Taxonomic notes on the paper wasps of the genus *Ropalidia* in the Indian subcontinent (Hymenoptera: Vespidae)

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**Abstract**

The taxonomy of *Ropalidia* wasps in the Indian subcontinent is revised, recognizing 26 species in the subcontinent. Their diagnostic characteristics are summarized in a key to species. New synonymies proposed in the present study are: *R. bicolorata shiva* Das and Gupta, 1989 under *R. bicolorata* van der Vecht, 1962; *R. colorata sordida* van der Vecht, 1941 under *R. colorata* van der Vecht, 1941; *R. rodialipa* Lambert and Narendran, 2005 and *R. anupama* Lambert and Narendran, 2005, both under *R. cyathiformis* Fabricius, 1804; *R. jacobsoni flavoscutellata* Das and Gupta, 1989, and *R. bangalorica* Lambert and Narendran, 2005, both under *R. jacobsoni* du Buysson, 1908; *R. travancorica* Lambert and Narendran, 2005, under *R. marginata* Lepeletier, 1836; *R. sridbarani* Lambert and Narendran, 2005, under *R. rufocollaris* Cameron, 1900; *Ropalidia rufoplagiata nursei* van der Vecht, 1941 under *R. rufoplagiata* Cameron, 1905; *Icaria lugubris* Smith, 1858, under *R. sumatrae* Weber, 1801; and a revised synonymy is *Icaria pendula* Smith, 1857, under *R. variegata* Smith, 1852. The new replacement name *Ropalidia kasaragodensis* Lambert and Narendran is proposed for *R. indica* Lambert and Narendran, 2005, non van der Vecht, 1941.

**Key words:** identification key, Polistinae, synonymy.

**INTRODUCTION**

Of somewhat more than 180 *Ropalidia* species currently recognized, 27 species have been recorded from the Indian subcontinent (Pakistan, India, Bangladesh, Nepal, Bhutan, Sri Lanka, and the eastern part of Myanmar), including 16 species so far known to be endemic to the subcontinent (Kojima & Carpenter 1997; Kojima 2006). Because of its well-known historical geology in terms of plate tectonics, the social wasp fauna in the Indian subcontinent is of special interest from the view point of the biogeography of social wasps, especially for the groups occurring in Madagascar, the Indian subcontinent and Australia – that is, eastern elements of the Gondwana. The paper wasp genus *Ropalidia* Guérin-Ménéville, 1831, is one of the two such vespid genera; the other is the cosmopolitan genus *Polistes* Latreille, 1802.

Das and Gupta (1989) made an extensive taxonomic study on the social wasps in the Indian subcontinent and recognized 22 species in *Ropalidia*. Gusenleitner (2001) added *R. sculpturata* from Nepal and *R. tamila* from Tamil Nadu in India (Gusenleitner 2004) to the Indian subcontinent fauna of *Ropalidia*. Recently, Lambert et al. (2005a,b) described six species from India, mainly referring to keys in Das and Gupta (1989). Unfortunately, the key to *Ropalidia* species in Das and Gupta (1989) is at least in part barely workable, because those authors adopted the subgeneric concepts applied by van der Vecht (1941, 1962) and Richards (1978), which often prevents correct identification at the species level (Kojima 1997). In the present paper, we give taxonomic notes on the *Ropalidia* species occurring in the Indian subcontinent, together with a key to species.
MATERIALS AND METHODS
Specimens examined are deposited in the Biologiezentrum des Oberösterreichischen Landesmuseums, Linz, Austria (BOLM), the Department of Zoology, University of Calicut, Kerala, India (DZUC), Malabar Christian College (MCC), Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA (MCZ), Nationaal Naturhistorisch Museum, Leiden, the Netherlands (RMNH), Natural History Collection, Ibaraki University, Mito, Japan (IUNH), US National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (USNM), and Western Ghats Regional Station, Zoological Survey of India, Kozhikode, India (ZSIK).

Abbreviations of collector names are as follows: L. K., Lambert Kishore; P. S. N., P. S. Nathan; K. V. K., Karl Von Krombein; J. C. B., J. C. Bridwell.

Morphological and color characters were observed on pinned specimens under a stereoscopic dissecting microscope. The following morphometric characters and views of observation are often ill-defined in the literature. In the present study they are defined as follows: widths of eyes and gena are measured as the maximum for each in strictly lateral view of the head; length of first metasomal tergum is measured in lateral view as distance from the posterior end of the basal slit for the reception of the metasomal suspensory ligament to the posterodorsal end of the tergum; “dorsal view of first metasomal tergum” refers to the view perpendicular to the dorsal face of the posterior widened part of the tergum.

KEY TO ROPALIDIA SPECIES OF THE INDIAN SUBCONTINENT
The present key is applicable to both females and males unless the sex is specified. Color characteristics are also used for some species, but they may not be applicable to some local forms occurring outside the Indian subcontinent.

1 Propodeum with paired, longitudinal, basal carinae (Figs 23–25); propodeal orifice very narrow (Fig. 28) .............2. R. marginata species group
   – Propodeum without such carinae (Figs 26, 27); propodeal orifice wider, more or less rounded dorsally (Figs 26, 27) ..........................6

2 Propodeum with strong punctures between basal carinae; striations lateral to carinae strong (Fig. 25).
   Second metasomal segment entirely black or dark reddish-brown, but often with yellow or brownish-yellow apical band; the yellow band, if present, narrow and not swollen anteriorly in lateral sides of the tergum, or faint and interrupted ............3
   – Propodeum with week transverse striation and scattered shallow punctures between basal carinae; striation lateral to carinae weak (Figs 23, 24). Second metasomal segment reddish-brown to brown, with distinct yellow apical band usually swollen anteriorly on lateral sides of the tergum .............4

3 Body larger; body length (head + mesosoma + first two metasomal segments) more than 15 mm; forewing length more than 12 mm. Posterolateral corner or propodeum with thin lamella absent (Fig. 29).
   First metasomal tergum in lateral view strongly swollen dorsally behind level of spiracle and highest before level of posterior margin of the sternum (Fig. 29). Male antennal flagellum with distinct tyloids, serrated beneath; terminal flagellomere curved, with apex not sharply pointed (see Gusenleitner 2004: Fig. 1) .......................................................... R. magnamina van der Vecht, 1941
   – Body smaller; body length less than 14 mm; forewing length less than 11 mm. Propodeum with each posterolateral corner raised into thin lamella (Figs 25, 30). First tergum in lateral view more or less gradually swollen dorsally toward level of posterior margin of the sternum (Fig. 30). Male antennal flagellum with tyloids modified into flat plates, not serrated beneath; terminal flagellomere curved, sharply pointed apically (Figs 1, 2; also see Gusenleitner 2004: fig. 2) .................................................. R. tamila Gusenleitner, 2004

4 Yellow apical band of second tergum narrow, with its width approximately or less than one-fifth length of the tergum (Figs 31, 32; possibly applicable only to Indian subcontinent populations) ............. R. marginata (Lepeletier, 1836)
   – Yellow apical band of second tergum wide, with its width near the middle more than one-fourth length of the tergum (Figs 33, 34) ............5

5 First metasomal tergum proportionally slender (Figs 33, 34), with its maximum width in dorsal view approximately 0.4-fold as wide as that of second tergum (Fig. 34). Male terminal antennal flagellum strongly curved, blunt apically, approximately threefold as long as its basal width (Fig. 5). Aedeagus of male genitalia broadly spatulate apically (see van der Vecht 1962: fig. I.a) ... R. spatulata van der Vecht, 1962
   – First metasomal tergum proportionally wider (Figs 35, 36), with its maximum width in dorsal view nearly half as wide as that of second tergum. Male
terminal antennal flagellomere less strongly curved and bluntly pointed at apex, approximately twofold as long as its basal width (Fig. 4). Aedeagus not spatulate apically.......................... R. brevita Das and Gupta, 1989
6 Basal angle of second submarginal cell distinctly less than 90° (Figs 18, 19)........7 R. stigma species group
- Basal angle of second submarginal cell larger than 90° (Figs 20–22)..............................13
7 Propodeum with median depression distinct and reticulately punctured; lateral sides of propodeum also reticulately punctured.........................8
- Propodeum barely punctured, only finely, transversely striate; posterior face barely depressed medially or if depressed, only as fine median furrow...........................9
8 Female gena narrow, in lateral view about half as wide as eye (Fig. 11); female antenna with first
flagellomere more than threefold as long as its apical width (Fig. 6) ........... R. kasaragodensis Lambert and Narendran, nom. nov.

- Female gena wider, in lateral view distinctly more than half as wide as eye; female antenna with first flagellomere distinctly less than threefold as long as its apical width (Fig. 7)................................

..... R. birmanica van der Vecht, 1941, R. santoshae Das and Gupta, 1989, R. sculpturata Gusenleitner 2001. (For taxonomic status of these three taxa, see the comments for each species.)

9 Suture between second tergum and sternum indistinct except in posterior margin (Fig. 41) ...................................... R. hongkongensis de Saussure, 1854

- Suture between second tergum and sternum distinct throughout the segment (Figs 42, 43) .................. 10

10 Female gena as wide as eye. Second metasomal tergum in dorsal view gradually swollen posteriorly in anterior one-third (Fig. 45). First tergum brown, except for black basal half; second tergum with paired, anterolateral, yellow spots ................ R. nigrita Das and Gupta, 1989

- Female gena narrower than eye. Second tergum in dorsal view gradually swollen posteriorly in anterior two-thirds (Fig. 44) .................................. 11

11 Female antenna slender; first flagellomere more than threefold as long as its apical width (Fig. 8); second flagellomere longer than wide; terminal flagellomere distinctly longer than its basal width. First tergum more than 2.6-fold as long as wide ........................................................ R. rufocollaris (Cameron, 1900)

- Female antenna thicker; first flagellomere nearly threefold as long as its apical width; second as long as wide; terminal slightly longer than its basal width. First metasomal segment less than 2.4-fold as long as wide .................................................. 12
12 Ventral metapleuron smooth, without punctures.
   ...........................................R. stigma (Smith, 1858)
   – Ventral metapleuron sparsely, shallowly punctured
      ........................................R. mathematica (Smith, 1860)

13 Ventral corner of pronotum obliquely cut off (Fig. 14). First tergum abruptly swollen
dorsally near posterior margin of basal slit to receive metasomal suspensory ligament
(Fig. 46). ............R. rufoplagiata (Cameron, 1905)
   – Ventral corner of pronotum gradually narrowed ventrally (Figs 15–17). First tergum in lateral view
gradually swollen posteriorly (Figs 47–50,52, 54–56,58,60).................................14

14 Forewing with two submarginal cells (Fig. 22).
   Mesosoma black, with pronotum, scutellum and metanotum mostly red..............................
   .........................R. bicolorata van der Vecht, 1962
   – Forewing with three submarginal cells (Figs 20,21)......................................................15

15 Propodeal valvula large, semicircular or broadly rounded-triangle in outline, in lateral view covering
   most part of propodeal teeth forming propodeal orifice (Figs 47,48,50) .............................16
   – Propodeal valvula small, in lateral view barely covering propodeal teeth forming propodeal orifice
      (Figs 55,56)..................................................................................................................19

16 Posterior margin of head in dorsal view broadly and shallowly emarginate medially (Fig. 12). Pronotal
carina barely sinuate backward at humeral angle (Fig. 15). Propodeal valvula large, nearly circular
(Fig. 50). First metasomal segment long, with posterior widened part of the tergum in dorsal view more
or less gradually swollen posteriorly, then narrowed again near apical margin (Figs 51,53)..............
   ......................................................17, R. fasciata species group
   – Posterior margin of head in dorsal view barely emarginate medially (Fig. 13). Pronotal carina strongly
      sinuate backward at humeral angle (Fig. 16). Propodeal valvula rounded-triangle (Figs 47,48). First
      metasomal segment short, with posterior widened part of the tergum in dorsal view gradually swollen
      toward apical margin, or parallel-sided or only
slightly narrowed near posterior margin

18, *R. variegata* species group

17 Second metasomal segment obliquely cut off at posterior end, with tergum longer than sternum (Fig. 50)............... *R. fasciata* (Fabricius, 1804)

- Second metasomal segment vertically cut off, with tergum and sternum nearly equal in length (Fig. 52) .............................................

18 Median furrow of propodeum usually indistinct (Fig. 26). First metasomal tergum in lateral view with dorsal margin more or less evenly convex, highest at level of posterior margin of the sternum (Figs 47,48) .............................................

- Median furrow of propodeum usually distinct (Fig. 27). First metasomal tergum in lateral view with dorsal margin more strongly convex in posterior half, highest slightly posterior to level of posterior margin of the sternum (Fig. 49)..............

19 Border between punctured posterodorsal area and unpunctured anteroventral area of mesepisternum distinct, often marked by carina. Posterior margin of first metasomal sternum not deeply emarginate..20

- Border between punctured posterodorsal area and unpunctured anteroventral area of mesepisternum indistinct; punctures often extending into anteroventral part, though very sparsely. Posterior margin of first sternum deeply emarginate medially (Figs 57,59) .............................................

20 Small species, body length (head + mesosoma + first two metasomal segments) less than 7.5 mm. First metasomal segment short, in lateral view with dorsal margin arising from posterior margin of basal slit for reception of metasomal suspensory ligament (Fig. 54); second segment in lateral view vertically cut off posteriorly (Fig. 54). Male flagellum with developed tyloids, more or less serrated ventrally; terminal flagellomere weakly curved (Fig. 9). Body largely yellow.....*R. cyathiformis* (Fabricius, 1804)
– Larger species, body length more than 9 mm. First metasomal tergum in lateral view with dorsal margin arising after some distance from posterior end of basal slit for reception of metasomal suspensory ligament (Fig. 55); second segment in lateral view obliquely cut off posteriorly, with tergum shorter than sternum (Fig. 55). Male flagellum with tyloids of slightly raised longitudinal ridge; terminal flagellomere bullet-shaped (Fig. 55). Body black; first tergum red or orange or black

\[ \text{R. sumatrae (Weber, 1801)} \]

21 Head and mesosoma shiny, with very scattered, indistinct punctures. First metasomal segment relatively short (Fig. 57); dorsal margin of tergum in lateral view arising from posterior end of basal slit for reception of metasomal suspensory ligament (Fig. 56)

\[ \text{R. montana Carl, 1934} \]

– Head and mesosoma dull, with microscopic fine punctures in addition to rather large, shallow, flat-bottomed punctures. First metasomal segment longer (Fig. 59); dorsal margin of tergum in lateral view arising after short distance from posterior end of basal slit for reception of metasomal suspensory ligament (Fig. 58)

\[ \text{R. cyathiformis (Cameron, 1905)} \]

22 Occipital carina strongly widened ventrally, occupying about one-sixth width of gena at widest part (see Kojima 1996)

\[ \text{R. sericea (Cameron, 1905)} \]

23 Punctures on metasoma very shallow, minute and sparse. Clypeus entirely yellow (only sometimes with median black spot); scutum with paired longitudinal yellow bands; second metasomal tergum with large

\[ \text{R. scitula (Carl, 1934)} \]
yellow spot on each lateral side

R. ornaticeps (Cameron, 1900)

– Punctures on metasoma distinct. Clypeus mostly black; scutum entirely black, without yellow spots; second tergum black... R. scitula (Bingham, 1897)

TAXONOMIC NOTES

Ropalidia marginata group

Ropalidia brevita Das and Gupta

Ropalidia spatulata van der Vecht (1962): 9 (partly).

Ropalidia brevita Das and Gupta (1984): 416. Nomen nudum.

Ropalidia brevita Das and Gupta (1989): 110, 121, 163.

das and Gupta (1989) described this species as closely related to R. spatulata and R. marginata. In the morphological characters including the male antenna (see Figures 1–3) and genitalia, R. brevita is similar to R. marginata, while in coloration R. brevita is similar to R. spatulata. These three species certainly co-occur and can be distinguished from each other by the characters referred to in the key. Although the distinction is sometimes unclear, the first metasomal segment of R. brevita tends to be more strongly swollen laterally in the posterior widened part (Fig. 36) than that of R. marginata (Fig. 32) and to have a shorter posterior widened part than that of R. spatulata (Fig. 34).

The late J. van der Vecht recognized the species as a subspecies of R. marginata and may have distributed specimens with his identification label of an unpublished subspecific name to various institutions/museums.

Specimens examined. India: Himachal Pradesh: 9♀ (MCZ), Kooloo (=Kullu), M. M. Carleton; Haryana: 6♀ (MCZ), Amballa, M. M. Carleton; Rajasthan: 2♂ (USNM), Abu; Goa: 6♀ 4♂ (USNM), Morigumao, J. C. B. (2♀, xii.1924; 2♀, vii.1925; 2♀ 4♂, ix.1925); Kerala: 2♀ (USNM), Walayar forest, S. Malabar, 1000 ft., ix.1951, P. S. N.

Distribution. India (Himachal Pradesh, Delhi, Haryana, Rajasthan, Uttar Pradesh, Sikkim, West Bengal, Assam, Orissa, Goa, Karnataka, Kerala).

Ropalidia marginata (Lepeletier)

Epipona marginata Lepeletier (1836): 541.

Icaria jucunda Cameron (1898): 46. Synonymized under Ropalidia marginata (Lepeletier, 1836) by Nguyen et al. (2006): 101.

Icaria pruinosa Cameron (1906): 228. Synonymized under R. marginata jucunda (Cameron, 1898) by van der Vecht (1941): 104.

Ropalidia marginata van der Vecht (1941): 122. Synonymized under Ropalidia marginata (Lepeletier, 1836) by Nguyen et al. (2006): 101.

Ropalidia canaria Cheesman (1952): 3, 19. Synonymized under R. marginata jucunda (Cameron, 1898) by Kojima (2001b): 36, 55.

Ropalidia travancorica Lambert and Narendran, in Lambert et al. (2005b): 273–275. Syn. nov.

Represented by several geographic color forms, R. marginata is distributed widely from Pakistan in the west, to New Guinea and Queensland in Australia, and some Pacific islands in the east. In the eastern part of the Lesser Sunda Islands and the southern part of Moluccas, R. marginata is replaced by the closely related species, R. laticinta van der Vecht, 1962, which co-occurs with R. marginata in the western part of the Lesser Sunda Islands (Kojima et al. 2007). In the southern part of Myanmar, a local color form currently treated as a formally named subspecies of R. marginata, rufitarsis van der Vecht, 1941, is distributed, which, however, may eventually be revealed to be a local color variation of R. spatulata (see Nguyen et al. 2006).

Lambert and Narendran (in Lambert et al. 2005b) described R. travancorica based on a single female from Travancore in Kerala in the subgenus “Icarielia,” and referring to Das and Gupta (1989), compared the species with R. scitula but without seeing any specimens of R. scitula. Detailed comparison of the holotype of R. travancorica with specimens of nearly all the Oriental species of Ropalidia from various localities has led us to conclude that R. travancorica is a synonym of R. marginata.

Specimens examined. India: Rajasthan: 1♀ 1♂ (USNM), Abu; Karnataka: 5♀ (MCC), Indian Institute of Science Campus, Bangalore, 17.xi.1999, Agrahori; Kerala: 1♀ (holotype of Ropalidia travancorica, ZSIK), labeled “HOLO/TYPE” (circular label, marked with red), “INDIA: Kerala/Thiruvananthapuram/ Palayam Kotta/Coll. Thovali/31.xii.1998” (collection date given in the original description is “3.xii.1998”), “Ropalidia (Icarielia/travancorica sp. n./Det. Narendran T.C. &/Lambert, 2004” and “1781;” 2♀ (MCC), Kasaragod, 5.x.2005, L. K.; 3♀ (USNM), Walayar forest, S. Malabar, 1000 ft., ix.1951, P. S. N.; Maharastra: 1♀ (USNM), Bombay 1924, J. C. B.; Tamil Nadu: 1♂ (USNM), Nedundada, Tanjore, 1.vi, P. S. N.; 2♀ 1♂ (7♀ 1♂, USNM; 15♀, MCZ), Coimbatore, P. S. N. (15♀, v.1948; 3♀ 1♂, ii.1951; 2♀, xi.1950; 2♀, ix.1951). Sri Lanka: Puttalam: 1♀ (USNM), 5.iii.1958, R. L. A. Perera; Matela: 2♀
Taxonomy of Indian *Ropalidia*

*Ropalidia spatulata* van der Vecht (1962): 9; Yamane and Yamane (1979): 4, 6, 32; Das and Gupta (1984): 422; Das and Gupta (1989): 110, 119, 163.

**Specimens examined. India: Kerala:** 10♀ (MCC), Calicut, 30.x.1998, L. K.; 1♀ (MCC), Nilambur, 4.xi.1998, L. K.; 1♀ (MCC), Manjeri, 18.iv.1999, Jobiraj; 1♀ (MCC), Pulpally, 24.iv.1999, L. K.; 1♂, Trissur, 4.x.1999, K. Usha; 1♀, Trivandrum, 10.iii.2000, L. K.; 1♀, Sulthan Battery, 24.v.2000, L. K.; *Tamil Nadu:* 2♀ (MCZ), Coimbatore, xi.1949, P. S. N.; 1♀ (MCZ), Gudalur, Nilgiri Hills, 3500 ft., iv.1949, P. S. N.; *Myanmar:* 5♀ (USNM), Mandalay, H. M. Smith (8.vii.1951; 10.vii.1951; 29.vii.1951; 6.viii.1951; 15.ix.1951)

**Distribution.** Nepal, India (Kerala).

*Ropalidia magnanima* van der Vecht

*Ropalidia magnanima magnanima* van der Vecht (1941): 109, 125; van der Vecht (1962): 9; Das and Gupta (1984): 419; Das and Gupta (1989) 110, 116, 161.

*Ropalidia magnanima albitarsis* van der Vecht (1941): 125; van der Vecht (1962): 9; Das and Gupta (1984): 419; Das and Gupta (1989): 110, 116, 161.

*Ropalidia magnanima anthracina* Das and Gupta (1984): 419. *Nomen nudum*

*Ropalidia magnanima anthracina* Das and Gupta (1989): 110, 115–116, 157, 159, 161.

Three subspecies have been recognized in *R. magnanima*, viz. the nominate subspecies described from Myanmar, *albitarsis* van der Vecht, 1941 from Myanmar and Vietnam, and *anthracina* Das and Gupta, 1989 from Myanmar. They might be color variations, but their subspecific status is tentatively maintained until more material become available to us.

**Specimens examined. India: Kerala:** 1♀ (MCC), Mukka, Kozhikode, 18.v.1982, K. N. Nair; 1♀ (MCC), Kannur, 3.ii.1995, Sureshan.

**Distribution.** India (Kerala), Myanmar, Vietnam.

*Ropalidia tamila* Gusenleitner

*Ropalidia tamila* Gusenleitner (2004): 1089.

**Specimens examined. India: Kerala:** 2♂ (RMNH), Poonnudi, 900 m, Trivandrum, iv–v.1971, P. S. N.; 1♂ (RMNH), Tenmalai, Travancore, 12–15.v.1937.

**Distribution.** India. (Kerala, Tamil Nadu).
**Ropalidia stigma group**

**Ropalidia birmanica** van der Vecht

*Ropalidia taiwana birmanica* van der Vecht (1962): 23; Das and Gupta (1984): 425; Das and Gupta (1989): 135, 167.

Van der Vecht (1962) treated the specimens from Myanmar as forming a subspecies, *birmanica*, of *R. taiwana* Sonan 1935, based on the observation that they are, in the female “very similar to typical *R. taiwana*, but the second gastral (=metasomal) segment not obliquely cut off at end, as seen in profile,” and in the male “antennae slightly less modified than in typical *taiwana* . . . second gastral segment . . . only slightly obliquely cut off.” Nguyen et al. (2006) referred to four females from Vietnam (two from Sa Pa, Lao Cai Province; one from Pa Co, Mai Chau, Hoa Binh Province; and one from Lam Dong Province). They also recorded “typical” *R. taiwana* from Vietnam and remarked that the four females “5 belong to *birmanica*, which might be raised to species rank” and “this, however, should be ascertained with detailed comparison among specimens from various localities.” The species status of the taxon that we identified as “*birmanica*” seems to be in little doubt based on observations on nests and adult specimens collected in Vietnam (L. T. P. Nguyen et al. unpubl. data, 2006). However, its exact taxonomic status (birmanica or an undescribed species) should be decided only after a detailed comparison of specimens from various localities with the type specimen of *R. taiwana birmanica*.

**Specimens examined.** China: 2♀ (USNM, MCZ), Gang Keu, Fukien, South China, 25.viii.1936, L. Gressitt.

**Ropalidia sculpturata** Gusenleitner

*Ropalidia sculpturata* Gusenleitner (2001): 655.

Gusenleitner (2001), when he described *R. sculpturata*, compared it with a Sulawesian species, *R. crassa* van der Vecht, 1941, and an Indian species, *R. santoshae* Das and Gupta, 1989, without examining specimens of these species. We examined the holotype of *R. sculpturata* and found that it is similar to the specimens that we have identified as *R. birmanica* van der Vecht, 1962, including the shape of the metasoma (Figs 37–40), but it differs from the latter in having the disk of the metaturnum slightly produced at each posterolateral corner and the posterior face of the propodeum more strongly punctured. As mentioned above, however, the exact taxonomic status of *R. sculpturata* should be discussed only after the concept of *R. birmanica* is established.

**Specimens examined.** Nepal: 1♀ (holotype of *R. sculpturata*, BOLM), labeled “NEPAL/ANAPURNA HIMAL/LUMLE/17.-22.06.1999/A. KUDRNA JR., “Biologiezentrum Linz/Austria (LI)/ex Coll. J. Halada/Eigang 2001”, “Ropalidia/sculpturata nov. spec. ♂/J. Gusenleitner, det. 2001/Holotypus”, and “Holotypus” (red square).

**Distribution.** Nepal.

**Ropalidia santoshae** Das and Gupta

*Ropalidia santoshae* Das and Gupta (1984): 422.

*Nomen nudum.*

*Ropalidia santoshae* Das and Gupta (1989): 111, 123, 156–159, 164.

No specimens of this taxon were available in the present study. Judging from the description by Das and Gupta (1989), *R. santoshae* is very similar to *R. birmanica*. However, again, a decision on their taxonomic status needs further detailed comparative study, including observations of the holotypes of both taxa.

**Distribution.** India (Sikkim, Arunachal Pradesh, West Bengal, Meghalaya).

**Ropalidia kasaragodensis** Lambert and Narendran, nom. nov.

*Ropalidia indica* Lambert and Narendran, in Lambert et al. (2005a): 1921. Junior primary homonym of *Ropalidia marginata indica* van der Vecht (1941): 121.

*Ropalidia indica* is preoccupied by *R. marginata indica* van der Vecht, 1941, which was a replacement name of *Vespa ferruginea* Fabricius, 1793, non *Vespa ferruginea* Gmelin, 1790 (=unrecognized species placed in *Crabro* (Sphecidae) by Dalla Torre (1897: 600)).

When they described this species, Lambert and Narendran (in Lambert et al. 2005a) compared the species with *R. rufocollaris* (Cameron, 1900; erroneously cited as “rufocollaris” as in Das & Gupta (1989: 111)). *Ropalidia kasaragodensis* undoubtedly belongs to the *R. stigma* species group, to which *R. rufocollaris* also belongs to. Within the species group, however, *R. kasaragodensis* is closer to *R. birmanica, R. sculpturata* or *R. santoshae* than to *R. rufocollaris* in having the propodeum distinctly punctured and having a distinct median depression. *Ropalidia kasaragodensis* is easily distinguished from these three taxa by the female gena.
very narrow, about half as wide as the eye in lateral view (at least 0.7-fold as wide as eye in R. birmanica, R. sculpturata and R. santoshae).

Specimens examined. 1♀ (holotype, OZNC), labeled “HOLO/TYP” (circular label, margined with red), “INDIA: Kerala/Kasaragod/Coll. K. Gopi/26.i.1994,” “♀ Ropalidia (Anthreneida)/indica sp. nov./Det. Narendran T.C. &/L. Kishore 2004,” and “♀ Ropalidia (Anthreneida)/kasaragodensis nom. nov./Det Lambert &/DET NARENDRAN, T.C./5.vii.2005.”

Distribution. India (Kerala).

Ropalidia mathematica (Smith)

Polybia mathematica Smith (1860): 90.

Icaria nigroplagiata Cameron (1900): 498. Synonymized under Ropalidia mathematica (Smith) by Kojima et al. (2005: 175).

Ropalidia mathematica mathematica; van der Vecht (1941): 110, 130; Das and Gupta (1984): 420; Das and Gupta (1989): 111, 133.

Ropalidia mathematica binotata van der Vecht (1941): 131. Synonymized under Ropalidia mathematica (Smith) by Kojima et al. (2005: 175).

Ropalidia mathematica nigroplagiata; van der Vecht (1941): 104, 132; Das and Gupta (1984): 421; Das and Gupta (1989): 111, 133, 134, 166.

Ropalidia mathematica sumbaensis van der Vecht (1962): 20. Synonymized under Ropalidia mathematica (Smith) by Kojima et al. (2005: 175).

The taxonomy of R. mathematica is detailed in Saito and Kojima (2005) and Kojima et al. (2005).

No specimens from the Indian subcontinent were available to us.

Distribution. India (Utter Pradesh, Meghalaya), Thailand, Vietnam, South China, Hong Kong, Bangka, Java.

Ropalidia hongkongensis (de Saussure)

Icaria hongkongensis de Saussure, 1854, in de Saussure (1853–1858): 239.

Ropalidia hongkongensis hongkongensis; Das and Gupta (1984): 418; Das and Gupta (1989): 111, 132.

Ropalidia hongkongensis juncta van der Vecht (1941): 141; Das and Gupta (1984): 418; Das and Gupta (1989): 132, 166. Synonymized under R. hongkongensis (de Saussure) by Nguyen et al. (2006: 101).
Icaria artifex

Ropalidia artifex

Icaria stigma

Smith (1858): 114; Bingham (1897): 386, Maxwell-Lefroy (1909): 215. Synonymized under Ropalidia stigma (Smith) by Nguyen et al. (2006): 103.

This species was often recorded in the literature under the name “artifex de Saussure,” which may have led Das and Gupta (1989: 125) to list India in the distribution range of Ropalidia artifex (de Saussure, 1853). Ropalidia artifex, however, has never been recorded from the Indian subcontinent.

Specimen examined. India: Goa: 1♂ (USNM), Mormugao, ix.1925, J. C. B.; Kerala: 1♀ (USNM), Walayar Forest, S. Malabar, 1000 ft., vii.1949, P. S. N.; 1♂ (MCC), Calicut University Campus, 10.iii.1999, L. K.; 1♂ (MCC), Calicut, 20.i.2000, L. K.; Sri Lanka: Matale: 2♀ (USNM), Sigiriya, 17.vi.1975, D.H. Messersmith et al.; Kurunegala: 1♂ (USNM), Badagamuwa Jungle, 24–27.i.1975, K. V. K. et al.; Ampara: 1♀ (USNM), Ekgal Aru, 12.vi.1976, K. V. K. et al.; Kandy: 5♀ (USNM), Udawattakele, K. V. K. et al. 1–3.x.1973; 2100 ft., 9–13.ii.1975, 1700 ft., 29–30.v.1976; Sanctu- ary, 8–11.ii.1979; 1600 ft., 18–21.i.1977; 1♀ (USNM), Udawattakele, 14–20.iv.1975, S. & P. B. Karunaratne; 1♀ (USNM), Jambugastenne near Lakspana, 1000 ft., 27.ix.1970, O. S. Flint, Jr.; 1♀ (USNM), Gannorwa Timber Reserve, 4.vi.1976, K. V. K. et al.; 1♀ (USNM), Kandy Reservoir, 29.iii.1975, S. & P. B. Karunaratne; Colombo: 1♀ (USNM), Arakawila Jungle, Padukka, 26.vi.1972, P. B. Karunaratne; 3♀ (USNM), Labugama Reservoir (400 ft., 2–3.x.1976, G. F. Hevel et al.; 1.xii.1976, G. F. Hevel et al.; 2–4.i.1977, K. V. K. et al.); 1♀ (USNM), Gampaha Botanic Garden, 14.i.1977, K. V. K. et al.; Monaragala: 2♀ (USNM), Inginiyagala, D.H. Messersmith et al. 2–3.vi.1972; 1–5.vi.1975; 1♀ (USNM), Angunakolapelessa, 17–19.vi.1978, K. V. K. et al.; Ratnapura: 2♀ (USNM), Sinharaja Jungle, 3 miles south of Weddagala, K. V. K. et al. (8–12.i.1977; 22–23.ix.1977); 2♂ 1♂ (USNM), Gilimale, K. V. K. et al. (♂, 17.vi.1976; ♀, Induruwela, 2.i.1979 & 708.iii.1979); Ugalakalrotota, 23–26.vi.1978, K. V. K. et al.; Galle: 7♀ (USNM), Kaneliya (2♂, 13–13, Baumann & Cross; Udugama, 400 ft., 6–12.x.1973, K. V. K. et al.; 11–16.i.1973, K. V. K. et al.; Hiniduma, 500 ft., 11–12.i.1972, K. V. K.; Mataara: 1♂ (USNM), Enselwatte, 25.v.1975, S. L. Wood & J. L. Petty. Distribution. Nepal, India (Uttar Pradesh, Sikkim, Bihar, West Bengal, Assam, Meghalaya, Manipur, Tripura, Madhya Pradesh, Orissa, Maharashtra, Goa, Kerala), Sri Lanka, Myanmar, Thailand, Malay Peninsula, Vietnam, China (Hainan), Borneo, Sumatra, Java, Bali, Philippine Islands.

Ropalidia plebeja group

Ropalidia rufoplagiata (Cameron)

Icaria rufoplagiata (Cameron) (1905): 71.

Ropalidia rufoplagiata; van der Vecht (1941): 111, 165. Ropalidia rufoplagiata rufoplagiata; van der Vecht (1962): 32; Das and Gupta (1989): 422; Das and Gupta (1989): 112, 137, 168. Ropalidia gravellyi; Dover and Rao (1922): 244. Synony- mized under Ropalidia rufoplagiata (Cameron) by Kojima et al. (2002): 19.

Ropalidia rufoplagiata gravellyi; van der Vecht (1941): 168; Yamane and Yamane (1979): 32; Das and Gupta (1984): 422; (1989): 137, 138, 168. Ropalidia rufoplagiata nursei van der Vecht (1941): 167; Yamane and Yamane (1979): 32; Das and...
Das and Gupta (1989) described *R. andamanensis* based on a single female collected in Port Blair of the Andamans. The species could be a synonym of *R. rufoplagiata*, but a decision on its taxonomic status will be made only after the holotype of *R. andamanensis* is compared with specimens of *R. rufoplagiata* from various localities including the Andamans. For this reason, *R. andamanensis* is not treated in this paper. 

Specimens examined. India: Karnataka: 1♀, 1♂ (IUNH), Bangalore, 27.ii.1991, R. Gadagkar. 

Distribution. India (Uttar Pradesh, Karnataka, Kerala, Maharashtra), Andaman Islands, Myanmar, Thailand, Vietnam, Malay Peninsula, Sumatra, Bangka, Java, Lombok, Sumbawa, Timor.

**Ropalidia bicolorata group**

**Ropalidia bicolorata** van der Vecht 
*Paraicaria bicolor* Gribodo (1892): 249. Secondary junior homonym of *Ropalidia bicolor* (Smith, 1865).

*Ropalidia bicolorata bicolorata* van der Vecht (1962): 38, 39; Das and Gupta (1984): 428; Das and Gupta (1989): 110, 153, 154, 173 (error: “bicolorata shiva” in map 26 should read “bicolorata bicolorata”).

*Ropalidia bicolorata parvula* van der Vecht (1962): 38, 39. Synonymized under *R. bicolorata* van der Vecht, 1962 by Nguyen et al. (2006): 100.

*Ropalidia bicolorata shiva* Das and Gupta, 1984: 428. Nomen nudum.

*Ropalidia bicolorata shiva* Das and Gupta (1989): 153, 154, 173 (error: “bicolorata bicolorata” in map 26 should read “bicolorata shiva”). Syn. nov.

Based on 46 female specimens from the easternmost part of India (Tripura, Assam and Manipur), Das and Gupta (1989) described *R. bicolorata shiva*. In their key to subspecies of *R. bicolorata*, the characters of *R. b. shiva* that distinguish it from the nominate subspecies are “Head and thorax with close and comparatively deeper (close superficial in the nominate subspecies) punctures; sides of propodeum closely but strongly (superficially in the nominate subspecies) rugoso-punctate; fore coxa black or with small yellow mark (black in the nominate subspecies).” At the same time, Das and Gupta (1989) mentioned that the “nominate subspecies was not available for study,” and therefore their comparison with the nominate subspecies seemed to be based only on the description by van der Vecht (1962). Although we have not yet seen any specimens of this species from India, we do not find, based on the description by Das and Gupta (1989), any reason for treating *R. b. shiva* as a diagnosable species. Hence, we propose to synonymize *R. bicolorata shiva* under the nominate species.

No specimens from the Indian subcontinent were available in the present study. 

Specimens examined. Thailand: 3♀ (USNM), Chiang Mai, D. & E. Thurman (2♀, 28.ii.1952; 1♂, 14.x.1951). 

Distribution. India (Assam, Manipur, Tripura), Myanmar, Thailand, China (Yunnan), Vietnam, Borneo.

**Ropalidia fasciata group**

**Ropalidia fasciata** (Fabricius) 
*Eumenes fasciata* Fabricius (1804): 290. 
*Polistes bioculata* Fabricius (1804): 278. Synonymized under *Ropaidia fasciata* (Fabricius) by Kojima (2001a: 8).

*Icaria picta* de Saussure, 1854, in de Saussure (1853–1858): 238. Synonymized under *Ropaidia fasciata* (Fabricius) by van der Vecht (1959: 245).

*Icaria maculifrons* Cameron (1903): 172. Synonymized under *Ropaidia picta* (de Saussure) by van der Vecht (1941: 104).

*Icaria intermedia* Cameron (1905): 70. Synonymized under *Ropaidia picta* (de Saussure) by van der Vecht (1941: 104).

*Ropalidia fasciata* Fabricius: van der Vecht (1959): 245; Yamane and Yamane (1979): 4, 10, 32; Das and Gupta (1984): 417; Das and Gupta (1989): 112, 140, 169. 

*Ropalidia faciata* [!] Lambert et al. (2005a): 1921.

*Ropalidia fasciata* is widely distributed from India and Nepal in the east to the Ryukyus, Taiwan, Palawan, Borneo, and the Lesser Sunda Islands in the west. In the areas east of the eastern border of the distribution range of *R. fasciata*, namely, the Philippine Islands (except Palawan), Sulawesi, Maluku, New Guinea and northern part of Australia, the closely related species, *R. impetiosa* (Smith, 1860) is distributed. The two species may be distinguished with certainty only in the male.

Specimens examined. India: Tamil Nadu: 1♀ (USNM), Coimbatore, P. S. N. Sri Lanka: Colombo: Iswetakeiyawa, 0–50 ft., 8.v.1976, K. V. K. et al.;
Ratnapura: 1♀ (USNM), Udawalawa, 5–6.vi.1975, D. H. Messersmith; Monaragala: 1♀ (USNM), Monaragala, 6.vi.1975, S. L. Wood & J. L. Petty.

Distribution. Nepal; India (Uttar Pradesh, Sikkim, Arunachal Pradesh, Assam, Tripura, Maharashitra, Tamil Nadu), Sri Lanka, Myanmar, Thailand, Vietnam, Malay Peninsula, Borneo, Sumatra, Nias, Bangka, Java, Karimun Djawa, Bali, Flores, Timor, South China, Palawan, Taiwan, Ryukyu Islands.

**Ropalidia colorata** van der Vecht

*Ropalidia colorata colorata* van der Vecht (1941): 111, 151; Yamane and Yamane (1979): 32; Das and Gupta (1984): 416; Das and Gupta (1989): 112, 141, 142, 170.

*Ropalidia colorata* var. *sordida* van der Vecht (1941): 154. Syn. nov.

*Ropalidia colorata sordida*; Das and Gupta (1984): 417; (1989): 112, 141, 142, 170.

Van der Vecht (1941) described *sordida* as a variety of *R. colorata* based on a single female from Kooloo (=Kullu, Himachal Pradesh). Judging from the content of his work, van der Vecht certainly proposed the name, “sordida,” for an infrasubspecific entity (see the International Code of Zoological Nomenclature (ICZN), fourth edition, Article 45.6.4). Das and Gupta (1984), without seeing any specimen that has characters agreeing with those of *sordida*, adopted it as a valid name of a subspecies (see ICZN article 45.6.4.1).

Judging from the original description of *sordida*, it would be, as van der Vecht considered, no more than an individual color variation. Thus, we propose to synonymize *R. colorata sordida* under the nominate species. Specimens examined. India: Himachal Pradesh: 2♀ (IUNH), Solan, c. 1500 m, 28–31.x.1978. Distribution. Pakistan (north-western part), India (Himachal Pradesh, Utter Pradesh).

**Ropalidia variegata** group

Distinctions of species in the *R. variegata* group are often difficult and treatments of taxa in this species group largely depend on the species concept on which a given taxonomic system is based. As we have worked with the species in this species group distributed in other areas (Kojima et al. 2005; Saito & Kojima 2005), the taxa in the Indian subcontinent are discussed based on the phylogenetic species concept elaborated by Nixon and Wheeler (1990) and Wheeler and Platnick (2000).

In the Indian subcontinent, two species of this seccies group are recognized; *R. variegata* (Smith, 1852) and *R. jacobsoni* (du Buysson, 1908). Das and Gupta (1989) distinguished the two species by the “median line of median furrow” (=median line of the propodeum not distinct” in *R. variegata* while “distinct” in *R. jacobsoni*, “temple (=gena) as wide as eye in profile” in *R. variegata* while “narrower than eye” in *R. jacobsoni*, and by the the shape of the aedeagus. The condition of the median furrow of the propodeum may differ between the species, but the distinction is often difficult. The female specimens we examined had their gena always narrower than the eye, about 0.65–0.7-fold as wide as the eye. We were unable to recognize any distinct difference in the male genitalia between the species, even in the figures given in Das and Gupta (1989). Detailed comparison of the morphology among the specimens from various places (specimens from the localities other than in the Indian subcontinent are not listed) revealed that the two species can be distinguished by the shape of the first metasomal tergum as given in the key.

**Ropalidia jacobsoni** (du Buysson)

*Icaria jacobsoni* du Buysson (1908): 123.

*Ropalidia jacobsoni jacobsoni*; Das and Gupta (1984): 418; Das and Gupta (1989): 113, 146, 171.

*Ropalidia jacobsoni flavoscutellata*; Das and Gupta (1989): 146, 147, 160, 171. Syn. nov.

*Ropalidia bangalorica* Lambert and Narendran, in Lambert et al. (2005a): 1920. Syn. nov.

Based on the examination of specimens from various localities, we reached the conclusion that *R. jacobsoni flavoscutellata* described by Das and Gupta (1989) based on three females and three males from Assam is no more than a local (or even within-population) color variation and propose to synonymize it under the nominate species.

When Lambert and Narendran (in Lambert et al. 2005a) described *R. bangalorica* based on a single female from Bangalore, they compared it with *R. fasciata*, referring to the key in Das and Gupta (1989). Reexamination of the holotype of *R. bangalorica* did not reveal any significant differences that allow us to conclude *R. bangalorica* and *R. jacobsoni* belong to different species. Herewith we propose to synonymize *R. bangalorica* under *R. jacobsoni*.

Specimens examined. India: Maharashtra: 2♀ (USNM), Bombay (ix.1924, J. C. B.; 1.x.1924); Goa: 1♀ (USNM), Mormugao, ix.1926, J. C. B.; Karnataka: 1♀ (holotype of *R. bangalorica*, OZNC), labeled “HOLO/TYYP” (circular label, margined with red),
Ropalidia variegata (Smith)  
Epipona variegata Smith (1852): 48.  
Icaria variegata; de Saussure (1854, in de Saussure 1853–1858): 237, pl. 4, figure 3a; Horne (1870): 169, pl. 20 figures 8 and 9; Bingham (1897): 386, 388.  
Icaria pendula Smith (1857): 98. Synonymized under Ropalidia variegata (Smith) by van der Vecht (1941). Revised synonymy.  
Ropalidia variegata; Bequaert (1918): 247; Dover and Rao (1922): 244; Dover (1925): 302, (1929): 47; (1931): 257; van der Vecht (1941): 104.  
Ropalidia variegata variegata; van der Vecht (1941): 112, 154; Yamane and Gupta (1984): 425; Das and Gupta (1989): 113, 144, 170.  
Ropalidia pendula; Richards (1978): 58.  
Smith (1857) described Icaria pendula from Bareilly (=Bareilly in Uttar Pradesh) and van der Vecht, on examination of the holotype, synonymized it under R. variegata. Without giving any grounds for treating it as a good species, Richards (1978) listed I. pendula as a species. Following van der Vecht (1941), we propose to treat I. pendula as a synonym of R. variegata.  
Specimens examined. India: Kashmir: 1♀ (USNM), Kalabar, ix.1946, P. S. N.; 1♂ (USNM), Tamil Nadu: 1♀ (USNM), Kurumbagaram, Karikal, 22.v.1946, P. S. N.; 18♀2♂ (MCZ, USNM), Coimbatore, P. S. N. (14♀2♂, MCZ, no date; 4♀, USNM: 31.viii.1946; 5.i.x.1947; viii.1948; i.1953; Kerala: 3♀ (USNM), Walayar Forest, 1000 ft., 8.i.x.1947, P. S. N.  
Distribution. Pakistan, Nepal, India (Kashmir, Punjab, Delhi, Uttar Pradesh, Bihar, West Bengal, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Kerala), Myanmar, Malaya Peninsula, China, Sulawesi.

Ropalidia cyathiformis group

Ropalidia cyathiformis (Fabricius)  
Eumenes cyathiformis Fabricius (1804): 289.  
Icaria ceylonica Cameron (1898): 48; Aiyar (1916): 713. Synonymized under R. cyathiformis (Fabricius, 1804) by van der Vecht (1941: 104).  
Icaria cagayanensis Ashmead (1905): 3. Synonymized under R. cyathiformis (Fabricius, 1804) by van der Vecht (1941).  
Icaria bilineata Cameron (1905): 72. Synonymized under R. cyathiformis (Fabricius, 1804) by van der Vecht (1941).  
Ropalidia cyathiformis; van der Vecht (1941): 104, 112, 158; Yamane and Yamane (1979): 4, 14, 32; Das and Gupta (1984): 416; Das and Gupta (1989): 112, 143, 170.  
Ropalidia rodialipa Lambert and Narendran, in Lambert et al. (2005a): 1922–23. Syn. nov.  
Ropalidia anupama Lambert and Narendran, in Lambert et al. (2005b): 270–273. Syn. nov.  

We examined the holotype and paratype of R. rodialipa and found that they are females but not males as mentioned by Lambert et al. (2005a); in their figures, the antenna was drawn to have 13 articles, with the terminal flagellomere very short (see fig. 12), but in contrast the metastoma was of the female, with six segments. They compared R. rodialipa with R. jacobsoni (du Buysson, 1908); the holotype differs from R. jacobsoni in the characters mentioned by Lambert et al. (2005a) as well as the pronotal carina barely sinuate laterally (in R. jacobsoni, it is strongly sinuate backward on lateral sides). We have not recognized any characteristics allowing us to consider R. rodialipa as distinct from R. cyathiformis.

Lambert and Narendran (in Lambert et al. 2005b) described R. anupama based on three females from Kerala and compared it with R. malaisei van der Vecht, 1962 and R. scitula (Bingham, 1897), both belonging to the R. flavopicta group (Kojima 1996). We have reexamined the holotype of R. anupama and found no significant characteristics that allow us to distinguish R. anupama from R. cyathiformis.

Specimens examined. India: Maharashtra: 1♂ (USNM), Bombay, 23.ix.1924; Goa: 1♀1♂ (USNM), Mormugao, ix.1925, J. C. B.; Kerala: 2♀ (holotype and paratype of R. rodialipa, DZUC), holotype labeled “HOLO/TYPE” (circular, with red margin), “INDIA: Kerala/Elathur/Steedhan/19.viii.2000”, “♀ Ropalidia (Anthreneida)/radialipa sp. nov./Det. Narendran T. C. &/L. Kishore, 2004”, and “Ropalidia cyathiformis/♀
Ropalidia sumatrae group

Ropalidia sumatrae Weber

Vespa sumatrae Weber (1801): 103.
Vespa mutillata Illiger (1802): 189. Synonymized under Icaria sumatrae (Weber, 1801) by de Saussure (1854, in de Saussure 1853–1858: 241).
Polistes pubescens Fabricius (1804): 279. Synonymized under Icaria sumatrae (Weber, 1801) by de Saussure (1854, in de Saussure 1853–1858: 241).
Eumenes formicaria Fabricius (1804): 288. Synonymized under Icaria speciosa de Saussure, 1855 by Schulz (1912: 88); under Ropalidia sumatrae (Weber, 1801) by van der Vecht (1941: 104).
Anthreneida coronata White (1841): 321. Synonymized under Ropalidia sumatrae (Weber, 1801) by van der Vecht (1941: 104).
Icaria speciosa de Saussure (1855): 374. Synonymized under Ropalidia sumatrae (Weber, 1801) by van der Vecht (1941: 104).
Icaria lugubris (Smith, 1858): 115. Syn. nov.
Icharia [!] marangensis Gribodo (1892): 243. Synonymized under Ropalidia sumatrae (Weber, 1801) by van der Vecht (1941: 104).
Icaria rufigravis Cameron (1904): 121. Synonymized under Icaria speciosa by Meade-Waldo and Morley (1914: 406); under Ropalidia sumatrae (Weber, 1801) by van der Vecht (1941: 104).
Ropalidia sumatrae (van der Vecht (1941): 104), Treubia 18: 104.
Ropalidia sumatrae sumatrae (van der Vecht (1962)): 35, pls. 1 and 3; Das and Gupta (1984): 424; (1989): 112, 136, map 20.
Ropalidia krishna Dover and Rao (1922): 246. Synonymized under Ropalidia lugubris (Smith, 1858) by Dover (1941: 302).
Ropalidia lugubris; Dover (1925): 302; Richards (1978): 57.

Ropalidia sumatrae lugubris; van der Vecht (1941): 104, 185; Yamane and Yamane (1979): 32; Das and Gupta (1984): 425; Das and Gupta (1989): 136, 167.

Van der Vecht (1941) treated R. lugubris as a subspecies of R. sumatrae, mentioning that R. lugubris “is the Bornean representative of R. sumatrae; it differs from the typical form in having the first abdominal (=metasomal) segment black instead of red...in some of the specimens I have seen the first segment is partly red...occurrence of this form in Bengal needs confirmation.” Richards (1978), without mentioning any reason, listed R. lugubris as a good species. Das and Gupta (1989), following the view of van der Vecht, treated it as a subspecies of R. sumatrae and listed the holotype of R. krishna Dover and Rao, 1922, under R. sumatrae lugubris, which is the only the specimen that they examined. They also examined four female specimens from Myanmar and a female specimen from unknown origin that they identified as R. sumatrae sumatrae. They mentioned for R. sumatrae lugubris that its first metasomal segment is “black but sometimes reddish” (although they examined a single specimen) and that it differed from the nominate subspecies in the condition of punctation on the propodeum and second tergum. Although no specimens from the Indian continent were available for us, examination of specimens from various localities including Borneo (partly listed below) have led us to synonymize R. lugubris under R. sumatrae.

Specimens examined. Malaysia: 2♀ (USNM), Selangor (Kepong, viii.1949; Ulu Langget, 17.vii.1957, Usamru). Singapore: 4♀♂ (USNM) (1♀, v.1949, N. L. H. Krauss; 1♂, ii.1949, N. L. H. Krauss; 3♀♂ Baker). Borneo: 2♀ (USNM), Muara Kaman, Samarinda, xi.1950, A. M. R. Wagner. Sumatra: 5♀ (MCZ), Pematong Siantar, vi.1937, C. T. & B. B. Brues.

Distribution. India (West Bengal), Myanmar, Thailand, Vietnam, China (Yunnan), Borneo, Bangka, Sumatra.

Ropalidia flavopicta group

Ropalidia montana Carl

Icaria montana Carl (1930): 22. Nomen nudum.
Ropalidia montana Carl (1934): 675, figures 1–6 and 8–13.

Specimens examined. India: Tamil Nadu: 39♀ (MCZ, USNM), Nilgiri Hills, P. S. N. (10♀ (MCZ) 1♂ (USNM), Singara, 3400 ft., v.1948; 1♀ (MCZ), Mungo...
Range, 3800 ft., v.1949; 9♀ (MCZ), Gudalur, 3500 ft., iv.1949; 18♀ (MCZ), Cherangoole (1♀, 3400 ft., vi.1948; 8♂, 3500 ft., iv.1949; 5♀, 3500 ft., x.1950; 4♀, 3500 ft., xi.1950); 2♀ (MCZ), Kurumbagaram, Karikal, v.1950, P. S. N.; 33♀ (USNM), Anamalai Hills, P. S. N. (1♀, 4–5 ix.1946; 2♀, ix.1946; 3♀, 21 vi.1946; 1♀, 28 vi.1946; 24♀, 3100 ft., v.1951; 1♀, 4–5000 ft., 28 vi.1946; 1♀, Cinchana, 1050 m) iv.1956.

**Distribution.** India (Kerala, Karnataka, Tamil Nadu).

**Ropalidia ornaticeps** (Cameron)

*Icaria ornaticeps* Cameron (1900): 496.

*Ropalidia flavopicta ornaticeps* van der Vecht (1962): 49; Yamane and Yamane (1979): 32; Das and Gupta (1984): 427; Das and Gupta (1989): 150, 151, 172.

*Ropalidia ornaticeps*; Yoshikawa et al. (1969): 167, pl. 51; Kojima (1996): 325, 326, 336.

The taxonomy of *Ropalidia flavopicta* (Smith, 1857) and its closely related species, including *R. ornaticeps*, was revised by Kojima (1996). No specimens from the Indian subcontinent were available to us.

**Distribution.** India (Assam, Tripura), Myanmar, Thailand, Cambodia, Vietnam, Malay Peninsula.

**Ropalidia scitula** (Bingham)

*Icaria scitula* Bingham (1897): 387, 392.

*Ropalidia scitula*; van der Vecht (1941): 110, 142; Yamane and Yamane (1979): 32; Das and Gupta (1984): 428; Das and Gupta (1989): 113, 152, 172.

This species has so far been recorded from north-eastern India and northern Myanmar. Northern Thailand is newly added for its distribution range.

**Specimens examined.** India: Arunachal Pradesh: 1♂ (RMNH), Amatulla 1300–2000 ft., Kameng, 23.v.1961, F. Schmid. Thailand: 1♀ (USNM), Chengmai, 24 vi.1936, C. Tongyai.

**Distribution.** India (Arunachal Pradesh, Sikkim, West Bengal, Meghalaya), Myanmar, Thailand (new record).

**Ropalidia sericea** (Cameron)

*Icaria sericea* Cameron (1905): 73; Aiyar (1916): 714.

*Ropalidia sericea*; Richards (1978): 57.

Since the original description of *Icaria sericea*, based on the single specimen, no additional specimens have been collected for this species (see Kojima 1996).

**Distribution.** India (Sikkim).

**DISTRIBUTION PATTERN OF ROPALIDIA SPECIES IN THE INDIAN SUBCONTINENT**

In total 26 species of *Ropalidia* are currently recognized to occur in the Indian subcontinent. They can be divided into the following five groups in terms of their distribution patterns:

1) **Species endemic to the Indian subcontinent.**

The following ten species may be categorized in this group with regards to their distribution patterns, and they could be further divided into three subgroups with reference both to the mode of colony foundation (independent founding, in which a colony is founded by inseminated female(s) without aid of workers; swarm founding, in which a colony is founded by workers and associated queens) and phylogentic relationships with the species categorized into other distribution-pattern-based groups.

1–1) Independent founding, phylogenetically related to the species with wide distribution ranges.

This subgroup includes three species: *R. brevita*, *R. spatulata* and *R. colorata*. The first two species are closely related to each other and to *R. marginata*, the related species with a wide distribution range; and *R. colorata* is closely related to *R. fasciata*, which has a wide distribution range.

1–2) Independent-founding species, phylogenetically related to the species that occur from the Indian subcontinent to the northern part of Indochina along the eastern slope of Himalaya.

This subgroup consists of four species: one is *R. tamila*, which is undoubtedly closely related to *R. mag-nanima*; and the remaining three species are *R. santoshae*, *R. sculpturata* and *R. kasaragodensis*, all of which are in the *R. stigma* group and are closely related to each other and to *R. birmanica*, which is related to *R. taiwana* distributed from North Myanmar through Vietnam and South China to Taiwan.

1–3) Swarm-founding species.

*Ropalidia montana*, *R. scitula* and *R. sericea* may belong to this subgroup. The former species is distributed in the southern part of India, where the species may be swarm-founders judging from their morphologi-
cal similarities to the species that are known to be swarm-founders; these two species are known only from the north-eastern part of the Indochinese subcontinent (R. scitula is known also from northern Thailand).

2) Species occurring from the Indian subcontinent in the west to the north part of Indochina and/or South China in the east along the eastern slope of Himalaya.

Ropalidia magnanima of the R. marginata groups and three species of the R. stigma group (R. birmanica, R. nigrita, and R. rufocollaris) belong to this group.

3) Species distributed from the north-eastern part of the India subcontinent to Indochina and the Malay Peninsula.

Only R. ornaticeps could be categorized in this group. The species belongs to the R. flavopicta group and may closely related to R. flavopicta (Smith, 1887), which occurs in South China, Vietnam, Malay Pensular, Borneo and Sumatra.

4) Species distributed widely from the Indian subcontinent to the Sunda Islands.

All of the ten species categorized in this distribution-pattern-based group except R. bicolorata and R. sumatra are evidently independent founders. Ropalidia bicolorata and R. sumatra may be swarm founders, but details of their colony founding modes are yet unknown. Of the ten species, three species (R. mathematica, R. hongkongensis, R. stigma) belong to a phylogenetically defined group, the R. stigma group, and two species (R. jacobsoni, R. variegata) belong to the R. variegata group. The other species in these two species groups are known to occur in Australia but not in New Guinea. Ropalidia rufoplagiata belongs to the R. plebeja group and R. fasciata to the R. fasciata group; other species of both species group are known to occur in Sulawesi, New Guinea and northern part of Australia. The remaining three species, R. bicolorata, R. cyathiformis and R. sumatrae, may not have any closely related species that are known from New Guinea or Australia.

5) Species occurring widely from the Indian subcontinent to Australia and Pacific islands.

Only R. marginata is included in this group.

As far as we know, the species in the R. flavopicta group, including R. montana and R. ornaticeps, are all swarm founders, which may use a chemical trail pheromone when they migrate a new nesting site in a swarm of workers and queens (Jeanne 1991; Kojima 1994) and thus may barely disperse across large water bodies such as channels and wide rivers. The swarm-founding Ropalidia wasps of the R. flavopicta group are distributed from the Indian subcontinent to New Guinea and north-eastern part of Australia, but they are absent in Sulawesi, Moluccas and the eastern part of the Lesser Sunda Islands. Such a disjunct distribution pattern would strongly suggest their Gondwana origin and eastward dispersal into the Sunda Islands from the Asian continent (see also Kojima et al. 2005, 2007).

Similar disjunct distribution patterns are found in the R. marginata group, R. stigma group, R. variegata group and R. plebeja group. These four species groups are distributed from the Indian subcontinent to the northern Australia (and further eastward to Pacific Islands in the R. marginata group); no species of the R. marginata group has yet recorded from Halmahera (Kojima et al. 2005) and no species of the R. stigma group and R. variegata group from Halmahera and New Guinea (Saito & Kojima 2005), and no species of the R. plebeja group has yet been recorded from Moluccas (Kojima et al. 2005). An assumption of the Gondwana origin and subsequent eastward dispersal to the Sunda Islands from the continental Asia seems to be widely applicable to Indo-Australian species of Ropalidia.

Phylogenetic analyses in the genus and within species groups are, however, required to test this kind of biogeographic assumption. Furthermore the Gondwana origin hypothesis may explain little about the distribution pattern of species groups which include species occurring only in the Indian subcontinent and South-East Asia, such as R. sumatrae group and R. bicolorata group. Again, a detailed phylogeny at species level is required as a reference for further discussion on the biogeography of Indo-Australian Ropalidia.

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