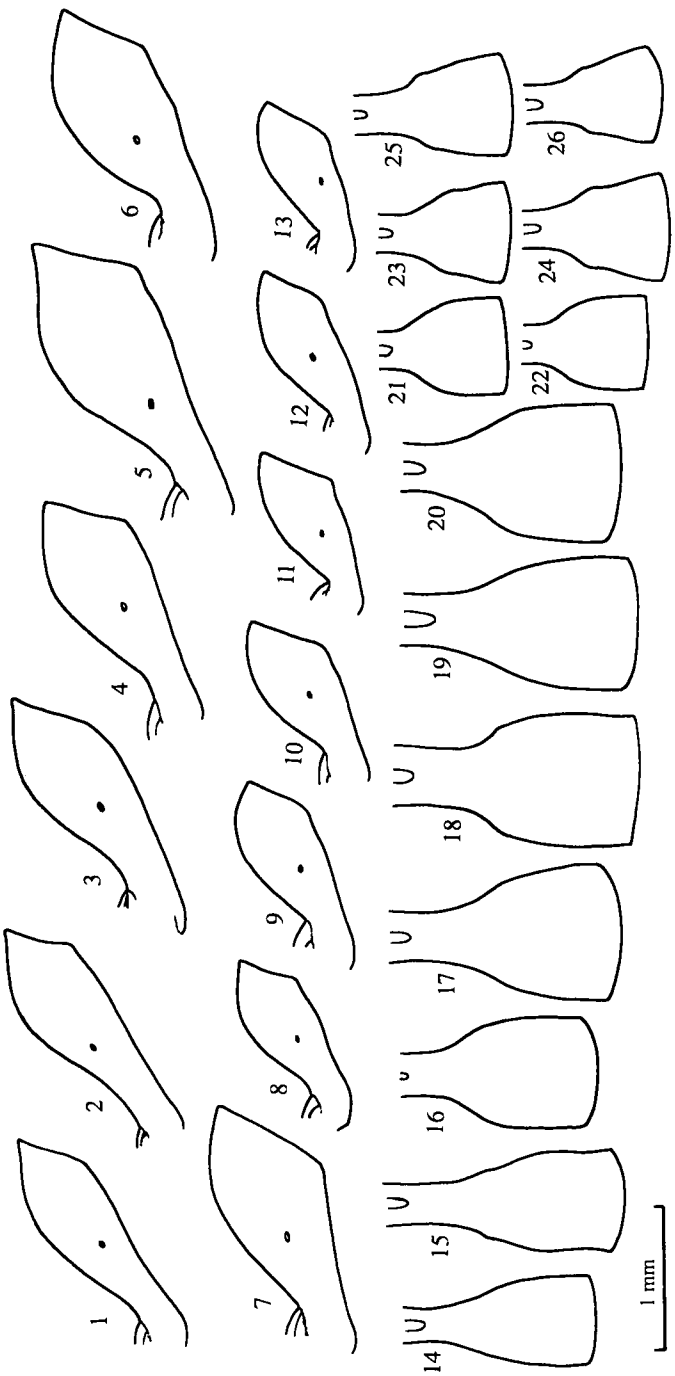
I examined the specimens, including the types, of the four "subspecies" of van der Vecht (1962) and reached the conclusion that all of them are valid species at least in the sense of the phylogenetic species concept (Nixon & Wheeler, 1990). In addition, I reexamined some of the specimens van der Vecht's (1962) descriptions of Philippine forms of "*R. flavopicta*" were based on. A few specimens were revealed to belong to species different from the "subspecies" he placed them in, and a new species is described based on a female which van der Vecht (1962) listed under "*R. flavopicta flavobrunnea* van der Vecht".

Institutions where specimens are housed are abbreviated as follows (listed in alphabetical order): AMNH, American Museum of Natural History, New York; BISH, Bernice P. Bishop Museum, Honolulu; BMNH, the Natural History Museum, London; IRSNB, Institut Royal des Sciences Naturelles de Belgique, Brussels; IUNH, Natural History Laboratory, Ibaraki University, Mito; MNHN, Museum National d'Histoire Naturelle, Paris; NMB, Naturhistorisches Museum Basel, Basel; NMNH, National Museum of Natural History, Washington; OUM, Hope Entomological Collection, University Museum, Oxford; RMNH, Nationaal Natuurhistorisch Museum, Leiden; SAM, South Australian Museum, Adelaide; ZMA, Zoologisch Museum, Amsterdam.

Only major references are listed here and others can be found in Kojima & Carpenter (1996).

General notes on the *Ropalidia flavopicta*-group

Before proceeding, a brief note on the *R. flavopicta*-group is given. Although Richards (1978: 58) considered *R. aristocratica, R. copiaria, R. scitula* and *R. timida* to belong to the subgenus "*Icariola*" [he (1978: 55) listed *R. timida* in the subgenus "*Icarielia*"], I follow van der Vecht's (1962) view. In addition to the ten forms that van der Vecht (1962) placed in the subgenus "*Icarielia*", *R. palawana* Kojima & Tano, 1985 from



Figs 1-26, first metasomal tergum of ♀ of the *Ropalidia flavopicta*-group. Figs 1-13, lateral view; figs 14-26, dorsal view. Figs 1, 14, *R. opifex* van der vecht; figs 2, 15, *R. lepida* van der Vecht; figs 3, 16, *R. malaisei* van der Vecht; figs 4, 17, *R. nigrescens* van der Vecht; figs 5, 18, *R. decorata* (Smith); figs 6, 19, *R. copiaria* (de Saussure); figs 7, 20, *R. scitula* (Bingham); figs 8, 21, *R. timida* van der Vecht; figs 9, 22, *R. montana* Carl; figs 10, 23, *R. romandi* (Le Guillou); figs 11, 24, *R. leopoldi* Bequaert; figs 12, 25, *R. deminutiva* Cheesman; figs 13, 26, *R. integra* Cheesman.

Palawan, *R. obscura* Gusenleitner, 1996 from Thailand and five Papua-Australian species (*R. deminutiva* Cheesman, 1952, *R. integra* Cheesman, 1952, *R. leopoldi* Bequaert, 1932, *R. romandi* (Le Guillou, 1841) and its subspecies *cabeti* (de Saussure, 1853), and *R. nigrior* Richards, 1978) may belong to the *R. flavopicta*-group. However, the only synapomorphy for this species-group so far known is a behavioral one: the construction of a nest envelope that is independent of the combs (Kojima & Carpenter, unpublished). At present, nests are known for about half of the species, and subsequently the group may eventually be proved to be paraphyletic.

In addition to these species, Richards (1978: 58, 128-129) placed nine other species in the subgenus "*Icarielia*". However, *R. loriana* (du Buysson, 1909) and *R. longipetiolata* (Cameron, 1911) seem to form a natural species-group very different from the *R. flavopicta*-group. Three of the remaing species (*R. bensoni* Richards, 1978, *R. festina* (Smith, 1865) and *R. zonata* (Cameron, 1906)) have twisted mandibles, and may form another natural species-group together with several Papua-Australian species, which Richards (1978) placed in the subgenus "*Icariola*", such as *R. kurandae* Richards, 1978 and *R. mackayensis* Richards, 1978. The remaining four species (*R. conservator* (Smith, 1860), *R. insolens* Cheesman, 1952, *R. ivorina* Cheesman, 1952 and *R. novaeguineae* (von Schulthess, 1913)) may also form a different species-group.

The shape of the first metasomal tergum is often useful to distinguish the species of the *R. flavopicta*-complex [= eight "subspecies" of *R. flavopicta* as recognized by van der Vecht (1962)] from the other species in the *R. flavopicta*-group. *Ropalidia opifex* (figs 1, 14) and *R. lepida* (figs 2, 15) have the first metasomal tergum relatively long and more slender. On the other hand, *R. timida* (figs 8, 21) and *R. montana* (figs 9, 22) have short segments. The species from Papua-Australian regions have the first metasomal segment short (figs 10-13) and in dorsal view gradually widening towards the posterior margin and without posterior parallel-sided part (figs 23-26). The remaining seven species have the first metasomal tergum (figs 3, 5-7, 16, 18-20) similar to those of the *R. flavopicta*-complex (figs 4, 17, 54-59, 89, 102-103). However, they are easily distinguised from the species in the *R. flavopicta*-complex by other characters, such as the occipital carina strongly widened ventrally (*R. decorata*, *R. obscura*), entirely black mesoscutum and uniformly infuscate marginal cell of the fore wing (*R. aristocratica*, *R. copiaria*), and deep and wide propodeal concavity (*R. scitula*). *Ropalidia malaisei* and *R. palawana* will be discussed later in comparison with the species in the *R. flavopicta*-complex.

Descriptions of the species of the *R. flavopicta*-complex other than Philippine forms

Ropalidia flavopicta (Smith, 1857)
(figs 27-44, 48, 51, 54-55, 60, 63-74)

Icaria flavopicta Smith, 1857: 99.
Ropalidia flavopicta flavopicta; van der Vecht, 1962: 51.

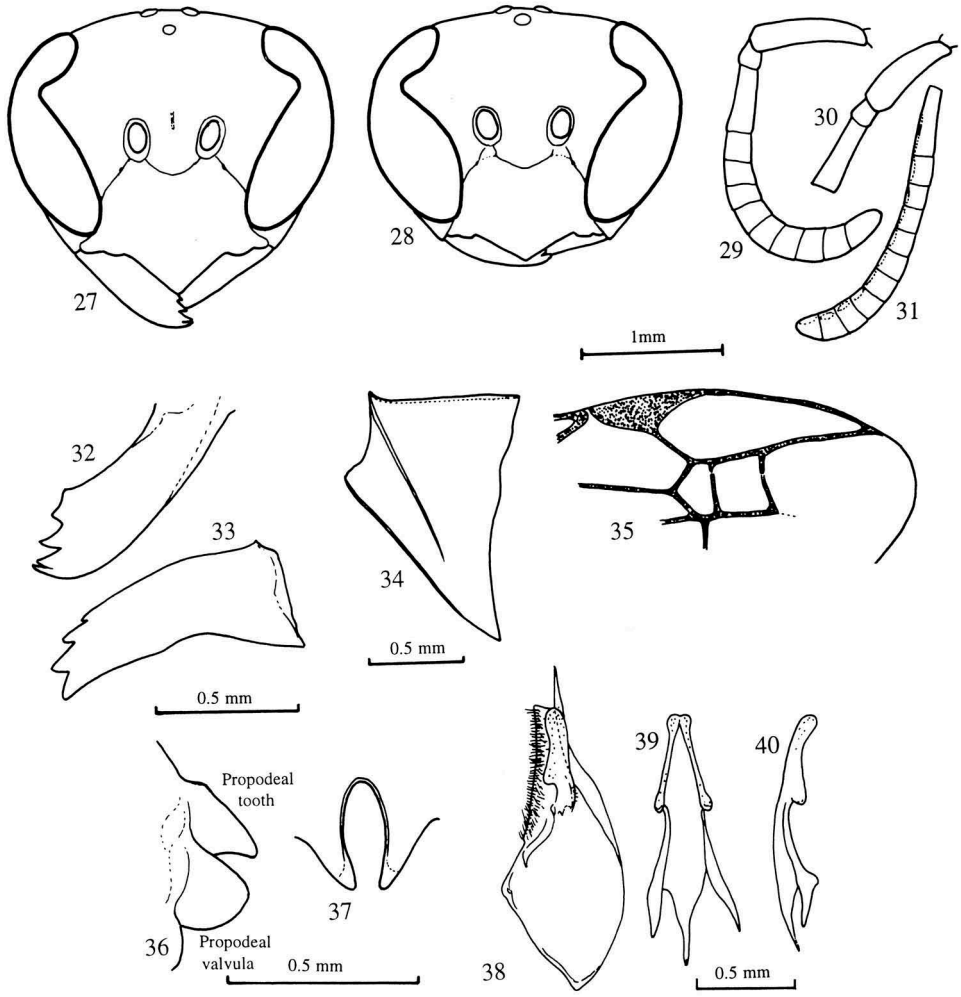
Material.— **Borneo**: holotype, ♀ (BMNH), labelled "Type" [circled with orange], "SAR" [= Borneo, Sarawak] [circular], "*flavopicta* Type Sm" [in Smith's handwriting], "*Ropalidia flavopicta* Smith", and "B. M. Type HYM 18.857"; 1♀ (RMNH), Sabah, Interior Zone, 05°11'N, 115°59'E, 16 Km NE of Tenom, Agricult. Res. Station, Resthouse, 250 m, 22-24.xi.1987, at light, J. Huisman & R. de Jong; 1♂ (RMNH)

S. Sabah, 105 km S of Beaufort, 4°24'N, 115°43'E, 1000 m, 1.iv.1987, J. van Tol & J. Huisman; 1♀ (SAM), Sabah, Kota Kinabalu, Kiangsam, 4.x.1970, C.G. Roche; 1♀ (RMNH), Sabah, nr. Long Pa Sia, c. 1010 m, Malaise trap 1, 1-14.iv.1987, C. v.Achterberg; 1♀ (RMNH), same data but Malaise trap 1b, 25.xi.-8.xii.1987; 4♀♀ (RMNH), Sabah, nr. Danum Valley, Field C, c. 150 m, Malaise trap 10, 20-26.iii.1987, C. v.Achterberg; 1♀ (RMNH), same data but 15-19.iii.1987; 1♀ (RMNH), same data but 20-22.xi.1987; 1♀ (RMNH), same data but Malaise trap 5, 19.iii.-19.iv.1988, C. v.Achterberg & T. Burghouts; 1♀ (RMNH), same data but 5.xii.1987-20.i.1988; 1♀ (RMNH), same data but 12.vii-2.viii.1987, C. v.Achterberg & D. Kennedy; 1♀ (RMNH), same data but 26.v.-20.vi.1987; 1♀ (RMNH), same data but 13.ix-4.x.1987; 1♀ (RMNH), same data but 20.vi.-12.vii.1987; 1♀ (RMNH), Tawau, Quoin Hill, Cocoa Res. Sta. 4.xii.1962, Y. Hirashima; 1♀ (RMNH), Forest Camp. 19 km N. of Kalabakan, 12.x.1962, Y. Hirashima; 1♀ (BISH), Sarawak, Bau Dist., Pangkalan Tebang, 300-450 m, 6.ix.1958, T.C. Maa; 28♀♀ + 1♂ (RMNH), Sarawak, Lawas, vii.1977, R.H. Hamilton, from nest; 6♀♀ (RMNH), Beranges, 25.xi.[19]30, J. v.d.Vecht. **Sumatra**: 2♀♀ (RMNH), N. Sumatra, Tebing Tinggih, 20.xii.1954, J. v.d.Vecht; 1♂ (RMNH), Bengkulu N.P., Kerinci Sebelat, c. 50 m, 28.viii.1993, S. Kahono; 9♀♀ + 4♂♂ (RMNH), Sibolangit, 500 m, 18.xii.1954-5.i.1955, J. v.d.Vecht; 4♀♀ (RMNH), Toba-meer [= Danau Toba], B. Hagen; 2♀♀ (RMNH), Gn. Betoeng, 400 m, Soengeilangka Est., 27.iii.1937, J. v.d.Vecht & E. v.d.Vecht B.; 5♀♀ (RMNH, ZMA, MNHN), Fort de Kock [= Bukittingi], 920 m, 1925, E. Jacobson (1♀ in MNHN labelled "*Icaria variegata* Sm. det. A. v. Schulthess 1927"); 8♀♀ (RMNH), Padangpanjang, 800 m, 0°30'S, 100°26'E, 1.v.1988, R. Hensen; 2♀♀ (ZMA), Boran Padang, 1100 m, x.1918, Leefmans; 3♀♀ (ZMA), Padang, x.1918, Leefmans; 2♀♀ (RMNH), Kedaton, 150m, 23.iii.1937, J. v.d.Vecht; 8♀♀ (RMNH), Tanjong Morawa, Serdang, B. Hagen; 8♀♀ (ZMA), Tandjunggadang, 1000 m, 1926, E. Jacobson; 1♀ (ZMA), same data but 1200 m, xii.1925; 1♀ (ZMA), same data but ii.1926; 2♀♀ (RMNH), Si-Rambe, Pangherang-Pisang, xii.[18]90-iii.[18]91, E. Modigliani; 2♀♀ (RMNH), Habinsaraw, Simanimbo, 1928, J.C. v.d.Meer Mohr; 1♀ (RMNH), 600 m, Res. Benkoelen, Tandjong Sakte, 11-20.vi.1935, M.E. Walsh; 4♀♀ (ZMA), Anei Kloof, 500 m, 1926, E. Jacobson; 1♀ (ZMA), Madan (Deli), i.1919, Leefmans; 1♀ (ZMA), Deli, I.P. de Buray; 1♀ (ZMA), Sumatra Utara, Sibolanjit, 700 m, 12.ii.1994, T. & M. Simon Thomas; 1♂ (ZMA), Medan [Sibaulangit], x.1917. **Viet Nam**: 1♀ (BISH), Fyan, 900-1000 m, 11.vii.-9.viii.1961, N.R. Spencer. **Peninsular Malaysia**: 1♀ (RMNH), Kedah nr. Jitra, Catchment area, 4.iv.1928; 3♀♀ (RMNH, IUNH), Penang [= Pinang], Sungen Pinang Hills, ex. nest, 7.x.1956, H.T. Pagden; 1♀ (RMNH), Penang, Penang Hill, 2500 [m], 17.i.1959, H. T. Pagden; 1♀ (RMNH), Negri, Port Dickson, 3.i.1935; 1♂ (RMNH), same data but 10.I.1935. **Thailand**: 1♀ + 1♂ (RMNH), Trang, Bansai Pop, iv.1924, I.H.N. Evans.

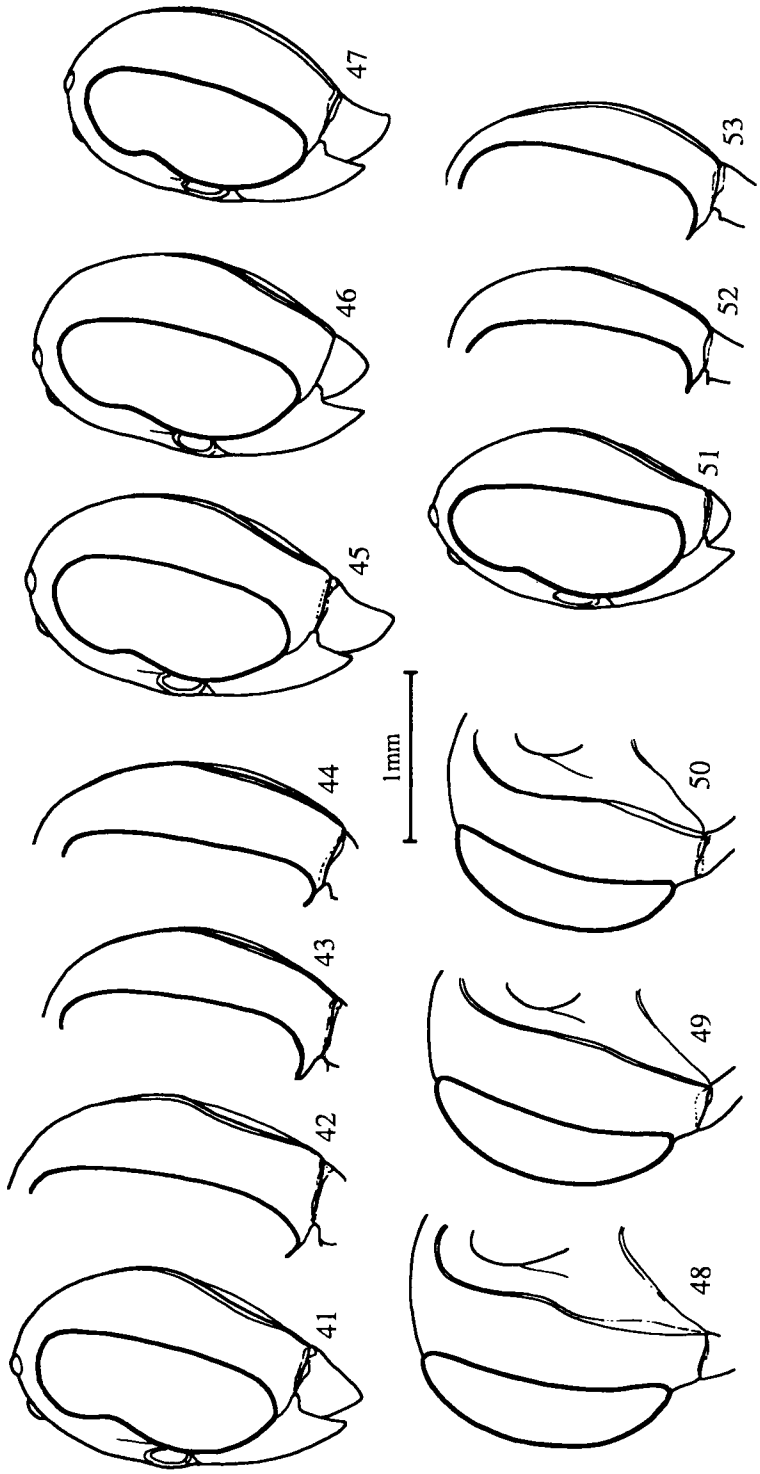
The recent study on the social organization of this species from Sumatra showed that the species has size dimorphic female castes (Yamane, personal comm.). The present description of the female is based on workers, and the caste differences will be described by Dr Sô. Yamane mainly based on biometric comparisons.

Female.— Head in front about 1.15 times as wide as high (fig. 27), in dorsal view slightly more than twice as wide as long, rather strongly narrowed behind eyes towards occiput, moderately emarginate posteriorly, wider than mesosoma including tegulae. Gena in profile widest at level near middle of eye, where it is about 0.85 times as wide as eye, and slightly narrowed towards mandibular base (figs 41-44); occipital carina complete, slightly bent anteriorly at level near middle of eye, then running down in nearly straight line, slightly thickened ventrally (figs 41-42), bending often weaker in specimens from continental areas (figs 43-44); in profile, ventral part of occiput visible (figs 41-44). Clypeus nearly flat, bluntly pointed apically, emarginate dorsally, about 1.3 times as wide (measured as a distance between the uppermost points where clypeus touches eyes) as high (measured from the bottom of dorsal emargination to apex). Inner margins of eyes about 1.25 times further from

each other at vertex than at clypeus (fig. 27). Ocelli arranged in equilateral triangle, distance from inner eye margin to posterior ocellus about three times distance between posterior ocelli, the latter distance about the same as their diameter; interocellar area slightly raised. Antenna slightly swollen apically (fig. 29); scape slightly curved and weakly flattened dorsoventrally, slightly more than four times as long as wide at apex; second segment about one-third of length of scape; third segment about 2.5 times as long as wide at apex, slightly longer than length of fourth and fifth segments combined; fourth segment slightly longer than wide; each of fifth to eleventh segments wider than long; terminal segment about 1.25 times as long as



Figs 27-40, *Ropalidia flavopicta* (Smith). Figs 27, 29, 32-37, ♀; figs 28, 30-31, 38-40, ♂. Figs 27-28, head, frontal view; fig. 29, right antenna; fig. 30, basal part of right antenna, frontal view; fig. 31, flagellum of left antenna, seen from behind; figs 32-33, mandible, frontal (32) and ventral view (33); fig. 34, pronotum, lateral view; fig. 35, apical part of right fore wing; fig. 36, propodeal tooth and valvula, lateral view; fig. 37, propodeal orifice; fig. 38, paramella with lamina volsellaris and digitus; figs 39-40 aedeagus, ventral (39) and lateral view (40).



Figs 41-53, head of species of *Ropalidia flavopicta*-complex. Figs 41-50, ♀; figs 51-53, ♂. Figs 41-47, 51-53, lateral view; figs 48-50, posterolateral view. Figs 41, 48, 51, *R. flavopicta* (Smith) from Sabah, Borneo; figs 42-43, *R. flavopicta* from a single colony collected in Penang, Malay Peninsula; fig. 44, *R. flavopicta* from Viet Nam; figs 45, 49, 52, *R. javanica* van der Vecht; fig. 46, *R. ochracea* van der Vecht; figs. 47, 50, 53, *R. ornaticeps* (Cameron).

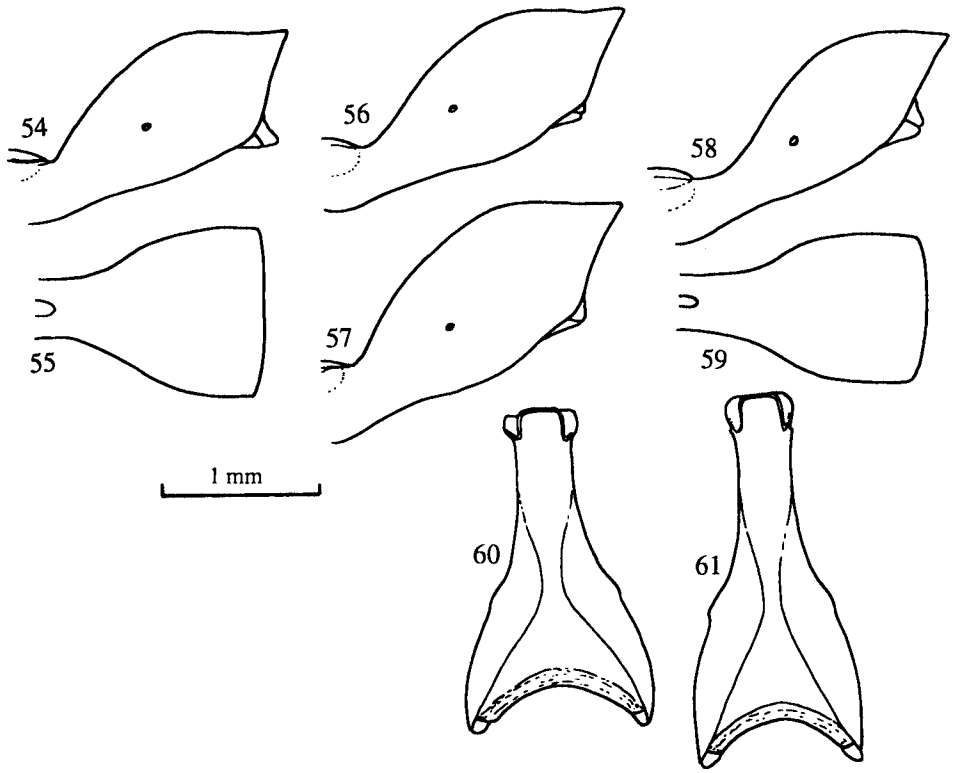
wide at base. Mandible not twisted (figs 32-33); dorsal tooth truncate apically; ventral three teeth subequal in length.

Mesosoma in dorsal view about 1.5 times as long as wide. Pronotum in dorsal view with anterior margin weakly rounded, lateral sides weakly divergent posteriorly and slightly sinuate, little concave anteriorly and convex posteriorly; pronotal carina complete, weakly but sharply raised, hardly sinuate (fig. 34). Scutum slightly convex, a little wider than long. Disk of scutellum trapezoid, weakly convex, margined laterally with weak truncation; median carina present in anterior one-third to half. Metanotum nearly flat, without lateral carinae, weakly produced posteromedially. Propodeum in posterodorsal view weakly narrowed posteriorly, with lateral sides hardly convex; posterior face with shallow concavity, median furrow shallow and obliterated anteriorly; in profile posterior face slightly convex. Propodeal valvula small, rounded triangle in outline, in profile hardly covering propodeal tooth (fig. 36); propodeal orifice about twice as wide as long and with rounded top (fig. 37). Basal angle of second submarginal cell of fore wing slightly larger than 90°; 2r-m and 3r-m hardly sinuate, both inserted into either r or M at angle of nearly 90° (fig. 35).

First metasomal segment rather short, not thick (figs 54-55), in dorsal view gradually swollen posteriorly after short basal petiolar part, then nearly parallel-sided near posterior margin, where it is about three times as wide as basal petiolar part (fig. 55); in profile dorsal face rising from posterior end of reception of propdeal muscle, then weakly curved down towards posterior margin, but slightly concave near posterior end (fig. 54); apical lamella wide, not depressed; ventral margins of tergum beneath closely approaching each other before posterior divergence (fig. 60); first sternum emarginate posteriorly, posterior flattened triangle hardly wider than long (fig. 60). Second segment about as wide as long, and as high; in dorsal view rather strongly but smoothly swollen posteriorly in anterior half, nearly parallel-sided near posterior margin; in profile vertically cut off at end; sternum slightly more convex than tergum; suture between tergum and sternum extremely fine; apical lamella narrow, weakly depressed; articulation of tergum smoothly passing into "neck" in the middle, margined posteriorly with slight truncation on lateral sides.

Body dull, covered with dense fine tomentum except apical half of clypeus, in addition sparser suberect hairs; eye bare; posterior half of metanotum and propodeum rather shiny. Frons and vertex with sparse, shallow punctures, their interspaces distinctly larger than punctures, each puncture with central postule; clypeus and gena nearly unpunctured; pronotum and scutum reticulately and superficially punctured; scutellum, metanotum, except polished, posterior subtriangular area, with sparse punctures similar to those on frons; posterodorsal area of mesepisternum sparsely and shallowly punctured, its anteroventral part unpunctured, border between them indistinct. Posterior face of propodeum with traces of fine transverse striae. First metasomal tergum with shallow, ill-defined punctures on posterior margin; punctures on second segment shallow and sparse, and larger and less defined on sternum than on tergum.

Body black (figs 63-74); antenna yellowish brown, scape dark brown above, yellow below, and flagellum fuscous above. Following parts yellow: mandible except brown teeth (ventral margin often black), clypeus except large median black spot, which is connected with base of clypeus (black spot sometimes much reduced (fig.



Figs 54-61, first metasomal segment of the *Ropalidia flavopicta*-complex. Figs 54, 56-58, lateral view; figs 55, 59, dorsal view; figs 60-61, ventral view. Figs 54-55, 60, *R. flavopicta* (Smith); fig. 56, *R. javanica* van der Vecht; fig. 57, *R. ochracea* van der Vecht; figs 58-59, 61, *R. ornaticeps* (Cameron).

71) or sometimes absent (fig. 72), especially in specimens from continental areas), wide band along inner margin of eye, narrowly extending above and ending well below top of eye (sometimes extending further above to be united with spot behind posterior ocellus (fig. 73)), spot on frons above level of half of antennal socket (in some specimens extending dorsally to form a band reaching anterior ocellus (fig. 72)), spot posterolateral to each posterior ocellus (often absent or quite small (figs 64, 69)), band on gena (often interrupted at mid-length (figs 65, 70)), band along pronotal carina, which has irregular posterior margin and narrow branches extending along posterodorsal margin of pronotum (well developed in some specimens from continental areas (figs 73-74)), band on each side of middle of scutum (often narrow), tegula except outer semitransparent spot, paired large lateral spots on disk of scutellum, anterior transverse band on metanotum, with posterior margin broadly emarginate medially, spots in lateral depressions of scutellum and metanotum (often absent), large scrobal spot and spot near posteroventral margin of mesepisternum, spot on ventral surface of mesepisternum (often absent, but usually developed (fig. 74) in specimens from continental areas), spot at posteroventral margin of metapleuron, large spot on each side of median furrow of propodeum, paired lateral spots near posterior margin of first metasomal tergum (sometimes united to form a band

which is emerginate anteromedially (fig. 67)), paired basal spots on second tergum, which narrowly extend posteriorly along suture between tergum and sternum (sometimes reduced to small spot (figs 69-70)), large spot on second sternum (sometimes reduced or absent (figs 65, 70), but often well developed (fig. 74) in specimens from continental areas), narrow apical bands on second to fifth metasomal segments, and most of visible part of sixth segment. Legs dark ferruginous; tibiae and tarsi yellowish brown; most part of fore coxa, apical two-thirds of mid coxa and apical half of hind coxa, apical margin of femora, and spots on outer surfaces of tibiae, yellow. Wings hyaline, darker along costa; marginal cell not infuscate.

Length (of head + mesosoma + first and second metasomal segments) 6-7.5 mm.

Male.— Similar to female including colour pattern; but eye more strongly swollen; inner eye margins more strongly convergent ventrally, distance between inner eye margins at vertex about 1.5 of that at clypeus (fig. 28); gena relatively narrower, in profile nearly 0.6 times as wide as eye; occipital carina bluntly bent at the level slightly lower than middle of eye (fig. 51); clypeus relatively smaller, about 1.2 times as wide as high; antenna slightly more slender than in female, scape about 3.5 times as long as wide at apex (fig. 30), third segment slightly less than three times as long as wide at apex, distinctly longer than length of fourth and fifth segments combined, terminal segment bullet shaped as in female, somewhat longer than wide at base; third to terminal antennal segments with weak tyloids (or longitudinal ridges) beneath (fig. 31).

Genitalia as in figs 38-40: parameral spine without setae or hairs; lamina volsellaris rather slender and elongate; aedeagus slender, with ventral processes which are not well developed and have minute microscopic teeth.

Length (of head + mesosoma + first and second metasomal segments) 6-6.5 mm.

Ropalidia javanica van der Vecht, 1962
(figs 45, 49, 52, 56, 75-77)

Ropalidia flavopicta javanica van der Vecht, 1962: 54.

Material (including paratypes, indicated with asterisks).— **Java**: holotype, ♀ (RMNH), labelled "E. Java 850 m, Idjen Plateau, Blawan, ix.39, ex. nest, H. Lucht", "Museum Leiden ex. coll. J. v.d.Vecht" and "Holotype" [red]; *2♀♀ (RMNH), W. Java, Udjung Kulon, 5.xii.1958, A.M.R. Wegner; *1♀ (RMNH), same data but 2.xii.1958; *2♀♀ (RMNH), Djampang Tengah, viii.1935, M.E. Walsh; *1♀ (RMNH), Mt. Tjisoerne, x.1935, M.E. Walsh; *36♀♀ (RMNH, IUNH), Sukanegara, ii.1940, Native coll. ex. nest; *1♀ (RMNH), Java, Muler; *2♀♀ + *7♂♂ (RMNH), 850 m, Idjen Plateau, Blawan, ix.[19]39, H. Lucht, ex. nest; 1♀ (ZMA), Blawan, Idjen, H. Lucht; *1♀ + 1♂ (RMNH), 950 m, Blawan, Bondowoso, xii.1935, L.J. Toxopeus; 1♂ (RMNH), 900 m, Idjen Kalisengon, 28.vi.1930, J. v.d.Vecht; *1♀ (RMNH), 950 m, Idjen Plateau, Djerochoendjoen, 3.ii.1940, H. Lucht; 14♀♀ (IRSNB), Soekaboemi [= Sukabumi]. **Flores**: *16♂♂ (RMNH), Walawaru, 14.viii.1950, J. v.d.Vecht.

This species is distinguished from *R. flavopicta* by the relatively long first metasomal segment (figs 56, 62). In the female the occipital carina is weakly sinuate at level of one-third of eye from below (fig. 45); in posterolateral view, the carina is less strongly sinuate (fig. 49) than in the female of *R. flavopicta* (fig. 48); in the male the occipital carina is less sinuate (fig. 52) than in *R. flavopicta*.

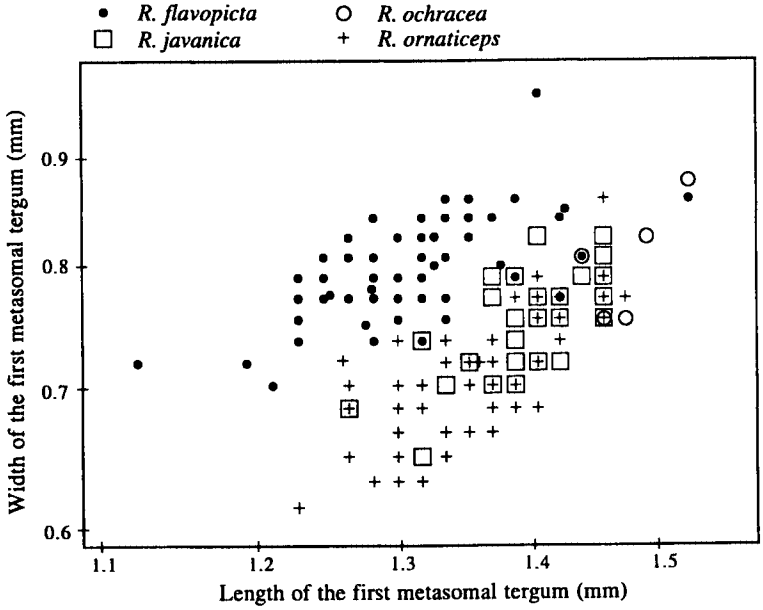


Fig. 62, relationships between the length (measured as a distance between the posterior end of reception of propodeal muscle and the posterodorsal end of the tergum in profile) and the maximum width of the first metasomal tergum in *Ropalidia flavopicta* (Smith), *R. javanica* van der Vecht, *R. ochracea* van der Vecht and *R. ornaticeps* (Cameron).

Length (of head + mesosoma + first and second metasomal segments) 6.5-7.5 mm both in the female and male.

Colour of female (figs 75-77).— Body black, with abundant yellow markings similar to those of *R. flavopicta*; but antennal scape entirely ferruginous (sometimes yellowish at extreme base and/or apex); posterior margin of mandible rather widely black; clypeus as a rule entirely yellow, except its black apical margin; yellow marking on frons much larger, occupying entire space between antennal sockets, gradually widening from the level of upper margin of antennal sockets to the level of centre of eye-emargination, where it abruptly narrowed and usually reaches anterior ocellus; band along inner eye margin wider, separated from band on frons by narrow black line; band posterolateral to posterior ocellus always present; band on gena complete, rarely incised; axillary areas of scutellum and metanotum usually with yellow spots; yellow spots on mesepisternum usually larger, often united to form wide, oblique band; basal paired spots on second metasomal tergum always large; yellow markings on second sternum usually absent, or present in small spot (only sometimes developed); third to terminal metasomal segments without yellow.

Colour of male.— Similar to female; but antennal scape yellow below; mandible nearly entirely yellow; marking on frons and band along inner eye margin wider, often united, resulting a yellow ventral half of face; spots on second metasomal sternum usually well developed.

Ropalidia ochracea van der Vecht, 1962 (figs 46, 57, 78-80)

Ropalidia flavopicta ochracea van der Vecht, 1962: 56.

Material (all types).— **Sumba:** holotype, ♀ (NMB), labelled "Lokojengo, C. Sumba, 23.9.1949, Dr. Bühler Dr. Sutter", "Holotype" and "*Ropalidia (Icarielia) flavopicta ochracea* m. ♀ det. J. v. d. Vecht 1962"; 1♀ (RMNH), C. Sumba, Lokojengo, 26.ix.1949, Bühler & Sutter; 1♀ (RMNH), C. Sumba, Langgalru, 8.x.1949, Bühler & Sutter; 1♀ (RMNH), W. Sumba, Rana, Wai Tombo, 5-9.viii.1949; 1♀ (RMNH), O. Sumba, Mau Marru, 18.vii.1949, Bühler & Sutter.

I did not find any structural differences sufficient to consider *R. ochracea* as a different species from *R. javanica*. Although there remains a slight possibility that the colour of these specimens had been changed through cyanide, the following facts suggest that the colour is natural: colouration is stable among the specimens collected on different dates (thus possibly different periods in cyanide, if they were killed in cyanide); and the yellow markings are also stable in nearly all specimens. The colouration is so different from that of *R. javanica* as described below that it can be considered as a "fixed difference" which may diagnose phylogenetic species (Nixon & Wheeler, 1990).

Length (of head + mesosoma + first and second metasomal segments) 7-7.5 mm in the female.

Colour of female (figs 78-80).— Marking pattern similar to that of *R. javanica*; most markings ochreous to orange-brown instead of yellow, and more extensive in some parts but reduced in other parts as follows: mandible black with spot at base; pale area of face below the level of anterior ocellus almost entirely (often with a dark line on each side above antennal socket, widened dorsally), pronotum almost entirely, paired bands on scutum wider and confluent posteriorly, and spots on mesepisternum, metapleura and propodeum reduced; spot on ventral surface of mesepisternum absent; paired spots on second metasomal tergum usually larger; second sternum with spots similar to but smaller than those on tergum. Tegula yellow rather than orange, except outer transparent spot; legs nearly black; anterior face of fore coxa, spots on outer surfaces of middle and hind coxae, yellow.

Ropalidia ornaticeps (Cameron, 1900) (figs 47, 50, 53, 58-59, 61, 81-87)

Icaria ornaticeps Cameron, 1900: 496.
Ropalidia flavopicta ornaticeps; van der Vecht, 1962: 49.

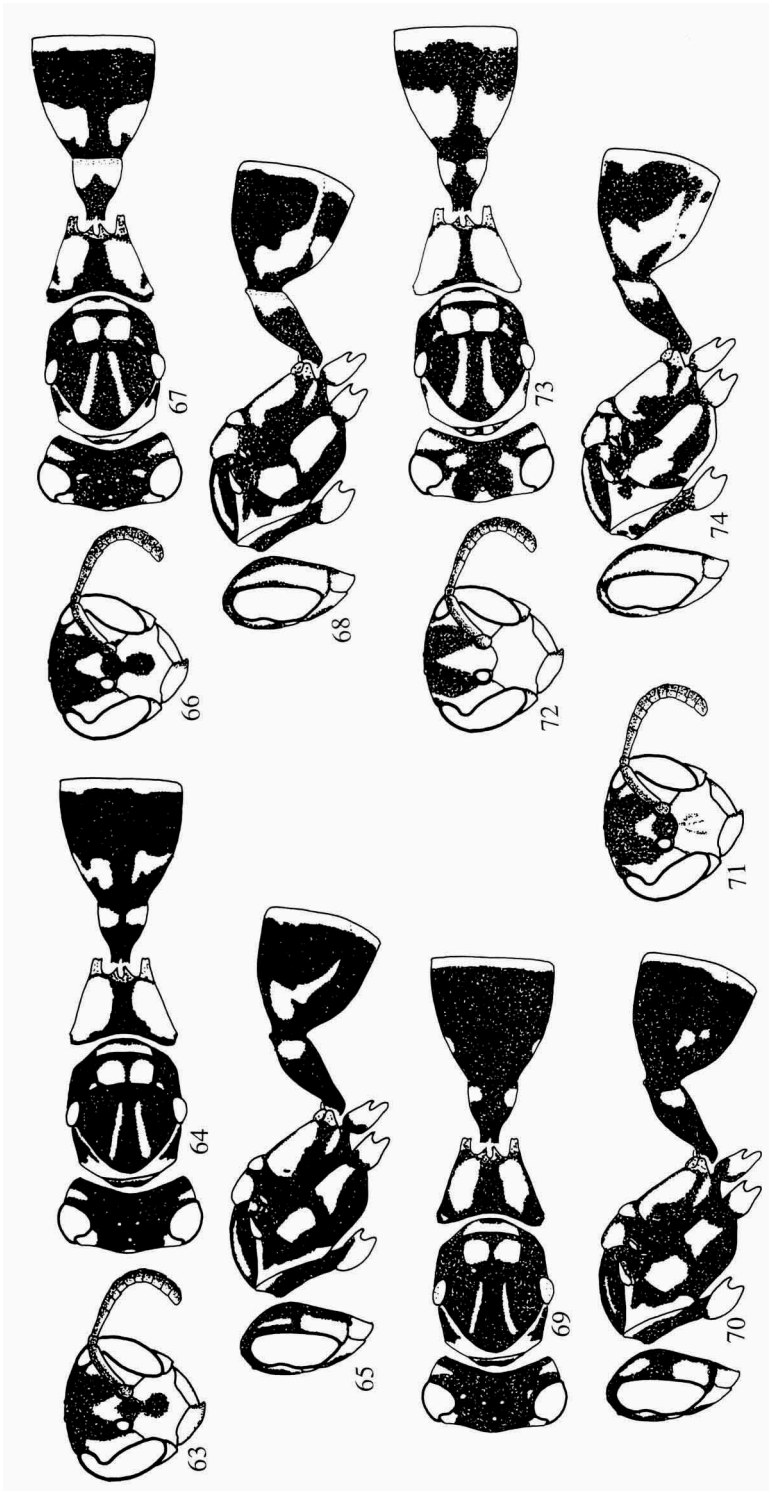
Material.— **India:** lectotype here designated, ♀ (OUM), labelled "*Icaria ornaticeps* Cam. Type, Khasia" [in Cameron's handwriting] + paralectotype, ♀ (BMNH), labelled "Type" [circled with orange], "*Icaria ornaticeps* Cam. Type, Khasia" [in Cameron's handwriting], "P. Cameron coll. 1914-119", "*Ropalidia flavopicta* Sm.", and "B. M. Type HYM 18.856"; 1♀ (NMNH), Assam, 6 mi NW Digboi, 30.iii.1944, D. E. Hardy; 1♀ (RMNH), Manipur State, Vagai Chungran, 300 ft., 21.v.1960, F. Schmit; 1♀ (RMNH), United Dist. of Miker and North Cachger Hills, Umbaso, 2300 ft., F. Schmid, 26.iv.1960. **Myammar:** 1♀ (RMNH), Kambaiti, 7000 ft. 9.vi.1934, R. Malaise; 2♀♀ (RMNH), Myitkyina, 175 m, 1-14.iii.[19]34, R. Malaise; 1♀ (IUNH), Rangoon [= Yangon], xii.1888, L. Fea; 1♀ (IUNH), Palon, Pegu, viii-ix.1887. L.

Fea; 1♀ (RMNH), Moulm, ii.[18]91, coll. Bingham; 2♀♀ (RMNH), Moulmein, v.1887, Fea; 8♀♀ (RMNH, IUNH), Tenasserim, Kawkareet [= ?Kawkareik], ii.1887, Fea; 1♀ (RMNH), Tennasserim, Meetan, iii.1887, L. Fea; 1♀ (RMNH), Tennasserim, Sukli, 75 km E. of Moulmein, 600 m, 27-31.x.1934, R. Malaise. **Thailand**:1♀ (RMNH), Fang, 21.i.1958, Yoda; 2♀♀ (RMNH), Nan [= Muang Nan]; 2♀♀ (IUNH), Chiangmai, Doi Sutep, 14.iii.1980, T. Fujisawa (Clypeus with dark spot connecting with the base of clypeus); 2♀♀ (NMNH), Chiangmai, Doi Suthep, 1278 m, 29.iii.-4.v.1958, T.C.Maa; 2♀♀ + 3♂♂ (RMNH), 300 m, Chingmai, 18°47'N, 98°59'E, 4.vii.1986, R. Hensen; 1♀ (NMNH), Chiang Doi Mt. nr. stream, 2.iii.[1952], D. & E. Thurman; 1♀ (RMNH), Chiengdow [= ?Chiang Dao], 14.iii.[19]61, Yoshikawa; 1♀ (RMNH), 1000 m, 50 km SW Loei, Phu Rua N. P., 17°20'N, 101°20'E, 14.vii.1986, R. Hensen; 2♀♀ + 11♂♂ (RMNH), 250 m, Chiang Khan, 17°52'N, 101°36'E, 17.vii.1986, R. Hensen; 1♀ (MNHN), Bangkok 1885, Harmand (labelled "*Icaria bilineata* R. du Buysson 1908"); 1♀ (RMNH), Bangkok, 5.iii.[19]61, K. Iwata; 3♂♂ (RMNH), 150 m, Phangnga, 8°28'N, 98°32'E, 29.vii.1986, R. Hensen; 1♀ (IUNH), Phuket, 3.xii.1957, L. D. Brongersma; 9♀♀ (RMNH), 50 m, Phuket Isl. S, 7°47'N, 98°19'E, 1.viii.1986, R. Hensen; 1♀ (RMNH), 400 m, 20 km E. Trang, Khao Chang N. P., 7°34'N, 99°49'E, 28.vii.1986, R. Hensen; 3♀♀ (RMNH), 18 km E Trang, Khao Cong N. P., 400 m, 7°34'N, 99°49'E, 24.v.1988, R. Hensen; 7♀♀ (RMNH), 500 m, Trang, 7°33'N, 99°36'E, 27.vi.1986, R. Hensen; 1♀ (RMNH), 100 m, 13 km SW Hat Yai; 6°56'N, 100°23'E, 24.vii.1986, R. Hensen. **Peninsular Malaysia**: 4♀♀ (RMNH), Kelantan, Kota Bharu, 18.v.1951, R.A. Lever. **Laos**: 1♀ + 1♂ (BISH), Sayaboury Prov., Sayaboury, 13.iv.1966; 1♀ (BISH), Vientiane Prov., Ban Van Eue, 15.ii.1967; 1♀ (BISH), same data but 30.iii.1967; 1♂ (BISH), Savannakhet, 29.ii.1967; 1♂ (BISH), 100 m, Uekinak nr. Pakkading, 22.iv.1965, J.L. Gressitt. **Cambodia**: 1♀ (BISH), Siem Reap, 10-12.iii.1968, D.E. Hardy; 1♀ (BISH), 2 km SE of Phumi Damrei Phong, 50 m, 14-16.iv.1961. **Viet Nam**: 1♀ (BISH), Karyu Danar, 200 m, 13-28.ii.1961, N.R. Spencer; 1♀ (BISH), 15-35 km NW of Phan Rang, 8-16.xi.1960, C.M. Yoshimoto, light trap; 1♀ (NMNH), 25 km SW of Pleiku, 400 m, 12.v.1960, L.W. Quate; 4♀♀ (MNHN) Cochichina, Baria, (leg. A. Brebion) Dr. J.L. Vanthier, 1908. **Locality unknown**: 1♀ (RMNH), Hevens 860; 2♀♀ (RMNH), coll. Felder; 4♂♂ (MNHN), Lakhon, Harmand, 1878 (1♀ labelled "*Icaria flavopicta* Smith, R. du Buysson det. 1898")

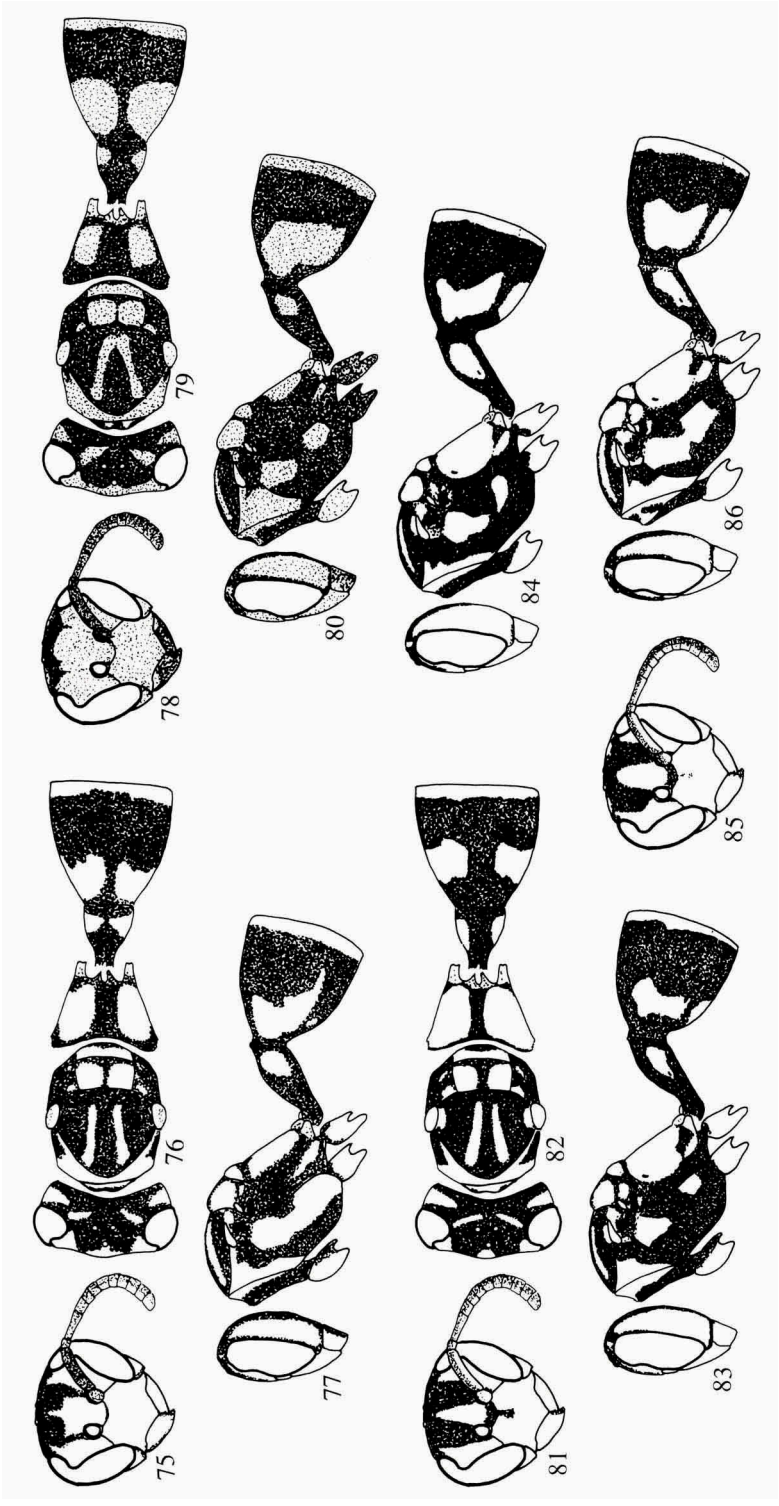
In structural characters, this species differs from the previous three species as follows: occipital carina in lateral view smoothly curved, rather distinctly thickened and raised ventrally (fig. 47, 50, 53); in posterolateral view, occipital carina hardly recurved anteriorly on lateral sides (fig. 50); first metasomal segment proportionally longer and more slender (figs 58-59, 61, 62) than in *R. flavopicta*, but the width/length ratio nearly the same as those in *R. javanica* and *R. ochracea* (fig. 62); in profile, dorsal face of first metasomal tergum slightly concave just after the reception of propodeal muscle, then gradually rising (fig. 58).

Length (of head + mesosoma + first and second metasomal segments) 6.5-7.5 mm in the female, 6-7 mm in the male.

Colour of female (figs 81-86).— Black, with yellow markings, which are usually more abundant than in *R. flavopicta* as follows: clypeus entirely yellow (sometimes with faint dark line (fig. 85), but rarely with basal spot (fig. 81)); marking on frons always extending dorsally to reach anterior ocellus; paired spots behind posterior ocelli as a rule present and developed into transverse bands; band on gena wide, usually widened in ventral half into occiput across occipital carina, so that the ventral part of the occipital carina is rarely black (but black in the lectotype (fig. 83)); scutum with short, narrow band beside tegula in addition to paired median bands (fig. 82); spots on mesepisternum developed, those on lateral face of mesepisternum often united to form wide oblique band (fig. 86), spot on ventral surface usually present; propodeum entirely yellow, except for narrow, median band and marginal



Figs 63-74, marking patterns of ♀ of *Ropalidia flavopicta* (Smith). Figs 63, 66, 71-72, head, frontal view; figs 64, 67, 69, 73, head, mesosoma and first two metasomal segments, dorsal view; figs 65, 68, 70, 74, head, mesosoma with coxae and first two metasomal segments, lateral view. Figs. 63-65, the type from Sarawak; figs 66-68, brightest individual in a colony collected in Sarawak; figs 69-70, darkest individual from the same colony; fig. 71, a specimen from Sabah, Borneo; figs 72-74, a specimen from Malay Peninsula.



Figs 75-86, marking patterns of ♀ of the *Ropalidia flavopicta*-complex. Figs 75, 78, 81, 85, head, frontal view; figs 76, 79, 82, head, mesosoma and first two metasomal segments, dorsal view; figs 77, 80, 83-84, 86, head, mesosoma with coxae and first two metasomal segments, lateral view. Figs 75-77, *R. javanica* van der Vecht; figs 78-80, *R. ochracea* van der Vecht (holotype); figs 81-86, *R. ornaticeps* (Cameron) (81-83, lectotype from Khasia, India; 84, paralectotype from Khasia; 85-86, a specimen from Assam, India).

incisions, which are distinct in front of valvulae; lateral spots on first metasomal tergum more developed, usually extending anteriorly to enclose spiracles; spots on second segment rarely reduced in size. Hind tibia as a rule black.

Coulor of male.— Similar to that of female, but yellow markings more developed; face below the level of anterior ocellus nearly entirely yellow (often with a black line on each side above antennal socket, widened dorsally); antenna more extensively yellow; mesepisternum often nearly entirely yellow, except for a few black faint lines and marginal incisions; legs more extensively marked yellow, hind tibia usually with yellow markings.

The first metasomal segment of *R. malaisei* van der Vecht is similar to *R. ornaticeps*, but the former is distinguished from the latter not only by the colour pattern but also by having the occpital carina sinuate as in *R. flavopicta*.

Ropalidia sericea (Cameron, 1905)

Icaria sericea Cameron, 1905: 73.

Material.— **India**: holotype, ♀ (BMNH), labelled "Type" [circled with red], "Cameron coll. 1906-138", "*Icaria sericea* Cam. Type, Sikkim" [in Cameron's handwriting], and "B.M. Type HYM 18.871".

Van der Vecht (1962: 49) listed *Icaria sericea* Cameron, 1905 as a probable synonym of *R. flavopicta ornaticeps* (Cameron), noting that "the type of *Icaria sericea* Cameron, 1905...in the British Museum...is a rather dark specimen.... In colour pattern this specimen appears to agree with certain dark specimens of subsp. *flavopicta* from Sumatra, and this could perhaps indicate that the locality label is incorrect." Richards (1978: 57), on the other hand, listed *R. sericea* (Cameron) as a valid species in the subgenus "*Anthreneida* White, 1841", and the type is in the drawer for the subgenus "*Anthreneida*" in BMNH.

The type has three submarginal cells in the fore wings but does not have a clear line separating the punctured posterodorsal area and unpunctured anteroventral area of mesepisternum, and subsequently it does not match the criterion of the subgenus "*Anthreneida*" defined by Richards (1978). This species most likely belongs to the *R. flavopicta*-group. The type of *Icaria sericea* agrees in its colour pattern with the dark specimens of *R. flavopicta* as van der Vecht (1962) suggested. On the other hand, structually it agrees with *R. ornaticeps*, except that the occipital carina is much strongly widened ventrally as in *R. decorata*: the occipital carina occupies about one-sixth of the gena at its widest part. Based on the differences in structure and colour from the species of the *R. flavopicta*-complex (strongly widened occipital carina, shape of the first metasomal segment, and marking pattern) and from *R. decorata* (much coarser punctures and marking pattern), I conclude that *R. sericea* (Cameron) is a valid species and the locality label of the type is correct.

Notes on the Philippine species of the *R. flavopicta*-complex

When I revised the Philippine forms of "*R. flavopicta*" (Kojima, 1982), I compared

them only with the "nominotypical subspecies of *R. flavopicta*". The first metasomal segment of some of these Philippine species is similar to that of *R. ornaticeps*, which weakens the basis for my conclusions. However, the Philippine species of the *R. flavopicta*-complex are distinct from *R. ornaticeps* by the weaker pronotal carina. In *R. ornaticeps* the pronotal carina is rather strongly raised into a lamella and slightly produced over the pronotal collar, so that the part just in front of the carina is hardly visible when the pronotum is seen dorsolaterally (fig. 87). On the other hand, in the Philippine species, the pronotal carina is much less raised and hardly produced, and the whole pronotal collar is visible in dorsolateral view (fig. 88).

Ropalidia palawana Kojima & Tano, 1985

Ropalidia palawana Kojima & Tano, 1985: 520.

Material.— **Palawan:** 1 ♀ (BMNH), Babyan, 10.i.1965, C. Baltazar.

This species is distinguished from the Philippine species of the *R. flavopicta*-complex by its colouration and the coarser punctation on the second metasomal segment as noted in the original description.

Ropalidia bipartita van der Vecht, 1962 (figs 89, 90, 92-97)

Ropalidia flavopicta bipartita van der Vecht, 1962: 61.
Ropalidia bipartita; Kojima, 1982: 111.

Material.— **Luzon:** 1 ♀ (RMNH, paratype), Mt. Polis, 2.i.[19]54, 5500 feet, H.M. & D. Townes [same locality as that of the holotype]; 1 ♀ (RMNH, paratype), Babalasang, Kalinga, Mt. Province, 3.iii.1953 M.C. Townes; 1 ♀ (BISH), Mountain Prov., Abatan, Buguias 60 km S of Bontac, 1800-2000 m, 4.vi.1964, N.M.Torrevillas; 1 ♀ (RMNH) Mt. Maquiling, 180 m, 16.iv.1930, G. B. Viado ["var. A of *R. flavopicta nigrescens*" in van der Vecht (1962)].

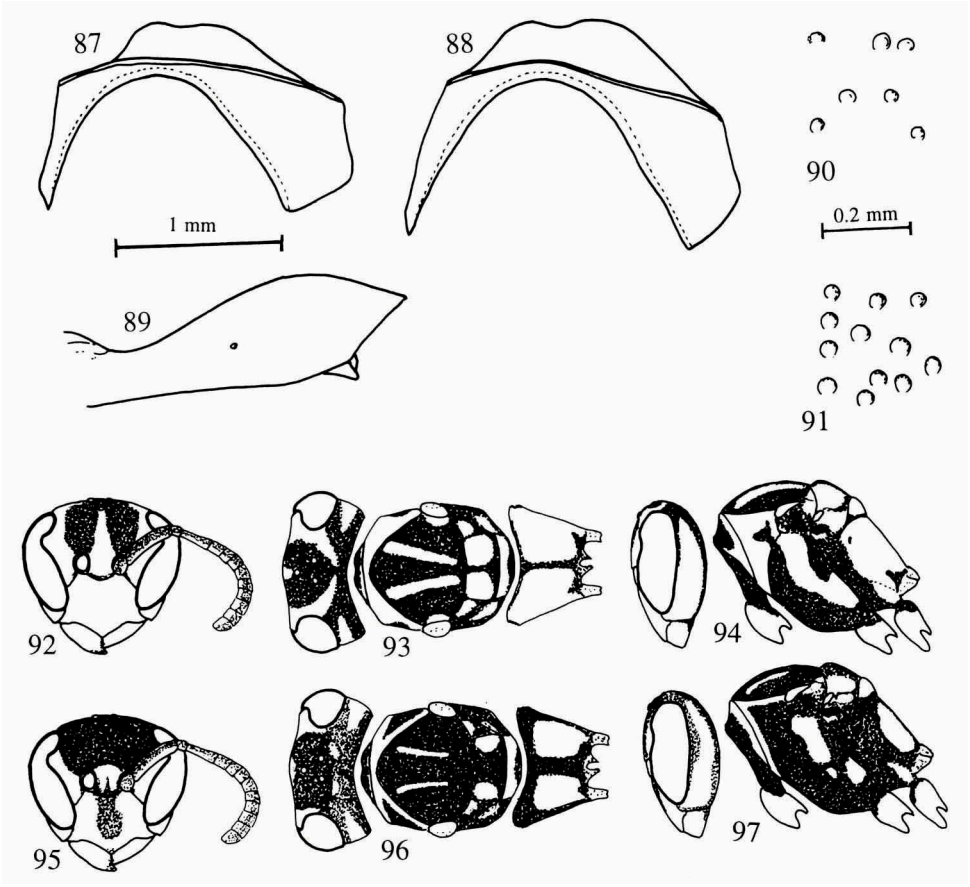
This species has been recorded only from Mountain Province, Northern Luzon (van der Vecht, 1962; Kojima, 1982). In addition to the first metasomal tergum relatively longer and more slender (fig. 89), the species is distinguished from the other Philippine species of the *R. flavopicta*-complex by the punctures on the second metasomal segment, which are sparser and much more superficial (fig. 90; cf. fig. 91 for other species). Although van der Vecht (1962) did not refer to it, one of the paratypes (from Mt. Polis) has paired large reddish-brown spots in the basal half of the second metasomal sternum, and the basal half of the second metasomal segment of the BISH specimen is reddish-brown. In addition to the specimens from Mountain Province, one of the specimens of "var. A of *R. nigrescens*" (see van der Vecht, 1962: 60) from Mt. Maquiling in RMNH agrees structually well with the paratypes of *R. bipartita*. Colour of this specimen differs from the paratypes (and also from the description by van der Vecht, 1962), but the differences may be within the range of variation.

Colour of the female from Mt. Maquiling (figs 95-97).— Clypeus with median

black spot connected with the base of clypeus (entirely yellow in paratypes, fig. 92); yellow marking between antenna confined to the area between antennae (in paratypes, extending from base of clypeus to anterior ocellus); band along inner eye margin reduced, and separated from a small spot behind each posterior ocellus (in paratypes, extending above and connected with, or only narrowly separated from the spot behind posterior ocellus); yellow markings on mesosoma reduced (figs 96-97) compared with those of paratypes (figs 93-94).

Ropalidia flavobrunnea van der Vecht, 1962
(figs 91, 101)

Ropalidia flavopicta flavobrunnea van der Vecht, 1962: 58.



Figs 87-97, characters of ♀ of the *Ropalidia flavopicta*-complex. Figs 87-88, pronotum, dorsolateral view; fig. 89, first metasomal segment, lateral view; figs. 90-91, punctures on second metasomal tergum; figs 92-97, marking pattern (92, 95, head, frontal view; 93, 96, head and mesosoma, dorsal view; 94, 97, head and mesosoma with coxae, lateral view). Fig. 87, *R. ornaticeps* (Cameron); figs 88, 91, *R. nigrescens* van der Vecht; figs 89, 90, 92-97, *R. bipartita* van der Vecht (89, 90, 92-94, paratype from Mountain Province, the Philippines; 95-97, a specimen of "var. A of *R. nigrescens*" in van der Vecht (1962), from Mt. Maquiling).

Ropalidia flavobrunnea flavobrunnea; Kojima, 1982: 118.
Ropalidia flavobrunnea lapiniga Kojima, 1982: 120. **Syn. nov.**
Ropalidia flavobrunnea iracunda Kojima, 1982: 122. **Syn. nov.**

Material (including paratypes, indicated with asterisks).— **Luzon:** 1♀ (RMNH), Mountain Prov., Talubin, 27.xii.1953, Townes family; 1♂ (RMNH), Mountain prov., nr. Kias, 24.xi.1953, Townes family; 1♀ (RMNH), Bontoc, J.W. Chapman; 1♂ (RMNH), Buranen. **Mindoro:** *3♀♀ (RMNH), Calapan, 25.viii.1952, Townes family [same locality as that of the holotype of *Ropalidia flavopicta flavobrunnea*]; *2♀♀ (RMNH), San Jose, 19.iv.1953, H. Townes; *1♀ (RMNH), Alcate, Vict., 7-8.iv.1954, H., M. & D. Townes; *2♀♀ (RMNH), S. Luis Calapan, 14-17.iv.1954, H., M. & D. Townes. **Negros:** 1♀ (RMNH), Dumaguete, xi.1917, Bottcher; 3♀♀ (RMNH), 30 km SE Bacolod, 200 m, 12.xi.1990, R. Hensen. **Samar:** 1♀ + 2♂♂ (RMNH), Catbalogan. **Leyte:** 1♀ (AMNH), San Jose, 11.viii.[19]44, E. Ray; 2♀♀ (AMNH), 1 mi. E Tarragona, C.L. Remington. **Mindanao:** 1♂ (RMNH), Surigao, 6-8.ii.[18]64; 1♀ (RMNH), Butuan; 5♂♂ (RMNH), Davao, Panabo, 12.v.1936, L.B. Uchanco [van der Vecht (1962: 59) listed them as "5♀"]; 1♀ (RMNH), Maco Tagum, Davao, 9.x.[19]46, H. Hoogstraal; 1♀ (RMNH), E. slope Mt. Mckinley, Davao Prov., 3300 ft., viii.[19]46, H. Hoogstraal; 2♂♂ (RMNH), same data but 3500 ft; 1♀ (RMNH), same data but 3000-3600 ft, 5.ix.[19]46; 1♀ (RMNH), Tangcolan, Bukidnon, leg. Baker; 1♀ (RMNH), Mainit, E. slope Mt. Apo, 4300 ft. 21.xi.[19]46, H. Hoogstraal; 1♂ (AMNH), Mt. Apo, Galog Riv., 6000 ft, 12.ix, C.S. Clagg; 1♀ (AMNH), same data but 26.ix; 1♀, same data but 19.x, C.F. Clagg; 1♀ (RMNH), Kidapawan, Cotabato, 24.iii.1953, H. Townes; 1♀ + 2♂♂ (RMNH), Pikit, Cotabato, 13.iii.1953, H. Townes; 1♂ (RMNH), same data but 20.iii.1953; 2♂♂ (RMNH), Aroman Exp. St., Cotabato, 11.ix.1952, H. Townes; 2♂♂ (RMNH), Bugasan, Parang, Cotabato Prov., 10.xii.[19]46, F.G. Werner; 1♂ (RMNH), Conel, Buayan, Cotabato Prov., 100 ft., 10.xii.[19]46, H. Hoogstraal; 3♀♀ + 3♂♂ (RMNH), Momumgan [van der Vecht (1961: 59) listed them as "4♀2♂"]; 1♀ + 1♂ (RMNH), Port Banga, Bottcher; 1♂ (RMNH), Lanao, Dansalan, 3600 ft., 27.iv.1936, H. Townes; 1♀ (MNHN), Samboanga, Hombron, 1841.

I previously recognized three subspecies in *R. flavobrunnea* based on the colour pattern and a morphometric character (width of gena): the nominotypical subspecies from Luzon, *R. f. lapiniga* Kojima from Leyte and Samar, and *R. f. iracunda* Kojima from Mindanao (Kojima, 1982). Research on the specimens in RMNH that van der Vecht (1962) studied and on some additional specimens from several places in the Philippines showed that, even if there might be some statistical differences in frequency distributions of colour pattern and some morphometric characters between arbitorarily selected populations, they are rather variable and interconnected. These characters seem to be far from those appropriate for diagnosing taxa and I propose here to sink my two subspecies under the nominate species. Specimens from the places at high elavations in Mindanao tend to be darker, with a black spot on the clypeus reaching the apex of the clypeus.

Ropalidia luzonensis spec. nov.
(figs 98-100, 102-106)

Material.— Holotype, ♀ (RMNH), Philippines, Montalba [probably Montalban, outside Quezon City, Luzon, 14°44'N, 121°07'E; the specimen is listed under *R. flavopicta flavobrunnea* by van der Vecht (1962: 59)].

Female.— Head about 1.15 times as wide as high, in dorsal view slighty more than twice as wide as long, strongly narrowed behing eyes, and rather shallowly emarginate posteriorly, slightly wider than mesosoma including tegulae. Gena in

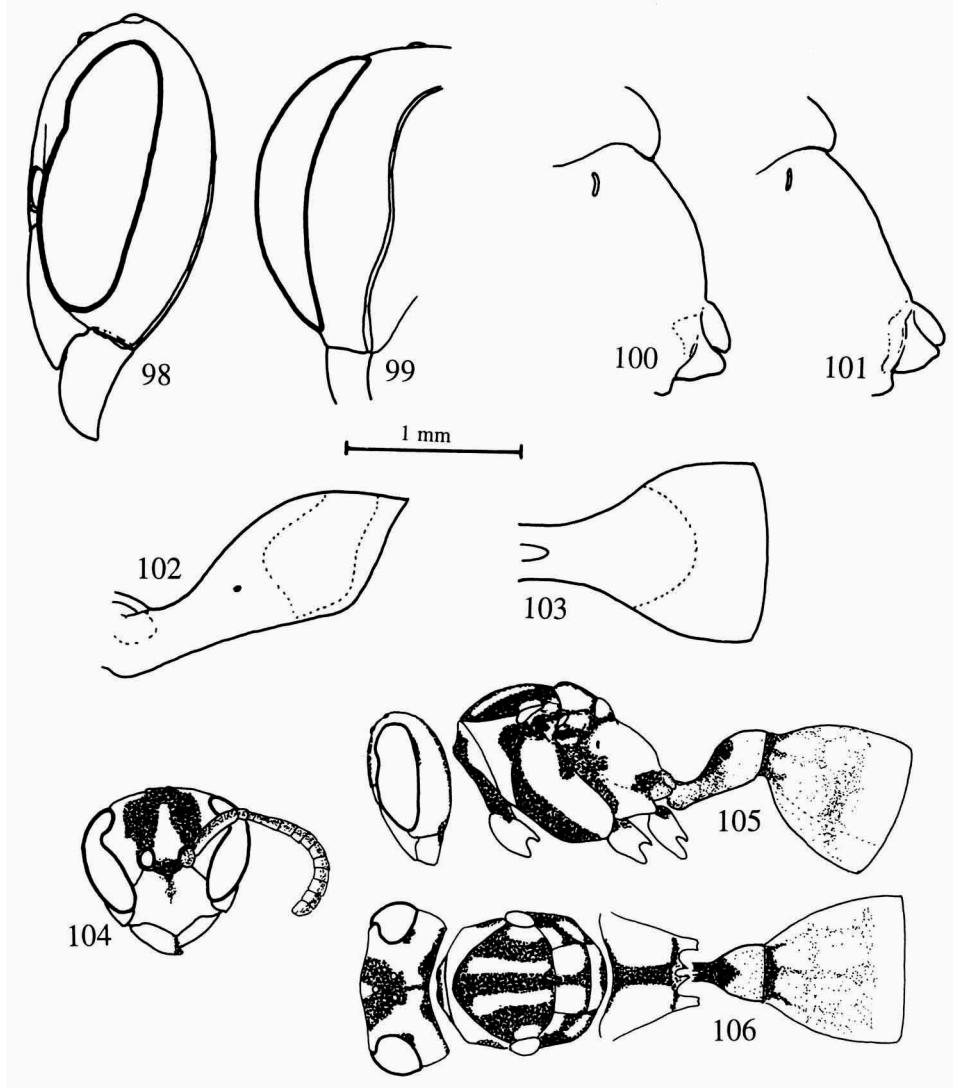
profile about 0.6 times as wide as eye (fig. 98); occipital carina complete, slightly thickened below, in profile smoothly and weakly curved, in posterolateral view sinuate anteriorly at the level near one-third of gena from below (fig. 99). Inner eye margins weakly converging ventrally, about 1.1 times further from each other at vertex than at clypeus. Clypeus pointed below, about 1.3 times as wide as high. Ocelli arranged in equilateral triangle, posterior ocelli about 2.5 times further from inner eye margin than each other, the latter distance slightly larger than their diameter. Antenna weakly swollen apically; scape about four times as long as wide at apex; third segment about 2.5 times as long as wide at apex, slightly longer than the length of the fourth and fifth segments combined; terminal segment slightly shorter than wide at base.

Mesosoma in dorsal view slightly less than 1.5 times as long as wide. Pronotal carina rather strongly raised but not producing over pronotal collar, not sinuate. Propodeum more strongly convex (fig. 100) than in *R. flavobrunnea* (cf. fig. 101), with narrow and deep median concavity; median furrow distinct throughout its length.

First metasomal segment relatively shorter and thicker (figs 102-103) than other Philippine species of the *R. flavopicta*-complex, about 1.5 times as long (measured as a distance between posterior margin of the reception of propodeal muscle and the posterodorsal end of the tergum in profile) as wide; in dorsal view rather strongly swollen after short basal petiolar part, then nearly parallel-sided in posterior one-third, about three times as wide at apex as at basal petiolar part; in profile dorsal face rising after a short distance from reception of propodeal muscle, smoothly and weakly curved (fig. 102). Second metasomal segment about as long as wide, wider than high; posterior margin with narrow, depressed lamella; suture between tergum and sternum indistinct; articulation of tergum smoothly passing into "neck" in the middle, margined with slight truncation on each lateral side.

Body dull, covered with rather dense, short appressed tomentum and sparse suberect hairs; eye bare; apical part of clypeus and posterior margin of metanotum polished. Clypeus with scattered, ill-defined, shallow punctures; frons with shallow, but rather dense punctures, which have distinct central postules; vertex and gena with scattered, small, and ill-defined punctures. Pronotum, scutum and scutellum with punctures similar to those on frons; metanotum with remore punctures anteriorly, unpunctured posteriorly; mesepisternum without epicnemial carina, with punctures posteriorly, and unpunctured anteriorly, border between punctured and unpunctured areas indistinct; metapleura with ill-defined, weak striae above; propodeum, except median concavity, with ill-defined, fine oblique striae. First metasomal tergum with remote, shallow punctures posteriorly; second metasomal segment with sparse, shallow punctures, which are less dense on sternum than on tergum.

Black, but extensively coloured yellow as follows (figs 104-106): mandible except brown teeth, clypeus except ill-defined, narrow, median blackish line, wide band on frons, slightly narrowing above, wide band along inner eye margin, extending dorsally to joint upper extension of the band on gena, gena nearly entirely including lower half of occipital carina; pronotum except dark-brown spots at anterior margin of collar and posterior corners, paired wide median bands and lateral spots beside tegulae on scutum, tegula except outer semitransparent spot, paired large spots on scutellum, anterior transverse band on metanotum, which is broadly emarginate



Figs 98-106, characters of ♀ of *Ropalidia luzonensis* spec. nov. (98-100, 102-106) and *R. flavobrunnea* van der Vecht (101). Figs 98-99, head, lateral (98) and posterolateral view (99); figs 100-101, propodeum, lateral view; fig. 102, first metasomal tergum, lateral view; fig. 103, first metasomal tergum, dorsal view; figs 104-106, marking pattern (104, head, frontal view; 105, head, mesosoma and first two metasomal segments, dorsal view; 106, same, lateral view).

posteromedially, posterior half of mesepisternum, except posterodorsal incisions, large lateral spots on propodeum, each of which is connect with a spot in ventral half of metapleuron, propodeal valvula except semitransparent margin; wide posterior band on first metasomal tergum, extending anteriorly on lateral sides, second metasomal segment, except irregular-shaped dark-brown marking at anterior margin and ill-defined brownish markings; apical bands of third to fifth metasomal segments and most of visible part of sixth segment. Legs brown, with yellow markings as fol-

lows: most of fore coxa, mid and hind coxae, except dorsal dark spots, apical parts of femora, which extend basally on dorsal surface, most of fore tibia and tarsi, upper and inner surfaces of mid tibia.

Note.— This species differs from the species of the *R. flavopicta*-complex as well as from the other species of the *R. flavopicta*-group by its rather strongly convex propodeum (fig. 100), and by the deep and narrow median concavity of the propodeum, which has a distinct median furrow throughout its length.

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