THE INDO-AUSTRALIAN SPECIES OF THE GENUS ROPALIDIA (ICARIA) (HYMENOPTERA, VESPIDAE) (SECOND PART)

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CONTENTS

The present paper is to be regarded as a continuation of a revision of the Indo-Australian species of the genus *Ropalidia* Guérin (= *Icaria* Saussure), the first part of which was published in Java (van der Vecht, 1941), a few months before the outbreak of the war in the Pacific. That part dealt with the morphology and the distribution of the species which are distinguished by having a more or less distinct raised carina separating the anterior and the lateral areas of the mesepisternum ("mesopleura"). It was my intention to publish supplementary notes on the bionomics of these species, together with a revision of the remaining species, in a second part, but war conditions made this plan fall through. Owing to various circumstances, the work on this subject was not resumed until recently.

In the following pages I have first brought together some additional information on the previously discussed species (subgenus *Anthreneida* White). Unfortunately this chapter is very fragmentary, mainly because the greater part of my collection of nests together with the accompanying notes was lost during the war. Then follows a discussion of the Oriental species that have not been treated by me in 1941. They belong to two groups: (a) *Paraicaria* Gribodo, originally described as a genus, but here regarded as a subgenus of *Ropalidia*, with two species, and (b) *Icarielia* Dalla Torre, a subgenus which in the Oriental region is represented by at least eight species.

Species without a raised carina on the mesepisternum ("mesopleura") are relatively rare in the Oriental region, but they are more numerous and rather strongly diversiform in New Guinea and neighbouring islands. It is my intention to discuss the species of this area in a future paper.

It is recognized that the classification hitherto used is conservative, but at this moment it appears practically impossible to split up the genus in a satisfactory manner into a number of smaller genera. It is easy to distinguish certain groups of more or less closely allied species, but such groups appear to be interconnected in various ways by transitional forms. In view of these difficulties I have thought it advisable to postpone further decisions in this field until the morphology and the bionomics of these wasps have been studied more in detail.

The paper is based mainly on the collections of the following museums:
BM = British Museum (Natural History), London.
CAS = California Academy of Sciences, San Francisco.
ETHZ = Entomologisches Institut, Technische Hochschule, Zürich.
IRSNB = Institut Royal des Sciences Naturelles, Brussels.
LEW = Laboratorium voor Entomologie, Wageningen.
MCG = Museo Civico di Storia Naturale, Genoa.
MHNG = Muséum d'Histoire Naturelle, Genève.
ML = Rijksmuseum van Natuurlijke Historie, Leiden.
MP = Muséum National d'Histoire Naturelle, Paris.
MZB = Museum Zoologicum, Bogor, Indonesia.
NMB = Naturhistorisches Museum, Basel.
NMW = Naturhistorisches Museum, Wien.
NRS = Naturhistoriska Riksmuseum, Stockholm.
OUM = Oxford University Museum, Oxford.

In addition to the authorities and hymenopterists of these institutions I am much indebted to Mr. H. T. Pagden, Penang, Malaya, for sending me material from Malaya and for allowing me to publish a series of his photographs as well as several notes communicated to me in correspondence. Dr. Henry K. Townes kindly allowed me to study the material collected by him and his family during their stay in the Philippine Islands in 1952-53.

Subgenus **Anthreneida** White

Anthreneida White, 1841, Ann. Mag. Nat. Hist., ser. 1, vol. 7, p. 321 (genus).
Type species: *Anthreneida coronata* White = *Ropalidia sumatrae* (Weber, 1801).
Icariola Dalla Torre, 1904, Gen. Insect., vol. 19, p. 72 (name for section III in H. de Saussure, 1862, Stett. Ent. Ztg., vol. 23, p. 132) (as a group of *Icaria*).
Type species: *Icaria gregaria* Saussure, 1853 = *Ropalidia gregaria* (Saussure). Designated by Meade-Waldo, 1913, Ann. Mag. Nat. Hist., ser. 8, vol. 11, p. 46.

Icariastrum Dalla Torre, 1904, Gen. Insect., vol. 19, p. 72 (name for Section I of H. de Saussure, 1862, Stett. Ent. Ztg., vol. 23, p. 132) (as a group of *Icaria*).

Type species: *Icaria opulenta* Smith, 1857 = *Ropalidia opulenta* (Smith). Designated by Meade-Waldo, 1913, Ann. Mag. Nat. Hist., ser. 8, vol. 11, p. 46.

The name *Icariastrum* was placed in the synonymy of *Ropalidia* s. str. by Bequaert, 1918, but in my opinion this is not correct. Its type species is so closely allied to *R. sumatrae*, the type of *Anthreneida*, that only the most extreme form of splitting would place these species in different subgenera. On the other hand the type species of *Ropalidia*, the Papuan *R. maculiventris* Guérin, belongs to a widely different group of species. *Icariastrum* is therefore to be regarded as a subjective synonym of *Anthreneida*.

For the moment I shall not attempt to subdivide the species discussed in 1941, and I use the name *Anthreneida* White for this whole group in a subgeneric sense. In the future *R. gregaria* (Saussure) and allied species (*R. fasciata* (F.), *colorata* van der Vecht, *variegata* (Smith), *crassa* van der Vecht and others) will probably prove to be sufficiently distinct to be placed in a separate subgenus *Icariola* Dalla Torre, but at present I am unable to draw a line between this group and the remaining *Anthreneida* species.

Rectification. — In paragraph 3 on p. 105 of Part I of this paper I have erroneously used the term "new names" for some names proposed for species which had previously been misidentified. The correct status of these names appears from the further text, where four of these forms are described as new species (*R. binghami* and *R. magnanima*) or as new subspecies (*R. marginata* subspp. *rufitarsis* and *sundaica*); the name *indica* (l.c., p. 121), however, must be regarded as a replacement name for *Vespa ferruginea* F., 1793, a primary homonym of *Vespa ferruginea* Gmelin, 1790, and of *V. ferruginea* Olivier, 1791. The type of *Ropalidia marginata indica* is therefore the same as that of *Vespa ferruginea* F., and not the specimen from Amballa mentioned as such in my paper.

Unfortunately, examination of the type of *Vespa ferruginea* F. in the Copenhagen Museum has revealed that the current interpretation of this species, dating from the identification by de Saussure, 1853, is incorrect. The typical material in the collection Sehestedt-Lund consists of two brightly ferruginous females which both have a narrow apical band on the second gastral segment. Consequently, *Vespa ferruginea* F. nec Gmelin, nec Olivier, as well as its replacement name *indica* van der Vecht go into the synonymy of *Ropalidia marginata* (Lep.), and the broad-banded Indian form is without a valid name. This form is now recognized by me as a separate species which I have described and named below.

Bionomics. — So far as we know at present, the species of the subgenus *Anthreneida* build open nests, usually consisting of a single comb.

This comb is as a rule constructed in places which are more or less protected against the rain, but I have seen some nests of *R. variegata* built on a completely exposed iron wire. Several species attach the comb to the under side of leaves (*R. fasciata, stigma*-group, *cyathiformis*, etc.) or twigs (*R. variegata*), but sheltered places under overhanging rocks may also be used (*R. marginata*), and *R. malayana* appears to build its linear nest preferably on the under side of an approximately horizontal branch.

The comb may be supported by a single stalk, or additional stalks may be constructed as the nest grows (see the nest of *R. malayana*, pl. 2). In the former case the stalk or petiole of the nest may be situated in or near the centre of the comb (rectinidal nests) or at one end of the comb (laterinidal nests); in *Ropalidia* the nests are probably never so regularly rectinidal as in *Polistes*, and various transitions between the two types of nests occur. In some species (*R. variegata*) the nest consists of only two rows of cells; in *R. fasciata* young nests may consist of two rows, but as a rule further rows are added as the nest increases in size.

In the following pages the structure of the laterinidal nests of certain species has been expressed in a formula, based on the aspect of the nest as seen on the open side of the cells, with the first (petiolate) cell in the top.

The formula gives first the number of cell rows, followed (in brackets) by the total number of cells with a bottom window (see below) + the number of cells without such a window (young cells); the latter numbers are then subdivided in numbers of windowed and young cells in each row, for which purpose the rows are indicated as follows:

p = the row containing the first, petiolate, cell,
l_1 = the first row on the left of p,
l_2 = the second row on the left of p, etc.,
r_1 = the first row on the right of p, etc.

For an example see fig. 2e and p. 25.

The "basal angle" of such a laterinidal nest is the angle between the longitudinal axis of the first (petiolate) cell, and a line along the bottom of the comb.

A peculiar feature of the nest of many (or all?) species of *Ropalidia* is the presence of an irregular "window" in the bottom of the cells which contain, or have contained, pupae. Probably the first to draw attention to this phenomenon was D. Vesey-Fitzgerald (1940), who wrote concerning a nest of the African *Ropalidia tomentosa* (Gerstaecker): "When first constructed the bottom of the cell is entire, but when the larva is approaching full size, or possibly earlier, the bottom of the cell is perforated with a large irregularly circular hole which is "glazed" over with a semi-transparent mem-

brane. The presence or absence of this window in the bottom of the cell at once indicates if any particular, pocket-like, cell is a newly formed one or an old one cut down." The occurrence of similar "windows" in the bottom of full-sized cells is recorded by this author for *Ropalidia nobilis* (Gerstaecker) and *R. cincta* (Lepeletier).

Since neither Vesey-Fitzgerald nor other authors appear to say anything about the origin or the significance of the "windows", the following notes may be of interest.

The mesenteron of the larvae of most aculeate Hymenoptera is closed, the larvae do not defaecate, and not untill pupation takes place are the accumulated digestive wastes (the meconium) removed from the body. In *Polistes* and *Vespa* the meconium remains in the cell when the larva pupates; in cells which are used a second time the bottom is found to contain a brownish mass consisting mainly of firmly packed chitinous particles, which is a sign of previous occupation. In a pupal cell of *Ropalidia,* however, no excrements will be found, and this made me think that they were perhaps removed by the adult wasps through the bottom of the cells. Observations on nests of *R. fasciata* which were kept in a cage for some days, have confirmed these suspicions. Unfortunately the detailed notes made at the time have been lost, but I remember well having seen wasps gnawing at the bottom of some cells which had been closed shortly before, and others carrying the cylindrical faecal pellets (a few millimeters long and perhaps 1-1½ millimeter wide), which seem to be enclosed in a membrane. The actual closing of a window has not been observed, but there can hardly be any doubt that this work is normally carried out by the adult wasps soon after removal of the excrements.

It will be interesting to find out to what extent this remarkable habit occurs among the social Vespidae.

Roubaud (1916) studied the African species *R. cincta* (Lepeletier) and *R. guttatipennis* (Saussure), two species which appear to be closely related to certain Oriental *Anthreneida.* The colonies live on open nests and appear to be founded by a small number of females: "Les associations de femelles fondatrices paraissent fréquentes chez les *Icaria.* J'ai observé assez souvent trois à quatre femelles associées sur des nidifications récentes ne possédant pas encore de larves à un état avancé." A similar conclusion may be drawn from the available data on the nests of certain Oriental species (see below under *R. gregaria, variegata, malayana,* and *sumatrae*). In some cases, however, a colony may be founded by a single female; I remember having observed this a few times for *R. fasciata* in Java, and perhaps the nest of *R. artifex,* var. *fuscata,* described on p. 22, was also entirely built by the

single female observed on it, for the nest was collected at about eleven o'clock and it had been rainy all morning; it was improbable, therefore, that one or more other wasps were out foraging at the time.

According to Roubaud, the colonies of the African *Ropalidia* are polygynous associations in which already a relatively small number of asexual females (workers) may have developed. He wrote: "L'existence d'ouvrières vraies infécondes est certaine chez les *Icaria*. Les femelles stériles sont de taille un peu plus réduite que les femelles fécondes. La dimension des ovarioles chez des *Icaria cincta* nouvellement écloses s'est montrée environ dix fois plus réduite chez les ouvrières que chez les sexuées". Practically nothing is known concerning the development of a worker caste in the Oriental species. In a few species I have observed differences in size which might suggest the existence of a worker caste (see below, under *R. magnanima* and *R. fasciata*), but detailed investigations have not been made.

Roubaud states that the larvae are fed with masticated caterpillars, but perhaps certain other insects are taken as well. Although I have tried a few times to follow *Ropalidia* wasps which seemed to be hunting on foliage I have never seen them attacking their prey.

Ropalidia binghami binghami van der Vecht

Ropalidia binghami van der Vecht, 1941, p. 113, ♀ ♂ — Indo-China, Luang Prabang (BM).

Siam: 2 ♀ C. Siam, 150 m, Kwae Noi River Exp., 23 April-May 1946, J. E. Jonkers (ML).

Ropalidia binghami wegneri subsp. n.

♀ — Similar to typical *binghami*, from which it differs in colour and in the structure of the margin of the second gastral tergite.

A large mark on each side of the clypeus, an elongate spot at the base of the mandibles, and a rather indistinct line at inner orbits (from clypeus to level of upper margin of antennal sockets), pale yellow.

First gastral segment orange-brown, only slightly infuscated in the middle above, second tergite of the same colour, with some ill-defined fuscous markings: a longitudinal band in the middle, from base to near the apex (least pronounced in the middle), and a dark subapical spot on each side, continuous with a subapical band on the sternite; the following segments dark brown, paler at apex. Hind metatarsus brownish with dark apex.

Apical spines longer and less numerous than in typical *binghami*: seen from above there are 6 somewhat irregular long spines, flanked on each side by 3 or 4 short spines; depressed apical margin between the spines

reduced, in the middle forming a few short teeth between the spines. The largest spines are distinctly longer than the second segment of the hind tarsi.

The short pubescence of the body has a brownish tinge.

In coloration this form resembles the Bornean *R. opulenta* (Smith).

Borneo: 1 ♀ East Borneo, Samarinda, 50 m, Muara Kaman, Nov. 1950, A. M. R. Wegner (holotype, ML).

Ropalidia pilosa (Smith)

Ropalidia pilosa (Smith); van der Vecht, 1941, p. 116 (♀ ♂, Celebes; type ♀ OUM).

Celebes: South Celebes, 1 ♀ Sindjai, ex. coll. Leefmans (MA); 1 ♀ Manipi, 750 m, Jan. 1950, C. J. H. Franssen (ML); 1 ♀ 1 ♂ Celebes, 57/101, leg. Wallace (BM), 1 ♂ Celebes and 1 ♂ Makassar ("Mak"), leg. Wallace, both from Mrs. Farren-White (BM).

Ropalidia magnanima magnanima van der Vecht

Ropalidia magnanima van der Vecht, 1941, p. 125, ♂ ♀ — Burma (type, BM); Tenasserim.

Burma: 1 ♀ or ♀, Rangoon, June 1887, coll. Bingham (BM; a small specimen, measuring only about 15 mm to end of second gastral segment); 2 ♀ Palon, Pegù, Aug.-Sept. 1887, L. Fea (MCG).

Tenasserim: 1 ♀ Ataran Valley, April 1894, C. T. Bingham (BM; "*Icaria guttatipennis* Saussure", det. Bingham; large specimen, measuring 19 mm to end of second gastral segment).

Ropalidia magnanima albitarsis van der Vecht

Ropalidia magnanima albitarsis van der Vecht, 1941, p. 125, ♀ — Tenasserim (type, BM); Indo-China.

Indo-China: 1 ♀ without precise locality, leg. Vitalis de Salvaza, Mme A. Vuillet, 1920 (MP).

This form shows a remarkable resemblance in colour pattern with a species of *Polistes* occurring in Indo-China and Siam.

Ropalidia spatulata spec. n.

(fig. 1, a, d-f)

Icaria ferruginea (F.); de Saussure, 1853, Ét. Fam Vesp., vol. 2, p. 38, ♀, pl. 5 fig. 6 [misidentification; not *V. ferruginea* F.].

Ropalidia marginata subsp. *indica* van der Vecht, 1941, p. 121 (new name for *Vespa ferruginea* Fabricius, 1793, nec *V. ferruginea* Gmelin, 1790, nec *Icaria ferruginea* auctt.).

In 1941 I accepted de Saussure's identification of *Vespa ferruginea* Fabricius (an invalid homonym of *Vespa ferruginea* Gmelin, 1790), but a recent examination of Fabricius's types has shown that these are both

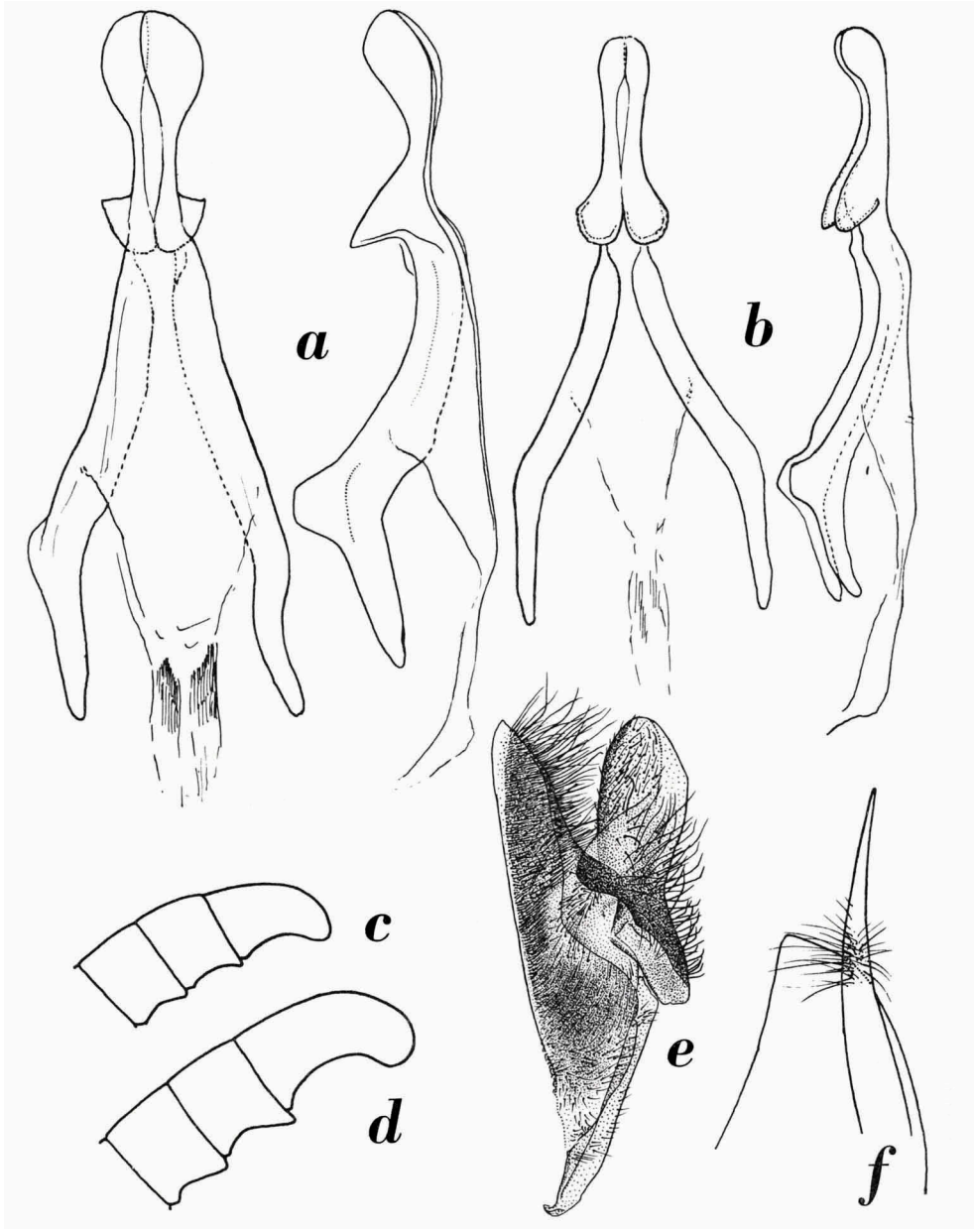

Fig. 1. a: *Ropalidia spatulata* sp. n., India, dorsal and lateral view of aedeagus of male; b: *R. marginata marginata*, India, ventral view of aedeagus of male, and *R. marginata sundaica*, Borneo, lateral view (slightly on ventral side) of aedeagus of male; c: *R. marginata marginata*, ultimate antennal segments of male; d: *R. spatulata*, do.; e: *R. spatulata*, volsella of male; f: *R. spatulata*, apex of paramere (parameral spine with tuft of hairs).

identical with typical *R. marginata* (Lepeletier). The broad-banded form which was figured by de Saussure (1853) and by Bingham (1897) thus appears to have no valid name. As I regard it now as specifically different from *R. marginata*, it is described here as a new species.

♂ — Ultimate antennal segment (fig. 1d) strongly curved, more than twice as long as its width in the middle. Aedeagus of genitalia broadly spatulate at tip (fig. 1a), angularly dilated at some distance from the tip, here strikingly different from the aedeagus of *R. marginata*.

Colour pattern as in typical *R. marginata* (Lep.), but the apical band of the second gastral segment as a rule laterally as wide as half the length of the segment.

The female agrees in colour pattern with the male, but I have been unable to find structural characters separating it from *R. marginata*. The temples are usually slightly wider than in that species, but their width appears to vary a little.

The holotype is a male from S. India, Kerala State, Walayar Forest, 700 ft., Oct. 1959, leg. P. S. Nathan (ML); the other specimens recorded below are paratypes.

Pakistan: 9 ♀ Karachi, 25 Jan. 1934, R. Malaise (NRS; ML); 1 ♀ "Kurrachee, Aug.-Sept., Maindron, 133-96" (MP); 1 ♀ Mauripur, 22 Aug. 1952, L. D. Brongersma (ML).

India: 1 ♀ Bombay Presidence, Matheran or Mahableshwar, I. Newton (BM, 1939-206); Malabar, 3 ♀ 1 ♂ Amarambalam Forest, 500-1500 ft., 20 Sept. 1938, BM-CM Exp. (BM), 2 ♀ 1 ♂ Nadungayam, 200 ft., 16-22 Sept. 1938, BM-CM Exp. (BM); 1 ♀ Madras, coll. Gribodo (MCG); 28 ♀ 42 ♂ Kerala State, Walayar Forests, Sept. and Oct. 1959, P. S. Nathan (ML); 1 ♀ 1 ♂ Amballa, M. M. Carleton (ML); 2 ♀ Madras, from Staudinger (ML); 1 ♀ Harmogoa, 18-9-29, Harttig vend. (ML); 3 ♀ 1 ♂ Malabar, Deschamps, coll. Magretti (MCG; 1 ♀ ML).

In the specimens from the Walayar Forests the ferruginous parts of the body are slightly darker than in most of the other specimens.

In the shape of the ultimate antennal segment of the male this form agrees with *R. magnanima* m. from Burma. Examination of the male genitalia of the latter may eventually prove these forms to be only subspecifically distinct.

Ropalidia marginata marginata (Lepeletier)

(fig. 1, b, c)

Ropalidia marginata (Lepeletier), typical form; van der Vecht, 1941, p. 120, ♀ ♂ (India and Ceylon).

India: Bombay, 1 ♀ 26 Oct. 1901, Dr. Uzel (NMW), 1 ♀ coll. Gribodo

(MCG); 1 ♀ "Pond" (= Pondichery), coll. Gribodo (MCG); 1 ♀ Madras ("*Icaria guttatipennis* Sauss.", from Staudinger), coll. Gribodo (MCG); 1 ♀ Tuticorin, Oct. 1938, BM-CM Exp. South India (BM); 20 ♀ 4 ♂ Coimbatore, 1950, 1959, 1960, P. S. Nathan (ML); 8 ♀ Anamalai Hills, Cinchona, 3500, ft., May 1960, P. S. Nathan (ML); 4 ♀ Kerala State, Walayar Forests, 700 ft., Oct. 1959, P. S. Nathan (ML); 1 ♀ Coimbatore, 21 April 1937, BM-CM Exp. (BM); 1 ♀ Suratgarh, 5 Jan. 1935, David Hummel (NRS).

Ceylon: 2 ♀ Colombo (NMW); 1 ♀ Ceylon, Novara Reise (NMW), 1 ♀ Ceylon, leg. Ransom, 1871 (NMW); 10 ♀ 3 ♂, various localities throughout the island, 1953-4, F. Keiser (NMB, ML).

Ropalidia marginata rufitarsis van der Vecht

Ropalidia marginata subsp. *rufitarsis* van der Vecht, 1941, p. 122, ♀ — Tenasserim (holotype ♀ BM) and Bhamò, Burma.

Burma: 1 ♀ Rangoon, July 1887, coll. Bingham (BM), 1 ♀ Thaungyin Valley, June 1891, coll. Bingham (BM); 1 ♀ Teinzò, May 1886, L. Fea (MCG), 10 ♀ Bhamò, Aug. 1885, June and Oct. 1886, L. Fea (MCG; 2 ♀ ML); 1 ♀ Palon, Pegù, Aug.-Sept. 1887, L. Fea (MCG).

This form may prove to be conspecific with *R. spatulata* m., described above, but this cannot be ascertained so long as the male remains unknown.

Ropalidia marginata sundaica van der Vecht

(plate 1, c, d; fig. 1 b)

Ropalidia marginata subsp. *sundaica* van der Vecht, 1941, p. 122, ♀ ♂ — Java (types from Kuripan in ML), also recorded from Marianne Islands, Malaya, Sumatra, Bangka, Borneo, and Karimun Djawa Is.

The northern limits of the distribution area of this form are uncertain. During a visit to the Museum in Genoa, in 1957, I identified a number of specimens from Burma and Tenasserim as subsp. *sundaica*, but at present I am inclined to think that at least some of these specimens may represent a narrow-banded form of *R. spatulata* m. It will be desirable to study much more material from the areas in between India and the Malay Archipelago.

Siam: 1 ♂ Bangkok, 24 Nov. 1957, L. D. Brongersma (ML).

Sumatra: 1 ♂ Siboga, April 1886, E. Modigliani (MCG); 1 ♂ Siboga, 7 ♀ Balighe, 1♀ 1 ♂ D. Tolong, 1 ♂ Si-Rambe, Dec. 1890-March 1891, E. Modigliani (MCG; 2 ♀ ML); 6 ♀ 5 ♂ Medan, leg. Mjöberg (NRS; 1 ♀ 1 ♂ ML); 1♀ Kota Tjane, leg. Mjöberg (NRS); 1 ♀ 1 ♂ Pulu Weh, R. Malaise (NRS).

Nias: 1 ♀ Lelemboli, Aug. 1886, 1 ♀ Mt. Sitoli, E. Modigliani (MCG).

Borneo: 7 ♂ Santubong, sea-shore, Dec. 1932, Oxford Univ. Exp.

(BM); 11 ♀ 12 ♂ Samarinda, Muara Kaman, Nov. 1950, 7 ♀ 7 ♂ Balikpapan, Nov. 1950, A. M. R. Wegner (MZB); 1 ♀ Sampit, 1 ♀ Pemanten, Jan. 1954, A. H. G. Alston (BM).

Java: 1 ♀ Buitenzorg (= Bogor), 1875, G. E. Ferrari (MCG), 1 ♂ Surabaja, Febr. 1872, d'Albertis (MCG); Udjung Kulon, 11 ♀ 2 ♂ Tandjung Alang 2, 8-12 July 1955, A. M. R. Wegner (MZB; ML), 3 ♀ 3 ♂ Tjidaon, Dec. 1958, A. M. R. Wegner (MZB; ML).

Karimun Djawa Is.: 2 ♀ Pulau Kemudjan, 2 ♀ 6 ♂ Karimundjawa, Oct.-Nov. 1955, A. Hoogerwerf (MZB; ML).

Lesser Sunda Is.: Specimens from Bali, Lombok (see van der Vecht, 1941, p. 124), and Sumbawa (7 ♀ 1 ♂ Raba, Swiss Expedition 1949, NMB, ML) cannot be distinguished from subsp. *sundaica*; the mesoscutum is only occasionally more extensively marked with black. From Sumba the Swiss Expedition (1949) brought a series of 31 ♀ and 2 ♂ (mainly from Waikarudi, 2-8 Sept. 1949; single females from Waimangura, Pogobina, and Melolo), but at the same time it collected several specimens of a slightly different form which is described below as a new species, *R. laticincta*. This species is also represented in Timor and in the Moluccas, where *R. marginata* is apparently absent (the specimens recorded from these islands in 1941 all belong to *R. laticincta*). The population inhabiting Flores is also regarded as belonging to *R. laticincta*, but it is sufficiently distinct to be treated as a separate subspecies.

Celebes: 1 ♀ Minahasa, Lolae, 23 June 1941, F. Dupont (ML); S. Celebes, 1 ♀ Loka, 1200 m, May 1949, C. J. H. Franssen (ML), 1 ♂ Bantimurung, 30 May 1948, J. van der Vecht (ML).

Talaud Is.: 2 ♀ 6 ♂ Lirung, Oct. 1949, C. J. H. Franssen (ML).

Tukang Besi Is.: 1 ♂ Binongko, March 1930, Snellius Exp. (ML).

Philippine Is.: Luzon, 2 ♀ Manila, 2 Nov. 1952 and 9 Jan. 1953, fam. Townes (coll. Townes; ML); 2 ♀ Alabang, April 1930, J. Valdez (CAS). — Mindoro, 1 ♂ San Jose, 1 Jan. 1945, E. S. Ross (CAS). — Leyte, 1 ♀ Tacloban, 12 Aug. 1952, H. Townes (ML). — Mindanao, 1 ♂ Lagao, Cotabato, 17 Jan. 1954, H. Townes (coll. Townes). — In 1941 I have placed a few Philippine specimens under the Papuan subsp. *jucunda* (Cameron) which is characterized by large yellow spots on the scutellum. Among the specimens recorded above, however, only the female from Leyte has the scutellum distinctly marked with yellow; in the females from Manila two small spots are only vaguely defined, and in the male from Mindanao the scutellum is entirely ferruginous.

Bionomics. — In January 1935 a nest was found under an overhanging boulder at Tjiburial near Bogor, Java. There were nine female

wasps on the uncovered subcircular comb which was hanging from a central stalk. The contents of the nest were: 14 previously used cells, in the centre, now containing eggs; 10 closed cells, containing pupae and prepupae; 36 cells containing larvae (25 large and 11 small); 35 small cells, on the periphery of the nest, containing eggs. Two weeks after the nest was collected 3 ♀ and 5 ♂ had emerged from the closed cells.

Another nest of this species, also found in Java, is figured on plate 1, c and d. It shows a central group of cells, containing pupae of a second brood, amongst which are a few open cells already evacuated by the wasps of the second brood. Then follows a zone of open cells containing larvae and eggs of the second brood, surrounded by a zone of closed cells containing pupae for the first time; the newest cells have been added excentrically, on the lower side of the nest.

Very probably the rectinidal nest, with its approximately central stalk, will prove to be characteristic of *R. marginata* and some allied species.

Ropalidia laticincta laticincta spec. et subsp. n.

Very similar to *R. marginata*, but the propodeum slightly shorter and more convex, and the posterior part of the gastral petiole more strongly swollen. Anterior margin of clypeus (♀) as a rule without distinct yellow band. The nominate form is characterized by the wide yellow fascia on the second gastral segment. In this respect it resembles the Indian *R. spatulata*, from which it differs in the shape of the male antenna and genitalia which are built as in *R. marginata*.

♀ — Head ferruginous-red, not or slightly marked with black, sometimes with irregular blackish transverse band on clypeus (leaving the basal half and the tip reddish) and a large black mark between and around the antennal insertions; ocelli often narrowly margined with black, rarely the ocellar area entirely black. Anterior margin of clypeus at most with vague yellowish mark (with distinct yellow band in *R. marginata*). Mandibles with yellow spot at base.

Thorax reddish, as a rule only slightly infuscated at the sutures; if more extensively blackish the dark colour extending over the anterior and posterior parts of the mesoscutum, most of the mesepisternum (laterally with red band, yellowish under tegulae), the larger part of the metapleura, and base and median line of propodeum. Anterior margin of pronotum with narrow, ill-defined, yellow band, scutellum and apex of propodeum each with two yellow spots, scutellum often somewhat yellowish, but without distinct yellow spots.

Gaster reddish; first tergite with narrow yellow apical band; segment

2 more or less infuscated in front of the yellow apical band; the width of this band increases from $^1/_4$ of the length of the tergite in the middle to about $^2/_5$ of its length at the sides, on the ventral side the fascia is narrower, in the middle measuring only about $^1/_6$ of the length of the sternite. Legs ferruginous; coxae I partly or entirely yellow beneath, II and III with or without yellow mark or line at outer side.

♂ — Differs from the female in the same characters as the male of *R. marginata*; the face is entirely yellow below the level of the upper margin of the antennal sockets, the yellow area in some specimens extending over the lower half of the eye-emarginations. Coxae more extensively marked with yellow. Antennae and genitalia as in *R. marginata*.

The holotype is a male from Sumba, Waikarudi, 8 Sept. 1949, Swiss Sumba Expedition (NMB); all other specimens recorded below from the Lesser Sunda Islands are paratypes.

Sumba: 74 ♀ 4 ♂ from various localities throughout the island, including a series of 46 ♀ and 2 ♂ from Waikarudi, 100 m, 2-9 Sept. 1949, and including the four localities where *R. marginata* was found (see above) (NMB; ML).

Timor: 13 ♀ 1 ♂ "Timor, Wienecke" (ML); 6 ♀ 6 ♂ "Cupan" (= Kupang), April 1889, L. Loria (MCG; ML); 13 ♀ 3 ♂ "Timor", coll. Gribodo (MCG; ML); 1 ♀ Kupang, Nov. 1929, Snellius Expedition (ML); 4 ♀ Kupang, May 1935, C. Bühler & Meyer (NMB; ML); 1 ♀ Baun, Jan. 1938, J. S. Phillips (ML).

Roti: 4 ♀ "Rote", Sept. 1935, C. Bühler & Meyer (NMB; ML).

Wetar: 1 ♀, 1898, leg. K. Schädler (ML).

Roma: 1 ♀, 1903, leg. Kühn (ML).

Kisar: 1 ♂, 1901, leg. Kühn (ML).

Moluccas: Buru, 6 ♀ 3 ♂ "Buru, leg. Denin, 1914" (ML, from series in MZB); 3 ♀ Balu-balu, 23 June 1959, 1 ♀ Wamlana, 30 May 1959, A. M. R. Wegner (MZB; ML). — Ceram, 1 ♀ South Ceram (ML). — Banda, 1 ♀ Bandaneira, coll. Plason (ML), 1 ♀ Saida (ML). — 1 ♀ Haruku, 3-7 May 1930, Snellius Expedition (ML). — Amboina, 2 ♀ Dec. 1874, leg. Beccari (coll. Gribodo, MCG); 1 ♀ 27 Oct. 1923, C. J. Brooks, no. 17309 (BM). — The Moluccan specimens are brightly coloured; clypeus with yellow band at anterior margin; scutellum with more or less distinct, ill-defined, yellow spots.

Ropalidia laticincta floresiana subsp. n.

Mainly distinguished by the narrower apical band of the second gastral tergite.

♀ — Head and thorax rather bright ferruginous, only very slightly marked with blackish around the ocelli, and at anterior and posterior margins of mesoscutum; base of mandibles and apical margin of clypeus slightly yellowish, but without well defined band or spots, the usual yellow markings of the thorax absent, or very faintly indicated on pronotum, postcutellum and propodeum.

Gaster also bright ferruginous; the petiole with very narrow apical yellow band (sometimes indistinct); the second segment with wider apical yellow band (about as wide as in subsp. *sundaica*, dilated laterally, on the sternite much narrower than on the tergite) and with a broad dark zone in front of this band, ill-defined anteriorly; the following segments dark brown at base.

Legs bright ferruginous, coxae I yellowish beneath.

♂ — Similar to the female, but the face yellow below a line through the centers of the eye-emarginations; mid and hind coxae as a rule partly yellowish.

The holotype is a male from Flores, Boa Wae, 450 m, 2 April 1957, A. M. R. Wegner (ML); the other specimens recorded below are paratypes.

Flores: 13 ♀ Endeh, 6-7 Nov. 1930, Snellius Expedition (ML); 1 ♀ 3 ♂ Wolosambi, 300 m, 9 May 1950, Miss H. C. Vos (ML); 1 ♀ between Endeh and Wolawaru (km. 14), 13 Aug. 1950, J. van der Vecht (ML); 6 ♀ 6 ♂ N. doa-Endeh, April 1958, Fr. M. Vianny (ML); 3 ♀ 1 ♂ Boa Wae, 450 m, 2 and 3 April 1957, A. M. R. Wegner (MZB; ML); 3 ♀ Mborong, 30 March 1958, A. M. R. Wegner (MZB; ML).

Ropalidia stigma stigma (Smith)

(fig. 2 g)

Ropalidia stigma (Smith), and do., typical form; van der Vecht, 1941, p. 126, ♀ ♂ (India-Java).

Ceylon: 2 ♀ Ratnapura, Löbell (NMW; erroneously identified as *pendula* Smith); 5 ♀ 1 ♂ Central Province, Kandy and Haragama, 1 ♀ Sabara-gamuva Province, Ratnapura, July-Sept. 1953, Febr. 1954, F. Keiser (NMB, ML).

Burma: 16 ♀ 7 ♂ Bhamò, July-Nov. 1886, L. Fea (MCG, 4 ♀ 2 ♂ ML), 11 ♀ 2 ♂ Palon, Pegu, July-Sept. 1887, L. Fea (MCG, 1 ♀ ML); 1 ♀ Schwego Myo, Oct. 1885, L. Fea (MCG); 2 ♀ 2 ♂ Washaung, 20 km. east of Myitkyina, 14 July 1934, R. Malaise (NRS; ML); S. Shan States.

3 ♀ Inle Lake, South end, Taungdo, 900 m, 10 Sept. 1934 (NRS; 1 ♀ ML), do., 2 ♀ Taunggyi, 1500 m, Aug.-Sept. 1934 (NRS), 1 ♂ Pekkong, 900 m, 8 Oct. 1934 (ML), all leg. R. Malaise.

Tenasserim: 2 ♀ Malewoon, July-Aug. 1887, L. Fea (MCG).

Malaya: 1 ♂ P. Penang, 600-800 m, Febr. 1889, L. Loria and L. Fea (MCG).

Indo-China: 2 ♀ Tonkin, région de Hoa-Binh, 1926, 1930, A. de Cooman (MP).

Sumatra: Lampong Districts, 2 ♀ Rubber estate "Bergen", Tandjongkarang, 19 Jan. 1953, A. Sollaert (ML); 8 ♀ Medan, 1 ♀ Kota Tjane, leg. Mjöberg (NRS; 2 ♀ ML) (extent of yellow markings variable).

Borneo: 1 ♀ East Borneo, Tabang, Bengen River, 10 Oct. 1956, A. M. R. Wegner (ML).

Philippine Is.: Luzon, 1 ♀ Los Baños, 7 March 1953, Townes family (coll. Townes). — Mindoro, 9 ♀ Alcate, Vict. 5-11 April 1954, H., M., and D. Townes (coll. Townes, 3 ♀ ML), 3 ♀ 5 ♂ S. Luis Calapan, 13-18 April 1954, H., M., and D. Townes (coll. Townes, 1 ♀ 2 ♂ ML).

Java: 1 ♂ Buitenzorg (= Bogor), G. B. Ferrari (MCG); 5 ♀ 6 ♂ Bogor, Dec. 1952-Jan. 1953, from nest, J. van der Vecht (ML; 1 ♀ Udjung Kulon, Tjigeunteur, 15 July 1955, A. M. R. Wegner (ML); 1 ♀ Dungus Iwul, 4 Nov. 1952, leg. Manis (MZB).

Bali: 3 ♀ "Bali" (MCG).

Bionomics. — A nest found in December 1952 in the garden of the Forest Experiment Station, Bogor, Java, consisted of two rows of cells, the oldest of which was attached by a short petiole to the mid rib of a fern leaf (fig. 2 g, showing the nest one week after it was collected).

At the time of collecting the condition and the contents of the cells were as follows:

1.	partly cut away, contains egg (used for a third time)	
2-4.	closed, containing pupae	used for a second time
5.	full-grown larva closing the cell	
6-9.	large larvae, nearly full-grown	
10-15.	smaller larvae, smallest in 14, 15	
16-25.	each containing an egg	
26-33.	closed, containing pupae	used for the first time
34-44.	larvae	
45-52.	cells very small, containing eggs	

The regular structure of the nest was slightly disturbed at the angle

between cells 29 and 31, where the beginning of a new cell, very small, but already containing an egg, was attached.

A few female wasps were collected together with the nest; in the following two weeks some more females and six males emerged from the closed cells.

R. stigma nigrolineata subsp. n. (? or var. n.)

♀ — Darker than *R. stigma*, vertex more extensively black, clypeus with the median line black, strongly dilated in lower half. Pronotum red, yellow anteriorly; mesoscutum black; scutellum and postscutellum with large yellow mark, mesepisternum black with red spot below tegulae; metapleura black; propodeum black with the usual yellow mark. Gastral petiole red, black at base and here on each side with short yellow line; second and following gastral segments dark fuscous, tergite 2 with two spots at base and narrow yellow band at apex; spots and band of second sternite much reduced or absent. Legs as usual. Otherwise as in subsp. *stigma*.

♂ — Even darker than the female, except for the sexual characters (yellow: lower half of face, mandibles, antennal scape below, epicnemium of mesothorax, and coxae I and II anteriorly); pronotum almost entirely black; spots on scutellum and postscutellum reduced.

Burma: 4 ♀ 1 ♂ S. Shan States Road, 40 km east of Taunggyi, Sept.-Oct. 1934 (holotype ♀, allotype ♂, and paratype NRS; 2 paratypes ML); 3 ♀ Taunggyi, 1500 m, Aug.-Sept. 1934 (paratypes NRS, 1 ♀ ML).

Ropalidia mathematica mathematica (Smith)

Ropalidia mathematica (Smith), and *R. mathematica*, typical form; van der Vecht, 1941, p. 130 (Celebes; Lombok).

Celebes: 1 ♀ Celebes, "*Polybia stigma* det. Meade-Waldo", 1 ♂ Celebes 58/142, leg. Wallace (BM); 1 ♀ S. Celebes, Bantimurung, 30 May 1948, J. van der Vecht (ML). — In a ♂ from Bantimurung, collected two days later, the antennal segments are as short as in *R. mathematica binotata* (van der Vecht, 1941, p. 127, fig. 22), but the gastral petiole has a yellow spot on each side at the base, and the second gastral sternite bears a broad, irregular and ill-defined, transverse, yellow band at some distance from the base. More material from Celebes is required to determine the status of this specimen.

Flores: 2 ♀ Rana Mese, 1300 m, 21 Nov. 1949, Swiss Sumba Exp. (NMB; ML), 1 ♀ Moni, Wolawaru, 11 Nov. 1949, Swiss Sumba Exp. (ML).

Ropalidia mathematica binotata van der Vecht

Ropalidia mathematica subsp. *binotata* van der Vecht, 1941, p. 131, ♀ ♂ — Java (ML); also recorded from Bali, South Sumatra, and Bangka Island.

Islands in Straits Sunda: 1 ♀ P. Sebuku, 17 June 1955, 1 ♀ 1 ♂ P. Sebesi, 13 June 1955, 2 ♂ P. Legundi, 21 June 1955, A. M. R. Wegner (ML). — Second gastral sternite on each side with small yellow spot, close to apex of the much larger mark on the tergite.

Java: 1 ♀ Buitenzorg (= Bogor), 1875, G. B. Ferrari (MCG), 1 ♀ Malang, coll. Gribodo (MCG); 1 ♂ "Java", Fruhstorfer (IRSNB); 1 ♀ 2 ♂ Udjung Kulon, Tjidaon and Tamandjaja, Nov.-Dec. 1958, A. M. R. Wegner (MZB, 1 ♂ ML); 1 ♂ "Java, 56/43" (BM).

Karimon Djawa Is. — The species is represented here by a rather dark form, but the few available specimens (2 ♀ 2 ♂, Nov. 1930, M. A. Lieftinck) appear to be too much discolored to be described.

Bali: 3 ♀ 6 ♂ Baturiti, 1000 m, July 1941, leg. Kalis (ML); 2 ♀ 1 ♂ "Bali" (MCG).

Sumbawa: 2 ♀ 4 ♂ Raba, 20 May 1949, 1 ♂ Sumbawa Besar, 19 May 1949, Swiss Sumba Exp. (NMB; ML); 1 ♀ "Sumbawa", 3 ♀ "Sumbawa, Tambora" (MCG).

Flores: West Flores, 1 ♀ Ruteng, 1 ♂ Mborong, 8-9 Nov. 1949, Swiss Sumba Exp. (NMB), 1 ♂ (unusually dark) Badjawa-Aimere, 19 Aug. 1950, J. van der Vecht (ML); 1 ♀ 1 ♂ Rana Mese, 8 April 1958, Fr. M. Vianny (ML); Central Flores, 1 ♀ Moni, Wolawaru, 11 Nov. 1949, Swiss Sumba Exp. (ML), 1 ♀ road Endeh-Wolawaru, at km 14, 13 Aug. 1950, 1 ♀ 1 ♂ Wolawaru, 14 Aug. 1950, 1 ♀ Wolo-odja, 15 Aug. 1950, J. van der Vecht (ML); 2 ♀ Wolosambi, May 1950, Miss H. C. Vos (ML).

Bionomics. — In September 1936 a nest of this species was found on Mount Pantjar near Bogor. It consisted of an uncovered comb, which was attached with a single petiole to a branch of a dense shrub, about 30 cm above the soil. The comb had an almost vertical position; it was 7.5 cm long, with a greatest width of nearly 3 cm, and contained 127 complete cells, 44 of which were closed and contained pupae; along the margins there was a number of smaller cells containing larvae or eggs. The nest was taken to the laboratory, where already the following day the numerous wasps on the nest (including many males) had eaten most of the larvae. In the small marginal cells the egg was attached to the bottom of the cell, but in previously used cells the egg was deposited about halfway in one of the angles on the side of the cell. The contents of the gut of the larvae consisted of numerous small chitinous fragments, amongst which some mandibles could be distinguished, one with two and one with four teeth.

A young nest collected by E. Jacobson (Java, Bandung, Dec. 1934; ML) consists of 10 cells, arranged in two rows, but a nest from Tjimerang, Java, April 1936, leg. Mrs. M. E. Walsh (ML), has 15 of its 17 cells arranged in three rows, with two very young cells forming the beginning of a fourth row.

Ropalidia mathematica sumbaensis subsp. n.

♀ — Head and thorax rather dark ferruginous-brown, with ill-defined blackish areas on vertex (enclosing the ocelli), at posterior margin of mesoscutum, on mesopleura, mesosternum, metapleura and propodeum; yellow markings as follows: a vague spot at base of mandibles, a short line (often absent) at anterior margin of horizontal part of pronotum, the usual broad median mark on propodeum (narrowed posteriorly and more or less incised at apex); in very brightly coloured specimens the major part of the scutellum and a small spot in upper part of mesopleura also yellow.

Gaster as in *R. mathematica binotata*, but the spots at base of second tergite smaller; the second sternite always immaculate.

Legs dark ferruginous, with at most a small yellow spot on coxae I.

♂ — Lower half of face and anterior side of coxae I pale yellowish; in some specimens the clypeus dark in the middle and the mandibles with dark spot at base; propodeal mark often reduced.

Sumba: 70 ♀ 16 ♂ from various localities throughout the island (NMB; ML; MZB); the series contains 17 specimens from Lokojengo and 18 from Langgaliru; holotype and allotype are a female and a male from the latter locality (NMB); all other specimens are paratypes; 3 ♀ East Sumba, Kananggar, May 1925, K. W. Dammerman (MZB; 1 ♀ ML).

Timor: 1 ♀ 1 ♂ from Baàguia, Aug. 1935, C. Bühler & Meyer (NMB), and 1 ♀ Nenas, 6 July 1949, Miss H. C. Vos (ML) are provisionally placed here, together with the old series from Timor recorded in 1941 under *R. mathematica binotata*. Clypeus of female very dark, of male pale yellow with dark median line on basal two thirds. Both the yellow and the black markings are slightly more extensive than in typical *sumbaensis*.

Ropalidia mathematica torrida (Smith)

Ropalidia mathematica subsp. *torrida* (Smith); van der Vecht, 1941, p. 133, ♀ (Moluccas).

Ambon: 3 ♀ 1 ♂ Amboina, coll. Gribodo (MCG; 1 ♀ ML). — Perhaps this form will eventually prove to be closer to *R. socialis* or *unicolor* than to *R. mathematica*.

Ropalidia socialis socialis (Saussure)

Ropalidia mathematica subsp. *unicolor* (Smith); van der Vecht, 1941, p. 133 (in part: specimens from Timor and Wetar).

In 1941 I placed de Saussure's *Icaria socialis,* which was based on a series of very dark specimens from Timor, under the subspecies *unicolor* (Smith) of *R. mathematica,* originally described as *Icaria unicolor* Smith from the Key Islands. At that time I remarked that a further study of *R. mathematica* in Timor would be of interest, since the Leiden Museum collection contained both the dark subspecies *socialis* and the yellow-marked *binotata* from this island.

It has now become sufficiently clear, that in Sumba as well as in Timor this group is represented by two forms which are sharply separated. They must be regarded as specifically different, and it seems now desirable to reestablish the name *socialis* for the dark form. Whether *R. socialis* is indeed conspecific with *R. unicolor* cannot be determined with certainty at this moment.

Timor: 2 ♀ Amarasi, May 1935, 2 ♀ Baaguia, Aug. 1935, 1 ♂ Soe, June 1935, Bühler & Meyer (NMB; ML); 3 ♀ "Timor" (2 from Ritsema), coll. Gribodo (MCG).

Ropalidia socialis trimaculata subsp. n.

♀ — Agrees with *R. socialis* (Saussure) from Timor, but scutellum, postscutellum and a broad median band on propodeum are bright lemon-yellow. Anterior margin of pronotum slightly yellowish in the middle.

Sumba: 4 ♀ Pogobina, type (14 Sept.) and paratypes (12 and 13 Sept. 1949) (type NMB, paratypes NMB, MZB, ML); further paratypes: 1 ♀ Waimangura, 23 Aug., 1 ♀ Laluku, 4 July 1949 (ML), all collected by the Swiss Sumba Expedition.

Evidently much less common than *R. mathematica sumbaensis.*

Ropalidia unicolor (Smith)

Ropalidia mathematica unicolor (Smith); van der Vecht, 1941, p. 133 (in part: specimens from the Kei Islands).

Kei Is.: 1 ♀ "Ke", leg. Wallace (holotype, OUM); 2 ♀ "Key Isl.", coll. Gribodo (MCG).

Ropalidia artifex (Saussure)

Ropalidia artifex (Saussure), and do, typical form; van der Vecht, 1941, p. 134 (Java; Malaya; Borneo).

Java: Central Java, 2 ♀ Bodja, Merbuh, March 1941 (ML).

Tenasserim: 2 ♀ Malvedaung, 30 km south of Ye, 300 m, Nov.

1934, R. Malaise (NRS; ML). — These specimens are somewhat darker than those collected in Java, yet they come closer to typical *artifex* than to the var. *fuscata*.

Ropalidia artifex var. **fuscata** van der Vecht

Ropalidia artifex var. *fuscata* van der Vecht, 1941, p. 136, ♀ ♂ — Sumatra (holotype ML), also recorded from Malaya and Borneo.

Since this form appears to occur together with more brightly coloured specimens in Malaya as well as in Borneo, it seems best to leave its status uncertain for the moment.

Borneo: 1 ♀ Bandjermasin, coll. Gribodo (MCG); Balikpapan, 1 ♀ Wain River, 2 ♀ Mentawir River, Oct. 1950, A. M. R. Wegner (MZB; ML). — In these females the thorax is more extensively reddish than in Sumatran specimens; in one specimen the gastral petiole is extensively blackish.

Bionomics. — In December 1954 I collected a female together with her nest at Tandjong Morawa in Deli, North Sumatra. The nest, at present in the collection of the Leiden Museum, is still very young and consists of only 9 cells, arranged in two rows; it is attached by a thin petiole, about 4 mm long, to a branch, and was hanging close to the ground, in secondary vegetation. The oldest cell is only about half grown, the other cells decrease in size towards the most distal cell which is only a small cup of one mm deep. The proximal five cells contained larvae, the others eggs.

Ropalidia rufocollaris rufocollaris (Cameron)

Ropalidia rufocollaris (Cameron), and do., typical form; van der Vecht, 1941, pp. 137, 138, ♀ ♂ (India, type BM).

Sikkim: 2 ♀ 3 ♂ Valley at Tista Bridge, 200 m, 8-15 Dec. 1934, R. Malaise (NRS; ML).

Burma: 5 ♀ 1 ♂ Schwego Myo; Oct. 1885, L. Fea (MCG), 1 ♀ Charin Cheba, 600-800 m, Oct. 1888, L. Fea (MCG), 1 ♀ 1 ♂ Bhamò, Sept. and Nov. 1886, L. Fea (MCG). N. E. Burma, 2 ♀ Punkataung, Road Sadon-Myitkyina, 8 July 1934, R. Malaise (NRS; ML), 1 ♂ Washaung, 200 m, 20 km east of Myitkyina, 14 July 1934, R. Malaise (ML); S. Shan States, 1 ♀ Pekkong, 900 m, 8 Oct. 1934, 1 ♀ road 40 km east of Taunggyi, 25 Sept.-13 Oct. 1934, R. Malaise (NRS; ML).

Siam: 1 ♀ " Siam, Gyldenst." (NRS).

Ropalidia hongkongensis juncta van der Vecht

Ropalidia hongkongensis juncta van der Vecht, 1941, p. 141, ♀ ♂ — Java (types, ML); Bangka; Assam; Tenasserim.

Burma: 1 ♀ Palon, Pegu, Aug.-Sept. 1887, L. Fea (MCG); 5 ♀ Bhamò, Sept. and Nov. 1886, L. Fea (MCG; 2 ♀ ML); 2 ♀ Schwego Myo, Oct. 1885, L. Fea (MCG).

Ropalidia taiwana birmanica subsp. n.

♀ — Very similar to typical *R. taiwana,* but the second gastral segment not obliquely cut off at end, as seen in profile (compare van der Vecht, 1941, p. 144, fig. 30). Yellow markings on clypeus and pronotum more or less reduced.

♂ — Antennae slightly less modified than in typical *taiwana*: carina of tenth antennal segment not emarginate (compare van der Vecht, l.c., fig. 32). The second gastral segment is only slightly obliquely cut off.

In both sexes the shape of the second sternite (bluntly angular in profile) serves to distinguish this form from the related species.

Burma: 2 ♀ 1 ♂ North East Burma, Sadon, 1200 m, June-July 1934, R. Malaise (holotype, ♂, and paratype ♀, NRS; 1 paratype, ♀, ML); S. Shan States, 3 ♀ Taunggyi, 1500 m., Aug.-Sept. 1934, R. Malaise (paratypes, NRS, ML), 3 ♀ 1 ♂ Road 40 km east of Taunggyi, Sept.-Oct. 1934, R. Malaise (paratypes, NRS, 1 ♀ 1 ♂ ML).

Ropalidia fasciata (Fabricius)

(plate 1, a, b)

Ropalidia picta (Saussure); van der Vecht, 1941, p. 145 (India to Formosa, Borneo and Java).

Ropalidia fasciata (Fabricius); van der Vecht, 1959, p. 235, 245.

Distribution. — A common species, occurring in cultivated areas from India to the eastern margin of the Sunda shelf (including Palawan), extending eastward on the Lesser Sunda Islands. In the Philippines, Celebes and further eastward the species is replaced by the very similar *R. gregaria* (Saussure), which can be separated with certainty in the male sex only (compare van der Vecht, 1941, pp. 145-151).

The following records are supplementary to those published in 1941.

India: 2 ♀ "India", 1873, Plason (NMW); 1 ♀ Thekkadi, Periyar Dam, Travancore, 6-10 May 1937, BM-CM Exped. (BM) (large specimen, almost without black markings); 1 ♀ Bombay, Matheran, ex coll. J. Pérez (MP) (similar to the preceding specimen, yellow markings reduced, clypeus almost entirely ferruginous, mesepisternum and base of second gastral tergite without yellow markings; lines on propodeum narrow, apical band of second gastral segment wider than usual).

Burma: 2 ♀ Bhamò, Oct. 1886, L. Fea (large and brightly coloured,

second gastral tergite without spots, one female with incomplete nest of two rows of cells) (MCG); 12 ♀ Bhamò, June and Oct. 1886 (varying from light to dark; gastral tergite 2 with lateral spots) (MCG; 1 ♀ ML); Carin Chebà, 1 ♀ 400-600 m, Nov. 1888, L. Fea, 3 ♀ 2 ♂ 900-1100 m, May-Dec. 1888, L. Fea (MCG); 1 ♀ Carin Gheku, 1300-1400 m, Febr.-March 1888, L. Fea (MCG); 2 ♀ Teinzò, May 1886, L. Fea (one large and dark, one very brightly coloured), 1 ♀ 1 ♂ Palon, Pegù, Aug.-Sept. 1887, L. Fea (MCG); 5 ♀ Tenasserim, Malewoon, July-Aug. 1887, L. Fea (MCG; 1 ♀ ML).

Formosa: 2 ♀ Fungshan (= Hozan), 10 Aug. 1949, L. Gressitt (CAS); 1 ♀ Pintung (= Heito), 11 Aug. 1949, L. Gressitt (CAS). — One of the females from Fungshan was collected together with the nest, which consists of two rows of young cells [formula: 2 (0 + 9) = p (0 + 5) + r_1 (0 + 4), see below for explanation].

Riukiu Is.: 1 ♀ Okinawa, Kadena air field, Nov. 1950, R. B. Evans (CAS).

Indo-China: 1 ♀ Saigon, coll. Gribodo (MCG).

Malaya: 1 ♀ Pulo Penang, leg. Doria (with MS names copied from the Spinola collection), coll. Gribodo (MCG); 1 ♀ do., 600-800 m, Febr. 1889, L. Loria and L. Fea (MCG).

Sumatra: 1 ♀ Pea Ragia, Oct. 1890, 1 ♀ Siboga, 1 ♂ Si Rambé, 3 ♀ Pagaranpisang, Oct. 1890-March 1891, 1 ♀ Padang, 1890, all leg. E. Modigliani (MCG; 1 ♀ ML) (these specimens are all brightly coloured); dark specimens, with broad dark line on clypeus, spots of second gastral segment small or absent: 1 ♀ D. Tolong, Nov. 1890, 4 ♀ Baligé, 1 ♀ Pea Ragia, 1 ♀ Si-Rambé, 1 ♀ Siboga, all Oct. 1890-March 1891, E. Modigliani (MCG; 1 ♀ ML); 1 ♀ Brastagi. 1500 m, 25-27 Dec. 1954, J. van der Vecht (ML); 40 ♀ 7 ♂ Medan, leg. Mjöberg (NRS). — The species appears to be common throughout the island.

Nias: 1 ♀ Mt. Sitoli, E. Modigliani (MCG).

Borneo: 2 ♀ 6 ♂ Sarawak, coll. Gribodo (MCG); 2 ♀ 1 ♂ Sarawak, 1865-'66, G. Doria (MCG); 1 ♀ Santubong, 14 Dec. 1932, Oxf. Univ. Exp. (BM); series from Samarinda and Balikpapan, Nov. 1950, A. M. R. Wegner (MZB; ML); series from Tabang, Bengen River, Aug.-Sept. 1956, A. M. R. Wegner (MZB; ML). — Most of the Bornean specimens are rather dark.

Palawan: 1 ♂ near Puerto Princesa, March 1945, H. H. Blakemore (CAS).

Java: 1 ♀ "Java" (MCG); 8 ♀ 4 ♂ Buitenzorg (= Bogor), 1875, G. B. Ferrari (MCG); 1 ♀ "Java", 1868, Baron Warsberg (NMW). — The species is common throughout the island.

Karimundjawa Is.: series from Karimundjawa and Mendjangan Besar, Oct.-Nov. 1955, A. Hoogerwerf (MZB; ML).

Bali: 2 ♀ Den Pasar, June 1935, R. Awibowo (ML); 2 ♀ Baturiti, 1000 m, July 1941, leg. Kalis (ML).

Flores: 2 ♀ 1 ♂ Rana Mese, 1300 m, Nov. 1949, Swiss Sumba Exp. (NMB; ML); 2 ♀ Wolawaru, 14 Aug. 1950, J. van der Vecht (ML).

Sumba: 88 ♀ 13 ♂ from various localities throughout the island, May-Sept. 1949, Swiss Sumba Exp. (NMB; ML). — The specimens from this island are generally rather brightly coloured, but in other respects they agree with the material from Java. Some females (about 15 out of 88) are slightly more robust and a little darker than the others; they have the pronotal fascia narrow, and the spots on the mesepisternum and on the base of the second gastral tergite are usually lacking. It seems possible that these characters indicate differences between fertile and sterile females, but dissection of fresh specimens would be necessary to draw reliable conclusions. Some specimens appear to be transitional.

Timor: 3 ♀ "Timor, Wienecke" (ML); 1 ♀ "Timor", coll. Gribodo (MCG); 1 ♀ Nenas, 1700 m, 6 July 1949, Miss H. C. Vos (ML); 1 ♀ Mollo, 1350 m, 1 ♀ Baguia, 1935, Bühler und Meyer (MB; ML). — Yellow markings reduced; mesepisternum and base of second gastral tergite without yellow spots.

Roti: 6 ♀, 1935, Bühler and Meyer (NMB; ML). — Coloration as in the Timor specimens.

Bionomics. — The nests of this species (see plate 1, figs. a and b) resemble those of the group of *R. stigma* in being laterinidal and more or less elongate; the outer cells are usually rounded on the outer side. As a rule the first few cells are arranged in two rows, but when the number of cells increases above ten to twelve, more rows are added. As the building continues, the number of rows increases as well as the number of cells in each row, but the general shape remains elongate, with the length up to twice or more times the width. There are indications that the shape of the nest depends to some extent from that of the object to which it is attached. Nests suspended from an elongate object, such as a stalk or a palm leaflet, tend to be more elongate than those hanging from a leaf with a broad surface.

A series of nests in the Leiden Museum may be described by the following formulae, arranged according to the total number of cells in each nest (for explanation see p. 6 and fig. 2e).

Nest A. 2 rows of cells (2 cells with and 7 without bottom window, or 2 old and 7 young cells) = petiolar row (2 old and 3 young cells) + first row to the right of the petiolar row, as seen on the open

side of the cells (0 old + 4 young cells); formula: 2 (2 + 7) = p (2 + 3) + r_1 (0 + 4).

Nest B. 2 (0 + 10) = p (0 + 5) + r_1 (0 + 5).

Nest C. 2 (6 + 6) = p (3 + 3) + r_1 (3 + 3).

Nest D. 4 (0 + 18) = l_1 (0 + 3) + p (0 + 6) + r_1 (0 + 5) + r_2(0 + 4).

Nest E. 5 (8 + 17) = p (3 + 4) + r_1 (3 + 4) + r_2 (2 + 5) + r_3 (0 + 3) + r_4 (0 + 1).

Nest F. 5 (10 + 24) = l_1 (0 + 1) + p (5 + 7) + r_1 (5 + 6) + r_2 (0 + 9)+ r_3 (0 + 1).

Nest G. 7 (58 + 26) = l_4 (0 + 7) + l_3 (0 + 11) + l_2 (10 + 3) + l_1 (12 + 2) + p (14 + 1) + r_1 (13 + 1) + r_2 (9 + 1).

Nest H. 13 (96 + 63) = l_3 (3 + 7) + l_2 (11 + 1) + l_1 (12 + 1) + p (13 + 1) + r_1 (13 + 1) + r_2 (13 + 1) + r_3 (13 + 2) + r_4 (10 + 5) + r_5 (9 + 6) + r_6 (0 + 13) + r_7 (0 + 12) + r_8 (0 + 9) + r_9 (0 + 4).

A: Java, Djakarta, Dec. 1907, E. Jacobson.
B: locality unknown.
C: Java, Priok near Djakarta, 1907, E. Jacobson.
D: Sumatra, Benkulen, Muara Teman, 1935, Mrs. M. E. Walsh.
E: Java, Priok, 1908, E. Jacobson.
F: Java, Bandung, July 1935, E. Jacobson.
G: locality unknown, E. Jacobson.
H: Java, Semarang, 1909, E. Jacobson.

The nests containing at most 10 to 12 cells (A-C) consist of only two rows; in the three nests of this type the second row is situated on the right hand side of the first row!

Sometimes cells with windows are already present in very small nests (A, C); such nests have probably been built by a single female. In other cases (B, D) up to 10 and 18 young cells are built before any of the larvae becomes full-grown; this condition could suggest the founding of the nest by two or more females.

The nests containing more than 12 cells consist of more than two rows; as a rule the right hand side of the nest is more strongly developed than the other side (D, E, F, H; exception: G).

In the two nests consisting of more than five rows (G, H) the young cells are relatively less numerous than in most of the younger nests. It seems possible that the colonies that inhabited these nests had already passed beyond the stage of maximum growth.

In the first week of November 1939 I found in my garden at Bogor, Java, a nest which was densely covered by wasps; the nest was suspended

from a fern leaf and was only moderately protected against the rain. On Nov. 18 there were still many wasps on the nest, but two days later the comb was deserted and all the cells proved to be empty. The elongate comb contained 185 cells from which wasps had emerged, and 63 cells which had remained uncompleted. Since the comb showed no traces of damage, such as are found when a nest has been attacked by *Vespa tropica* (L.), it looked as if wasps had left the nest voluntarily. However, although the wasps themselves may have cleared away the contents of the cells before leaving, it seems nevertheless possible that the colony had succumbed to an attack by ants.

Concerning the nest from Kuala Lumpur figured on plate 1, Mr. H. T. Pagden wrote me: "Only the foundress was present at first (17th September), there were two individuals on 28th Oct., and had been for some days. On 1st December there were 7 individuals visible... I intended to continue taking photographs at intervals, but all the wasps except two had vanished on the evening of 7th December and all the cells were empty... I do not know any explanation for the dispersal of the colony. There were eggs and larvae on 1st December and, presumably, the wasps must have destroyed these themselves. All the cells were empty on 7th except one capped cell. The leaf on which the nest was constructed was quite healthy and would certainly not have fallen for some time".

Ropalidia gregaria (Saussure)

(fig. 2, d and e)

Ropalidia gregaria (Saussure); van der Vecht, 1941, p. 149 (Philippine Is. and Celebes to Fiji Is. and N. Australia).

This species replaces *R. fasciata* (F.) in the area east of the line of Wallace.

Philippine Is.: Luzon, 1 ♀ Los Baños, 1 May 1932 (CAS); 1 ♀ 3 ♂ Manila, 1952 and 1953, Townes family (coll. Townes; 2 ♂ ML); 1 ♂ Rizal, July 1952, H. Townes (coll. Townes). — Samar, 2 ♀ 3 ♂ Oquendo, 15 Aug. 1952, H. Townes (coll. Townes; 1 ♀ 1 ♂ ML). — Mindanao, Cotabatu, 1 ♀ Lagao, Sept. 1952, H. Townes (ML), 1 ♂ Buluan, Jan. 1954, H. Townes (coll. Townes).

Celebes: S. Celebes, 1 ♀ Sengkang, May 1948, J. van der Vecht (ML); 1 ♂ Loka, 1200 m, May 1949, C. J. H. Franssen (ML).

Moluccas: Ambon, 3 ♀ 1 ♂ Amboina, Dec. 1874, leg. Beccari (MCG), 1 ♀ coll. Gribodo (MCG); 3 ♀ Waai, July 1959, A. M. R. Wegner (MZB; ML). — Haruku, 1 ♀ 3-7 May 1930, Snellius Exped. (ML). — 1 ♀ Ceram, with nest (7 cells) attached to leaf (OUM). — Buru, 1 ♀ Station

5 (nest no. 5), April 1921, 2 ♀ Station 9, 18 May 1921, L. J. Toxopeus (MA); 2 ♀ Balu-balu, 23 June 1959, A. M. R. Wegner (ML). — Halmahera, 1 ♀ Atiengo, 50-100 m, Sept. 1951 (ML). — Morotai, 1 ♀ 3-7 June 1930, Snellius Exped. (ML).

Kei Is.: 1 ♀ "Key" (MCG); formula of the nest from Tual, collected by H. C. Siebers with 5 ♀ and 2 ♂ (see van der Vecht, 1941, p. 150): 3 (11 + 13) = p (4 + 3) + r_1 (4 + 5) + r_2 (3 + 5).

New Guinea: Baliem Valley, 1600 m, four nests collected with wasps by L. J. Toxopeus, Archbold Expedition: A, 5 ♀, 30 Nov. 1938, with nest under grass blade, formula: 5 (0 + 25) = l_2 (0 + 5) + l_1 (0 + 6) + p (0 + 6) + r_1 (0 + 5) + r_2 (0 + 3); B, 22 ♀ 2 ♂, 22 Nov. 1938, with somewhat irregular nest under broad leaf of tree or shrub, nest broadly oval, 37 mm long, 26 mm wide, 14 rows, maximum number of cells per row = 13, total number of cells 130; only 20 cells near petiole with window; C, 6 ♀, 22 Nov. 1938, with nest under broad leaf of tree or shrub, formula: 7 (0 + 39) = l_1 (0 + 3) + p (0 + 6) + r_1 (0 + 7) + r_2 (0 + 7) + r_3 (0 + 7) + r_4 (0 + 6) + r_5 (0 + 3); D, 4 ♀, with nest under broad leaf of tree or shrub, formula: 5 (16 + 41) = l_2 (0 + 10) + l_1 (5 + 7) + p (6 + 7) + r_1 (5 + 7) + r_2 (0 + 10) (evidently the nest was collected with only a small part of the inhabitants). — Wissel Lakes, 2 ♀, 2 ♂, and 2 Ichneumonid parasites, bred from the nest (fig. 2d), 2 Oct. 1939, H. Boschma (ML); 2 ♀ with nest under leaf of tree or shrub, Waghete Tigi Lake, 12 Jan. 1955, L. D. Brongersma c.s., formula: 5 (2 + 20) = l_1 (0 + 4) + p (2 + 4) + r_1 (0 + 6) + r_2 (0 + 5) + r_3 (0 + 1). — Paniai, many specimens, Sept. 1939, K.N.A.G. Exped. (ML). — Hollandia, 12 ♀, 1956 and 1958, G. den Hoed (ML); do., one nest with formula: 2 (3 + 8) = p (2 + 4) + r_1 (1 + 4); do. 1 ♀ with nest, formula: 2 (0 + 10) = l_1 (0 + 5) + p (0 + 5), do, one nest on grass blade, consisting of three cells, only 2 mm deep (ML). — The specimens from the mountain localities are all more extensively marked with black than those from coastal areas.

Solomon Is.: Tulagi, 1 ♀ on Ridge, 26 June 1933, no. 19, "building nest alone"; 8 ♀ 1 ♂ "nest on Hibiscus", 1 July 1933, nrs. 60-64, 66-68 (♀♀), 65 (♂); 1 ♀ 23 Aug. 1933, "bred", no. 511; 1 ♀ on male flowers of Cocos, 24 Aug. 1933, no. 526; 2 ♂ "low herbage", 2 Sept. 1933, nrs. 564, 565; 6 ♀ 1 ♂ "on nest", 23 July 1934, nrs. 1427 (♂), 1428-1433 (♀♀); 13 ♀ "nest", 16 Sept. 1934, nrs. 1620-1632, all leg. H. T. Pagden (coll. Pagden; ML). — Santa Isabel, 1 ♀ 27 Febr. 1934, R. J. A. W. Lever, no. 1171 (coll. Pagden). — Guadalcanal, 2 ♀ Lunga Estate, on nest, 9 July 1933, nrs. 110, 112, H. T. Pagden (coll. Pagden; ML); 4 ♀ Lunga, 1936, R. A. Lever (BM). — Shortland Is., 1 ♀ Korovo, 29 April 1934, no. 1245, H. T. Pagden

(coll. Pagden), — Kolombangara Is., 1 ♀ Karikana Estate, 2 Oct. 1933, no. 704, H. T. Pagden (coll. Pagden).

Bionomics. — From the nest formulae given above it appears that the nesting habits of this species are very similar to those of *R. fasciata*. The nests are supported by a single stalk and are usually attached to the underside of a leaf. The largest nest hitherto discovered contained 57 cells.

Ropalidia variegata variegata (Smith)

Ropalidia variegata (Smith), typical form; van der Vecht, 1941, p. 156.

This brightly coloured from appears to be restricted to the plains of Pakistan and India, where it occurs together with similarly coloured species of Eumenidae (*"Odynerus"* and *Eumenes*) and Vespidae (*Polistes* and *Ropalidia*). It is of interest to note that *variegata* specimens from Abu and from South India agree with those from Banka and Java in the reduction of the yellow and increase of the black markings.

Pakistan: 12 ♀ Karachi, 25 Jan. 1934, R. Malaise (NRS, ML).

There is a ♀ with label "Indes" in the Museum at Genoa (MCG).

Ropalidia variegata jacobsoni (Buysson)

(fig. 2, a-c, f)

Ropalidia variegata jacobsoni (Buysson); van der Vecht, 1941, p. 157 (India; Bangka I.; Java).

South India: 2 ♀ 1 ♂ Coimbatore, April 1960, P. S. Nathan (ML); 6 ♀ Kerala State, Walayar Forests, Oct. 1959, P. S. Nathan (ML).

Burma: 7 ♀ Schwego Myo, Oct. 1885, L. Fea (MCG; 1 ♀ ML); 4 ♀ 2 ♂ Bhamò, July, Aug., and Nov. 1886, L. Fea (MCG; 1 ♀ 1 ♂ ML); 1 ♀ Washaung, 20 km east of Myitkyina, 14 July 1934, R. Malaise (NRS).

Sumatra: 1 ♂ Siboga, 1890-91, E. Modigliani (MCG).

Java: Bogor, 7 ♀ with nest (fig. 2 a), May 1949, leg. Inen (ML), 1 ♀ 29 Oct. 1951, A. M. R. Wegner (MZB); 1 ♀ 2 May 1953, J. van der Vecht (ML).

Celebes: 2 ♀ South Celebes, Dec. 1936, Indonesian collector (ML).

Bionomics. — Four of the females from Kerala State, South India, were collected with a nest, attached to a twig of a shrub or a tree (fig. 2 f); the nest consists of two rows of cells without windows; formula: 2 (0 + 34) = p (0 + 17) + r_1 (0 + 17). The petiolate cell is 7 mm deep, the sixth cell of each row is only 3 mm deep, and the cells gradually decrease in size towards the apex of the nest. As none of the cells show any signs of having

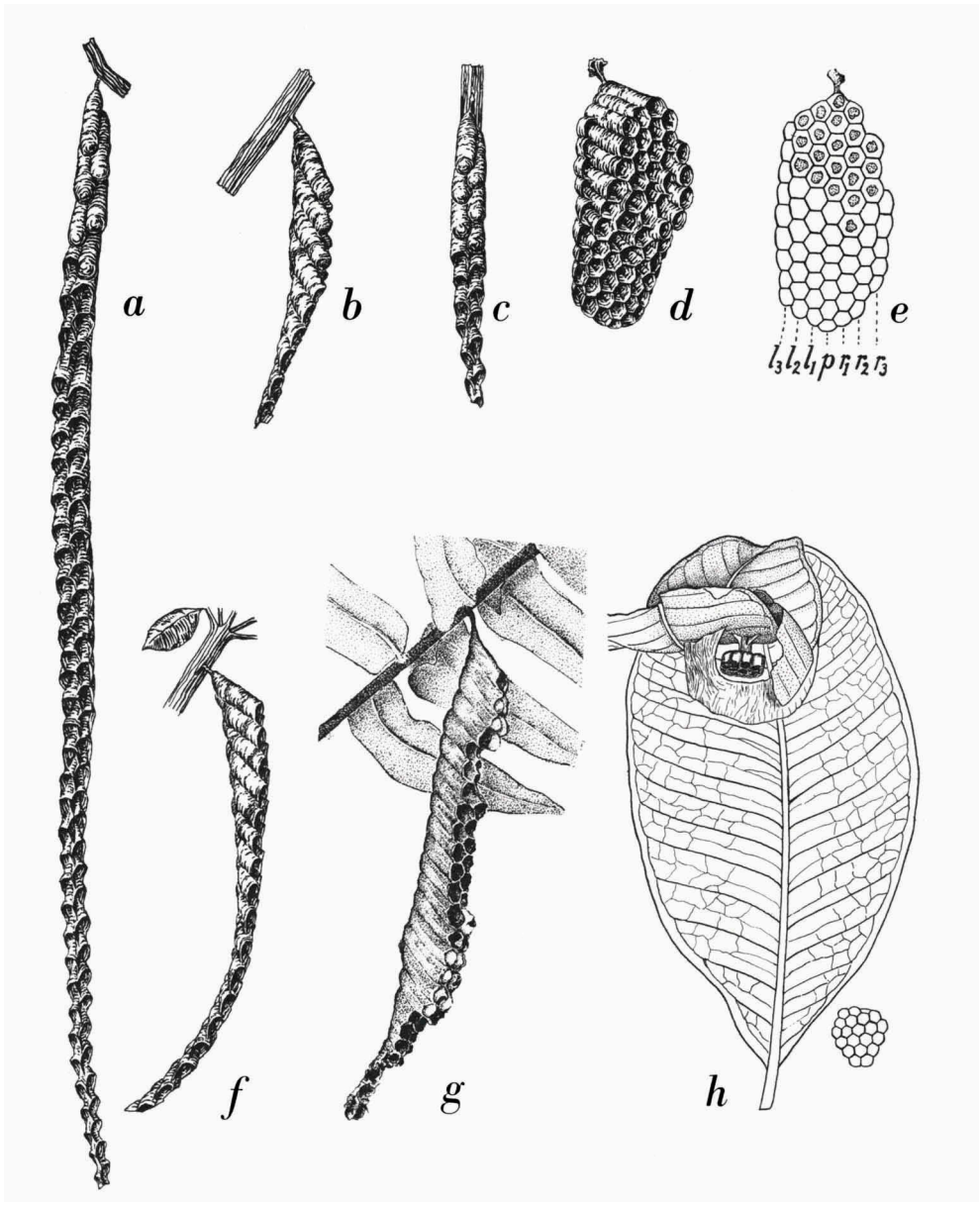

Fig. 2. Nests of some *Ropalidia* species. a: *R. variegata jacobsoni* (Buyss.), Bogor, West Java, May 1949, leg. M. Inen (ML); b and c: do., lateral and frontal view of younger nest, Mt. Tjibodas, Tjampea near Bogor, Febr. 1936, leg. F. Dupont (ML) d. and e: *R. gregaria* (Sauss.), Wissel lakes, New Guinea, Oct. 1939, leg. H. Boschma (ML), e illustrates the formula used in this paper for the description of the nests of some species of the subgenus *Anthreneida* (see p. 6); in this case the nest consists of the petiolar row p, three rows on the left and three on the right. f: *R. variegata jacobsoni* (Buyss.), Walajar Forest, 700 m, Kerala State, India, Oct. 1950, leg. P. Susai Nathan (ML). g: *R. stigma* (Smith), nest on fern leaf, Forest Experiment Station West Java, Dec. 1952, leg. J. van der Vecht (ML). h: *R.* (*Icarielia*) *aristocratica copiaria* (Sauss.), young nest between leaves of *Eugenia* spec., the leaves partly cut away to show the comb, Bogor, Java, May 1948, leg. J. van der Vecht. — a-f: natural size, g: $^2/_3$ ×, h: $^1/_2$ ×.

been used previously, this nest was apparently built by a group of females. — A nest collected in Bangka Island (Troe, Dec. 1935; ML) with some specimens of both sexes, contains 18 cells; formula : 2 (6 + 12) = p (3 + 6) + r_1 (3 + 6). — The two females recorded from Tjampea near Bogor, Java (van der Vecht, 1941, p. 157), were bred from a nest consisting of two rows of cells, suspended from a thin twig, and containing altogether 7 closed cells (with windows) and at least 11 open cells; the apex of the nest is damaged, but probably only a few young cells have got lost. — The nest found in May 1949 at Bogor by Inen (see above) is 14.5 cm long and consists of two rows of cells: 2 (24 + 52) = p (12 + 26) + r_1 (12 + 26). — The collection of the Paris Museum contains a damaged nest, collected by P. Serre at Djakarta ("Batavia"); it consists of two rows of cells.

It appears from the data recorded above that the nest of *R. variegata* invariably consists of two equal rows of cells, of which the second row is situated on the right hand side of the row containing the first, petiolate, cell. The nests are usually attached to a twig or thin branch; in all the nests examined so far the basal angle is sharp, but this is less pronounced in the Indian nest than in those from Java. The data of the first nest mentioned above indicate that new colonies are — or may be — founded by a small swarm of females.

Ropalidia variegata dichroma van der Vecht

Ropalidia variegata dichroma van der Vecht, 1941, p. 157, ♀ ♂ — Timor (types in ML).

Timor: 4 ♀ Baàguia, Aug. 1935, 1 ♀ Mollo, June 1935, Bühler & Meyer (NMB; ML); 4 ♀ Amanese, Kupang, 27 March 1957, A. M. R. Wegner (MZB; ML).

Roti: 5 ♀ 2 ♂ "Rote", Bühler & Meyer (NMB; ML).

Ropalidia cyathiformis (Fabricius)

Ropalidia cyathiformis (Fabricius); van der Vecht, 1941, p. 158 (Ceylon to Celebes).

In August 1959 I have examined the type of this species, a female in the collection Sehestedt-Lund (Univ. Zool. Mus., Copenhagen); this confirmed my earlier identification (1941) which was based on the original description and on the additional notes given by Schulz.

Ceylon: North Central Province, 1 ♀ Polonnaruwa, Aug. 1953 (NMB); North West Province, 1 ♂ Kalpitiya, Jan. 1954 (ML); 1 ♂ Puttalam, Febr. 1954 (NMB); Central Province, 5 ♀ Kandy, July 1953-March 1954; all leg. F. Keiser.

Burma: 2 ♀ 4 ♂ Myitkyina, 14 March 1934, R. Malaise (NRS; ML).

Celebes: 1 ♀ South Celebes, Pinrang, 29 May 1948, J. van der Vecht (ML); 2 ♀ 1 ♂, with nest, Makassar, Sept. 1949, C. J. H. Franssen (ML).

Sumba: 1 ♀ Waikarudi, 7 Sept. 1949, Swiss Sumba Exp. (ML).

Bionomics. — The nests of this species are not laterinidal, but show a tendency to extend in two directions from the first cell group. In nests suspended from long and narrow leaves of palms, grasses, etc., these directions may be directly opposite, but nests on the under side of the leaves of dicotyledonous plants may be more irregular, the directions of growth forming a blunt angle. The comb may contain up to a hundred cells, and is always supported by a single stalk; at least I have not seen any nests with additional stalks such as are found in the nests of *R. rufoplagiata, malayana,* etc.

A nest from Djakarta ("Batavia"), May 1908, leg. Jacobson (ML), consists of 9 cells in two rows, all on one side of the petiolate cell; five cells have windows. — A nest from Semarang, Sept. 1909, leg. Jacobson (ML), shows that the wasps first have built 7 cells in two rows on one side of the petiolate cell, and then have started to build in the opposite direction, where two cells (each containing an egg) had been constructed on the other side of the first, petiolate, cell. — A nest from Djakarta ("Batavia"), leg. Moens, is only 16 mm long and consists of about 20 cells, arranged in three rows; some of the cells are closed; the stalk is thin and cylindrical. — A nest from Bogor, March 1933, van der Vecht (ML), suspended from a palm leaf, is 6 cm long and 1 cm wide; it consists of five rows of cells (18, 21, 24, 24, and 14 cells, resp., total 101 cells); the stalk is situated near the centre of the nest and is strongly dilated in longitudinal direction.

The nest from Makassar, Celebes, Sept. 1949, leg. C. J. H. Franssen (ML), has been built in two directions from the petiolate cell, forming an angle of 120°; there are 3-4 rows on one side and 4-5 on the other side, altogether containing 59 cells; two females (one large, one small) and one male were received together with the nest.

Ropalidia rufoplagiata rufoplagiata (Cameron)

Ropalidia rufoplagiata (Cameron) and do., typical form; van der Vecht, 1941, pp. 165, 167.

Sumbawa: 1 ♀ Tambora, coll. Gribodo (MCG).

Bionomics. — The nests of this species are somewhat similar to those of *R. cyathiformis,* but the cells are larger, and the wasps show a tendency to construct additional supporting stalks as the comb increases in size.

A nest from Djakarta ("Batavia"), Dec. 1907, leg. E. Jacobson, consists of 34 cells, arranged in six rows (4, 6, 7, 7, 6, and 4 cells, resp.); it has

only one petiole which is situated somewhat excentrically. — Another nest from the same locality, Sept. 1908, same collector, is more elongate; it consists of 6 rows of cells (4 rows of ± 20 cells, one of 17 cells on one side and one of 8 cells on the other side, altogether about 105 cells); the main, primary, stalk is near the middle, and on one side there are two thin additional stalks. — A larger nest from the same locality, date, and collector, is approximately triangular, with sides of 4.5, 6, and 6.5 cm; it contains 248 cells; most of these have a bottom window; the nest is supported by four thin stalks, but there may have been one or two more; unfortunately it is uncertain to what substratum this comb had been attached. — A nest built on the under side of a palm leaf (probably from Bogor) is elongate, consisting of four rows of 20-30 cells; it is supported by a row of 15 short stalks.

Ropalidia rufoplagiata gravelyi Dover & Rao

(plate 2, a)

Ropalidia rufoplagiata gravelyi (Dover & Rao); van der Vecht, 1941, p. 168 (S. India to Sumatra).

Burma: 2 ♀ Carin Chebà, June 1888, L. Fea (MCG); 2 ♀ Schwego Myo, Oct. 1885, L. Fea (MCG; 1 ♀ ML). — The specimens of Fea recorded by me in 1941 are in MCG.

Bionomics. — In August 1958 Mr. Pagden found on Sungei Pinang Hills, Penang, a nest on a leaf of *Nephelium lappaceum* L. (plate 2, a); this nest was peculiar for having the cells with their openings upwards; it was protected by a leaf just above it.

Ropalidia plebeja (Saussure)

Ropalidia plebeja (Saussure); van der Vecht, 1941, p. 169 (Celebes).

Celebes: 1 ♀ Central Celebes, Lake Poso, 650 m, Febr. 1950, C. J. H. Franssen (ML). — This specimen agrees in all details with the type from Gorontalo in the Leiden Museum.

Ropalidia horni Sonan

Ropalidia horni Sonan; van der Vecht, 1941, p. 171 (Philippine Islands and North Borneo).

Philippine Is.: Palawan, 1 ♀ 1 ♂ Babuyan, 6 Dec. 1952, H. Townes, 16 ♀ Pto. Princesa, 5-9 Dec. 1952, H. Townes (coll. Townes; 6 ♀ ML). — Mindanao, Cotabato, 1 ♀ Parang, 23 March 1953, H. Townes, 1 ♀ Tacurong, 19 Aug. 1953, H. Townes (coll. Townes).

Ropalidia malayana (Cameron)

Ropalidia malayana (Cameron); van der Vecht, 1941, p. 174 (Sunda shelf).

Although the inhabitants of a single nest appear to be rather uniformly coloured, additional material of this species confirms the previously expressed view (van der Vecht, 1941, p. 175), that the colour phases are not sharply separated. In fact, two specimens collected in East Borneo by Wegner show different combinations of parts of the colour patterns of *malayana* and the var. *erythrospila*.

Ropalidia malayana (Cameron), typical form

Sumatra: 1 ♀ Medan, Mjöberg (NRS).

Borneo: 1 ♀ South Borneo, Pemanten-Sampit, July 1953, M. A. Lieftinck (ML); 1 ♀ East Borneo, 125 m, Tabang, Bengen River, 23 Aug. 1956, A. M. R. Wegner (ML). — The latter specimen has the pronotum dark red with yellow band and the mesoscutum reddish posteriorly, thus being transitional between *malayana* and *erythrospila*.

Ropalidia malayana var. **parvimaculata** (Cameron)

Borneo: 5 ♀ East Borneo, Balikpapan, Mentawir River, Oct. 1950, A. M. R. Wegner (MZB; 2 ♀ ML).

Ropalidia malayana var. **erythrospila** (Cameron)

(plate 2, b)

Malaya: 1 ♂ Kuala Lumpur, on Hibiscus, 21 Febr. 1936, H. T. Pagden (ML); Penang, 4 ♀ Sungei Pinang hill pass, 400 ft., from linear nest on nutmeg tree, 7 April 1956, H. T. Pagden (coll. Pagden, 2 ♀ ML).

Borneo: 1 ♀ Sarawak, Kuching, Sept.-Oct. 1950, M. A. Lieftinck (ML); 1 ♀ East Borneo, Tabang, Bengen River, 23 Aug. 1956, A. M. R. Wegner (ML). — The latter specimen has the mesoscutum black, and the postscutellum yellowish in the middle.

Bionomics. — In April 1956 Mr. H. T. Pagden discovered and photographed a nest of this form (see pl. 2, b) which was built along the under side of a branch of a nutmeg tree. The open comb was supported by a great number of stalks and contained some hundreds of cells.

In a letter dated August 14, 1957, Mr. Pagden wrote me: "This species appears to found its colonies, at least in some cases, by swarming. On 25 May 1957 my friend Paul Lim noticed about 30 to 40 individuals on a twig of a nutmeg tree (*Myristica fragrans*). There was no sign of any nest. Mr. Lim has shown me many nests of this species and the photo-

graphs which I have sent you were of nests found by him on his property, therefore, if he says there was no nest on 25 May it may be taken as certain that there was none. A few days later a comb of cells had been constructed, but unfortunately Mr. Lim did not note the date. I saw the nest on 2 June, at which time it was about 4 inches long. About one-third of the cells contained well grown larvae which almost filled them, while the remaining cells contained eggs or larvae in various stages of growth. It was difficult to count the wasps present due to their constant movement, but 34 were counted with certainty".

Ropalidia latebalteata (Cameron)

Ropalidia latebalteata (Cameron); van der Vecht, 1941, p. 178, ♀ (Peninsular Siam, Malaya, Borneo, Sumatra).

Sumatra: 1 ♀ Mt. Singalang, July 1878, O. Beccari (MCG), 4 ♀ 1 ♂ Deli, Sibolangit, 500 m, 19 Dec. 1954 and 4-5 Jan. 1955, J. van der Vecht (ML).

Borneo: 6 ♀ Bengen River, Tabang, Aug.-Sept. 1956, A. M. R. Wegner (MZB; ML).

Ropalidia ornatipes (Cameron)

Ropalidia ornatipes (Cameron); van der Vecht, 1941, p. 180, ♀ (Borneo).

Sumatra: 1 ♀ Sibolangit, 4 Jan. 1955, J. van der Vecht (ML).

Ropalidia sumatrae sumatrae (Weber)

(plate 1, e, f, plate 3)

Ropalidia sumatrae (Weber); van der Vecht, 1941, p. 181 (Birma — Sumatra).

Tenasserim: 4 ♀ Thagatà, April 1887, L. Fea (MCG); 3 ♀ "Vall. Houngdarau" (= Haundraw Valley), March-May 1887, L. Fea (MCG; 1 ♀ ML); 2 ♀ 1 ♂ Malewoon, July-Aug. 1887, L. Fea (MCG; 1 ♀ ML).

Malaya: 2 ♀ Perak, coll. Gribodo (MCG); 1 ♀ Perak, Kuala Kangsar, 1902, leg. Grubauer (NMW); 1 ♀ Mt. Ophir ("*speciosa* Saussure") (OUM).

Sumatra: 1 ♀ "Sumatra", from Staudinger, coll. Gribodo (MCG); 4 ♀ Marang, coll. Gribodo (including the type of *Icaria marangensis* Gribodo) (MCG); 4 ♀ Siboga, April 1888, 6 Oct. 1890, and March 1891, E. Modigliani (MCG; 1 ♀ ML); 1 ♀ Pagaranpisang, 1890-91, E. Modigliani (MCG); 1 ♀ Benculen, April 1891, E. Modigliani (MCG).

Bionomics. — In December 1935 I found a nest on Bangka Island, in the vertical bank of a hollow road near Toboali. The nest (pl. 1, figs. e and f) consisted of two uncovered combs, hanging vertically in a cavity originally made by termites; the larger comb consisted of over 300 cells

(about 60 of which were closed), whereas the smaller comb had only 37 cells, all containing eggs. When the nest was collected, there were at least 84 female wasps on it (a few wasps escaped), but no males were seen. The structure of the nest and the relation between the numbers of closed and open cells and of wasps on the nest seem to suggest that this colony was founded by a swarm of females, and not by a single queen.

The nest shown on plate 3 was discovered (by Mr. Pagden) in May 1939 between buttress roots of a tree at Folly Farm, Ringlet, Cameron Highlands, Malaya; it consisted of 8 or 9 combs, placed close together, but forming a rather irregular assemblage.

Ropalidia sumatrae lugubris (Smith)

Ropalidia sumatrae lugubris (Smith); van der Vecht, 1941, p. 185 (Borneo; ? India).

The type of this form, originally described as *Icaria lugubris* Smith, 1858, is a female in the Oxford University Museum (lectotype by present designation).

Borneo: 2 ♀ "Sar. 56/14" and "Sar. 56/44", syntypes, Sarawak, leg. Wallace (BM); 2 ♀ Sarawak, 1865-66, G. Doria, ex coll. Gribodo (MCG); 3 ♀ Bandjermasin, coll. Gribodo (MCG); 1 ♀ East Borneo, Mt. Selung, 100 ft., 5 July 1937, Mrs. M. E. Walsh (BM); 34 ♀ Samarinda, Muara Kaman, Nov. 1950, A. M. R. Wegner (MZB; ML); 3 ♀ Gunungsari, Aug. 1956, 12 ♀ Tabang, Bengen River, Sept.-Oct. 1956, A. M. R. Wegner (MZB; ML).

Ropalidia opulenta (Smith)

Ropalidia opulenta (Smith); van der Vecht, 1941, p. 185 (Borneo).

The type of this species is a female with label "Sar. 56/44" (Sarawak, leg. Wallace) in the British Museum (type no. 18.864).

Borneo: 2 ♀ "Sar." (Sarawak, leg. Wallace; one with blue label written by Smith), both from Mrs. Farren-White (BM); 2 ♀ "Borneo", 1886, F. Baczes (NMW); East Borneo, 1 ♀ 1 ♂ Samarinda, Muara Kaman, Nov. 1950, 7 ♀ 1 ♂ Balikpapan, Mentawir River, Oct. 1950, 5 ♀ Gunungsari, Aug. 1956, 10 ♀ 1 ♂ Tabang, Bengen River, Sept. 1956, all leg. A. M. R. Wegner (MZB; ML).

Ropalidia modesta (Smith)

Ropalidia modesta (Smith); van der Vecht, 1941, p. 187 (Birma to Java).

Sumatra: 1 ♀ Marang, type of *Icaria fulvipennis* Gribodo, coll. Gribodo (MCG); 4 ♀ Sibolangit, 500 m, Dec. 1954 and Jan. 1955, J. van der Vecht (ML).

Borneo: 2 ♀ East Borneo, Samarinda, Muara Kaman, Nov. 1950, A. M. R. Wegner (MZB).

Java: Udjung Kulon, 1 ♀ Tjikarang, 9 Sept. 1942, from nest inside a tree, M. A. Lieftinck (ML), 4 ♀ July 1955, 1 ♀ Nov. 1958, A. M. R. Wegner (ML); 1 ♀ "Meeuweneiland", 12 Sept. 1942, M. A. Lieftinck (ML).

Bionomics. — The following note was written by Dr. Lieftinck: "This species was encountered a few hundred yards behind the beach near Tjikarang (Udjungkulon Peninsula) in a patch of light coastal forest. Following the track my attention was drawn to a low buzzing sound emanating from the stem of a hollow tree beside the path. When I halted, still at some distance from the tree, I noticed a few black wasps of small size resting at about eye-level on the stem near the entrance of a circular hole (about 12 mm diameter). As the diameter of the hole was smaller than that of my killing-bottle I approached the tree, uncorked the vial, and holding this out horizontally was about to place it thoughtlessly right upon the entrance of the nest, anticipating the easiest catch of the day. The result was disastrous, for when the bottle was hard upon the hole, all of a sudden the vanguard of what appeared to be a large colony of wasps spurted out of it in a fierce and successful attack. Retrieving, I withdrew the bottle instantly and took my heels, the reward being a single wasp and the realization of having been painfully stung, all in exchange for the loss of several previously caught insects that were flung out of the bottle and strewn all over the forest floor."

Ropalidia granulata borneensis van der Vecht
(plate 4)

Ropalidia granulata borneensis van der Vecht, 1941, p. 190, ♀ — "Borneo, Bettotan near Sandakan" (type ML).

Borneo: 1 ♀ Balikpapan, Mentawir River, Oct. 1950, A. M. R. Wegner (MZB); 3 ♀ Tabang, Bengen River, Sept. 1956, A. M. R. Wegner (ML).

Malaya: Mr. H. T. Pagden collected this form in July 1957 on the Sungei Pinang Hills near Penang.

Bionomics. — According to information received from Pagden the specimens collected in 1957 inhabited an open comb inside a bamboo stalk. He sent me a series of photographs of this nest (reproduced on plate 4), and noted: "the cells face obliquely upwards in all nests I have seen, and always have some form of shelter above".

Subgenus **Paraicaria** Gribodo

Paraicaria Gribodo, 1892, Boll. Soc. Ent. Ital., vol. 23 (1891), p. 248 (genus).
Type species: *Paraicaria bicolor* Gribodo, 1891 (Monotypic).

The main reason for erecting a new genus for the species described by Gribodo as *Paraicaria bicolor* was the fact that the fore wing of this wasp has only two submarginal cells. This is indeed an exceptional character in the Vespidae, but Gribodo evidently overestimated its value, when he considered on this basis his new group to form a transition to the Masaridae, in which this character is not rare. Actually this is very clearly a case of convergence, for all other characters of this wasp show that it is undoubtedly a *Ropalidia* which has lost the second intercubital, or transverse submarginal, vein. It seems even possible to indicate the closest relatives of *Paraicaria* in the subgenus *Anthreneida: R. malayana* (Cameron) is in many respects so similar to *Paraicaria,* that I suspect it to be more closely allied to the *Paraicaria* species than to various other species of *Anthreneida.* Unfortunately the males of *Paraicaria* as well as the nests of these wasps are unknown, and I consider it therefore too early to draw definite conclusions concerning the relationships.

In addition to having only two submarginal cells, the *Paraicaria* species are distinguished by the clear hyaline wings, in which the marginal cell is not or only very slightly infuscated anteriorly, and by the short and thick antennae; the third antennal segment is hardly 1½ times as long as it is wide at the apex, and the length of the ninth segment is only half its width. The carina separating the smooth, sparsely punctate, anterior part of the mesepisternum from the densely punctate lateral areas is fairly distinct in the lower half. The gastral petiole is short, not very wide, but strongly swollen posteriorly.

Key to the species

1. Head and thorax densely, but rather superficially, punctate; concavity of propodeum smooth, hardly sculptured, the sides somewhat irregularly and superficially rugose, with few well-defined punctures; second gastral tergite with distinct interspaces between the punctures. (Dorsal surface of pronotum, and the scutella, red; a small spot on mandibles, a line at anterior margin of clypeus (often reduced), and a short line at inner orbits, yellow).

   a. Coxae I and lateral margins of clypeus black; propodeum black or with small yellowish spots . . . . . *bicolorata bicolorata* nom. n.

   b. Coxae I with large yellow mark; lateral margins of clypeus yellow; propodeum with two large yellow spots; colour of pronotum and scutella paler, orange . . . . . *bicolorata parvula* subsp. n.

— Head and thorax more coarsely punctate, the punctures rather deep, crater-like, with a distinct pustule in the middle of the shiny, flat, bottom; propodeum almost entirely coarsely punctate, only the middle of the concavity transversely rugose, rather dull; second gastral tergite densely, reticulately, punctate, without flat interspaces. (Thorax black; markings on face as in *R. bicolorata bicolorata*) . . . *nigerrima* spec. n.

Ropalidia bicolorata bicolorata nom. n.

Paraicaria bicolor Gribodo, 1892, Boll. Soc. Ent. Ital., vol. 23, p. 249, ♀ — "Chan-Yoma (Alta Birmania)", coll. Gribodo (MCG). Dalla Torre, 1894, Cat. Hym., vol. 9, p. 121 (cat.); 1904, Gen. Insect., vol. 19, p. 75 (cat.).

The name of this species has to be changed, because upon transferring it into the genus *Ropalidia, R. bicolor* (Gribodo) becomes a secondary homonym of *R. bicolor* (Smith) (= *Icaria bicolor* Smith, 1864).

Burma: 4 ♀ Chan Yoma, coll. Gribodo (syntypes, MCG); series (> 60 ♀♀) Carin Chebà, 900-1100 m, May-Dec. 1888, L. Fea (MCG; 4 ♀ coll. Giordani Soika; 9 ♀ ML); 3 ♀ North East Burma, Punkataung Road, Sadon-Myitkyina, 8 July 1934, R. Malaise (NRS, 1 ♀ ML); S. Shan States, 5 ♀ Taunggyi, 1500 m, 1 Aug.-22 Sept. 1934, R. Malaise (NRS, 2 ♀ ML), 10 ♀ 40 km east of Taunggyi, 25 Sept.-13 Oct. 1934, R. Malaise (NRS, 4 ♀ ML).

Siam: 1 ♀ Hinlap, January, H. Fruhstorfer (NMW); 1 ♀ Doi Setep, 8 Febr., Alice Mackie (ML); 3 ♀ Central Siam, Kwae Noi River Exp., Niki, 23 April-5 May 1946, E. Jonkers (ML). — The specimens from Niki agree with those from Burma, but in the two others the thoracic markings are orange, and the propodeum has two large yellow spots.

Ropalidia bicolorata parvula subsp. n.

♀ — Slightly smaller than the nominate subspecies, and more extensively marked with yellow, as described in the key on p. 38.

Length (h. + th. + t. 1 + 2): 5.5 mm.

Borneo: 6 ♀ North Borneo, Bettotan near Sandakan, 26 July-3 Aug. 1927, C. Boden Kloss & H. M. Pendlebury (holotype and 3 paratypes, BM; 2 paratypes, ML).

Ropalidia nigerrima spec. n.

♀ — Closely related to *R. bicolorata,* but easily distinguished by the coarser puncturation.

Head as wide as the thorax including the tegulae, about 2½ times as wide as long, in dorsal view not much excavated posteriorly; vertex rather steeply sloping behind the ocelli; temples distinctly narrower than the eyes; occipital carina distinct; posterior ocelli nearly 1½ times as far from the eyes as from each other (POL : OOL = 11 : 16); the distance between the posterior ocelli more than twice their diameter (11 : 4.5).

Pronotal carina moderately raised, slightly angular at the shoulders. Scutellum and postscutellum convex; propodeum convex as seen in profile, in dorsal view distinctly excavated, with biarcuate apex, the median excavation wide, but not very deep.

Basal, narrow, part of gastral petiole short, apical part strongly swollen, in profile almost spherical; greatest width of petiole less than half that of the second segment (15 : 32) and only little less than its length from apex of muscle (15 : 17). Second gastral segment obliquely cut off at end, the tergite distinctly longer than the sternite, and also longer than wide (35 : 32), posteriorly rather gradually sloping towards the depressed apical margin.

Clypeus sparsely and superficially punctate, frons, vertex, and the greater part of the temples densely and rather coarsely punctate, near the ocelli and on the vertex without flat interspaces; thorax more coarsely punctate than the head, the punctures deeper as well as larger, mostly with linear interspaces; the puncturation is sparse on the anterior surface of the pronotum, in front of the epicnemial carina of the mesepisternum, and in the middle of the postscutellum posteriorly; the metapleura and part of the sides of the propodeum are less densely punctate than the mesopleura; the excavation of the propodeum is transversely rugose with some scattered punctures. The swollen part of the petiole densely and even more coarsely punctate than the thorax, the second tergite less coarsely, but very densely punctate, with linear interspaces, the second sternite more sparsely punctate, with distinct interspaces.

Pubescence short, greyish, not conspicuous.

Black; antennae, mandibles, legs, and tegulae, dark brown, flagellum of antennae pale brown beneath; a spot at the base of the mandibles, a line at anterior margin of clypeus, and a spot at the inner orbits, just above the clypeus, pale yellow. Wings hyaline, hardly infuscated at anterior margin; veins and stigma brown.

Length (h. + th. + t. 1 + 2) : 6.5 — 7 mm.

Holotype: ♀ Berangas, South East Borneo, 26 Nov. 1930, J. van der Vecht (ML); the other specimens recorded below are paratypes.

M a l a y a: 6 ♀ Selangor, Bukit Kutu, 3300-3500 ft., 6 and 7 Sept. 1929 (2 ♀, BM and ML), and 25-30 Sept. 1932, H. M. Pendlebury (3 ♀ BM, 1 ♀ ML).

B o r n e o: 2 ♀ North Borneo, Bettotan near Sandakan, 26 July and 7 Aug. 1927, C. Boden Kloss & H. M. Pendlebury (BM, ML); 1 ♀ Sarawak, Santubong, 20 Sept.-5 Oct. 1950, M. A. Lieftinck (ML); 1 ♀ West Borneo, Sambas, May 1890, Th. F. Lucassen (ML); 4 ♀ East Borneo, Tabang, Bengen River, 29 and 30 Aug. 1956, A. M. R. Wegner (MZB, ML); 8 ♀ South East Borneo, Berangas, 26 Nov. 1930, J. van der Vecht (ML, 1 ♀ BM, 1 ♀ USNM); 1 ♀ South Borneo, Loa Tebuk, 3 July 1937, Mrs. M. E. Walsh (ML).

S u m a t r a: 2 ♀ Lau Rakit, Febr. 1918, leg. J. B. Corporaal (ML).

Subgenus **Icarielia** Dalla Torre

Icarielia Dalla Torre, 1904, Genera Insectorum, vol. 19, Vespidae, p. 72 (subgenus of *Icaria* Saussure).

Type species: *Icaria flavopicta* Smith. Designated by Meade-Waldo, 1913, Ann. Mag. Nat. Hist., ser. 8, vol. 11, p. 46.

The Oriental species without raised carina on the mesepisternum appear to form a natural group. Besides having a number of structural characters in common, they agree—at least so far as we know at present—in building nests which are partly or entirely enclosed in an envelope, consisting of one or more layers of paper-like (in *R. opifex* polythene-like) material. The first nest of this type was found in South India by J. Carl (1934), who described the wasp as *Ropalidia montana*. The largest of two nests found by Carl contained up to 60.000 cells, arranged in 35 interconnected combs in a peculiar type of architecture, for which Carl proposed the term "klimakocyttare". Some years later, I described and figured two nests of the type species of *Icarielia, R. flavopicta* (Smith) (van der Vecht, 1940). These nests were also enclosed in an envelope, and the larger of the two nests also consisted of several combs. Its architecture, however, was markedly different from that of the nest of *R. montana,* the most distinctive character being that the combs were alternatingly placed with the cell openings up and down. In 1947 I found an enclosed nest of *R. aristocratica copiaria* (Sauss.) in Java, and more recently the habit of constructing enclosed nests has been demonstrated by H. T. Pagden for three species occurring in Malaya (see below, under *R. aristocratica, timida,* and *opifex*).

In the majority of the species occurring in New Guinea the mesepisternal carina is also lacking, but we do not yet know whether in this area the nests of these species are also enclosed by an envelope.

Key to the Oriental species of *Icarielia* Dalla Torre

1. Occipital carina irregular: after a bend near the middle of the temple it runs downward on the temple, at a short distance from the posterior margin of the temple. Body shiny, almost impunctate. Fourth antennal segment longer than wide. Length (h. + th. + t. 1 + 2) 9-10 mm. . . . . *decorata* (Smith)
— Occipital carina regular, situated at posterior margin of the temple, at most slightly thickened in lower part 2
2. Frons and mesoscutum dull, with a microscopically fine basic puncturation, and moreover densely covered with rather large, shallow, flat-bottomed punctures, the bottom of which may have a more or less distinct central pustule 3
— Frons and mesoscutum either shiny, with scattered larger punctures, or dull without any distinct coarse puncturation; in the latter case the gastral petiole slender . 7
3. Marginal cell uniformly and rather strongly infuscated, the dark colour extending slightly beyond the limits of the cell. Mesoscutum without yellow lines . . . . . *aristocratica* (Sauss.)
— Marginal cell infuscated at anterior margin, the posterior part distinctly less dark 4

4. Mesoscutum with yellow lines . . . . . *flavopicta* (Smith)
— Mesoscutum black 5
5. Propodeum on each side with a rather coarsely and reticulately rugose zone between the insertion of the hind wing and the apex of the propodeum; as seen in profile the outline of the propodeum slightly convex; body black, with the dorsal part of the pronotum, the disk of the scutellum, and the greater part of the postscutellum, orange-red . . . . . *scitula* (Bingham)
— Propodeum very finely sculptured, not distinctly reticulately rugose; as seen in profile, its outline straight. Colour pattern different 6
6. Gastral petiole short and wide, its length less than 1½ times the greatest width, and twice its greatest height. Scutellum usually with two yellow spots; gastral petiole with yellow apical band. Length (h. + th. + t. 1 + 2): 6-7 mm . . . *timida* sp. n.
— Gastral petiole more slender, its length more than twice its greatest width and nearly 2½ times its greatest height. Scutellum and gastral petiole black (always?) . . . . . *malaisei* sp. n.
7. Head and thorax shiny, the basic puncturation hardly visible; frons, pronotum, mesoscutum, scutellum and mesopleura sparsely punctate, the punctures well defined and medium-sized, but everywhere much smaller than the interspaces, except on the mesoscutum just near the tegulae. Gastral petiole short, less than twice as long as wide, twice as long as the greatest height . . . . . *montana* Carl
— Head and thorax rather dull, very densely microscopically punctate, but without coarser punctures. Gastral petiole more slender 8
8. Pronotal carina obliterated at the sides. Mesoscutum and femora II and III black . . . . . *lepida* sp. n.
— Pronotal carina well developed, also at the sides. Mesoscutum with a pair of long yellow lines near the middle, and a short line on each side above the tegula; femora II and III marked with yellow . . . . . *opifex* sp. n.

Ropalidia decorata (Smith)

(fig. 3)

Polybia decorata Smith, 1858, Jl. Proc. Linn. Soc. Zool., vol. 2, p. 114, ♀ — Sarawak, Borneo, leg. A. Wallace (OUM); 1871, Jl. Proc. Linn. Soc. Zool., vol. 11, p. 384 (cat.). Dalla Torre, 1894, Cat. Hym., vol. 9, p. 163, ♀ (cat.). Bingham, 1897, Fauna Brit. India, Hym., vol. 1, p. 384 [erroneously regarded as synonym of *Polybia stigma* Smith]. Dalla Torre, 1904, Gen. Insect., vol. 19, p. 77 (cat.). Schulthess, 1913, Mitt. Schweiz. Ent. Ges., vol. 12, p. 164 (= *Icaria decorata* = *Icaria xanthopoda* Cam. sec. Meade-Waldo, in litt.).

Icaria xanthopoda Cameron, 1902, Jl. Straits Branch As. Soc., vol. 37, p. 103, ♀ — Sarawak, Borneo (BM). Dalla Torre, 1904, Gen. Insect. vol. 19, p. 75 (cat.). Schulthess, 1913, Mitt. Schweiz. Ent. Ges., vol. 12, p. 164 (syn. of *I. decorata* (Smith) sec. Meade-Waldo, in litt.).

?*Polybia stigma* Smith; Bingham, 1897, Fauna Brit. India, Hym., vol. 1, p. 384, ♀ ♂ (Burma to Borneo); 1908, Rec. Ind. Mus., vol. 2, p. 359 (Rangoon, Burma) [erroneous identification].

Ropalidia stigma (Smith); Dover, 1931, Jl. Fed. Mal. St. Mus., vol. 16, p. 257 [erroneous identification; incorrectly gives Fabricius as the author of the name *Polybia stigma*!].

This species (fig. 3) is easily recognized by its delicate sculpture and its relatively large size; the remarkable structure of the lower part of the temples is less pronounced in the male than in the female.

Malaya: Pahang, 1 ♀ Kuala Tahan, 1920, 3 ♀ Kuala Teku, H. M. Pendlebury (BM, 1 ♀ ML); Selangor, 2 ♀ Gombak Valley, 1921, H. M. Pendlebury (BM); 1 ♀ Perak, ex coll. von Schulthess (ML); 1 ♀ Perak, coll. Gribodo (MCG).

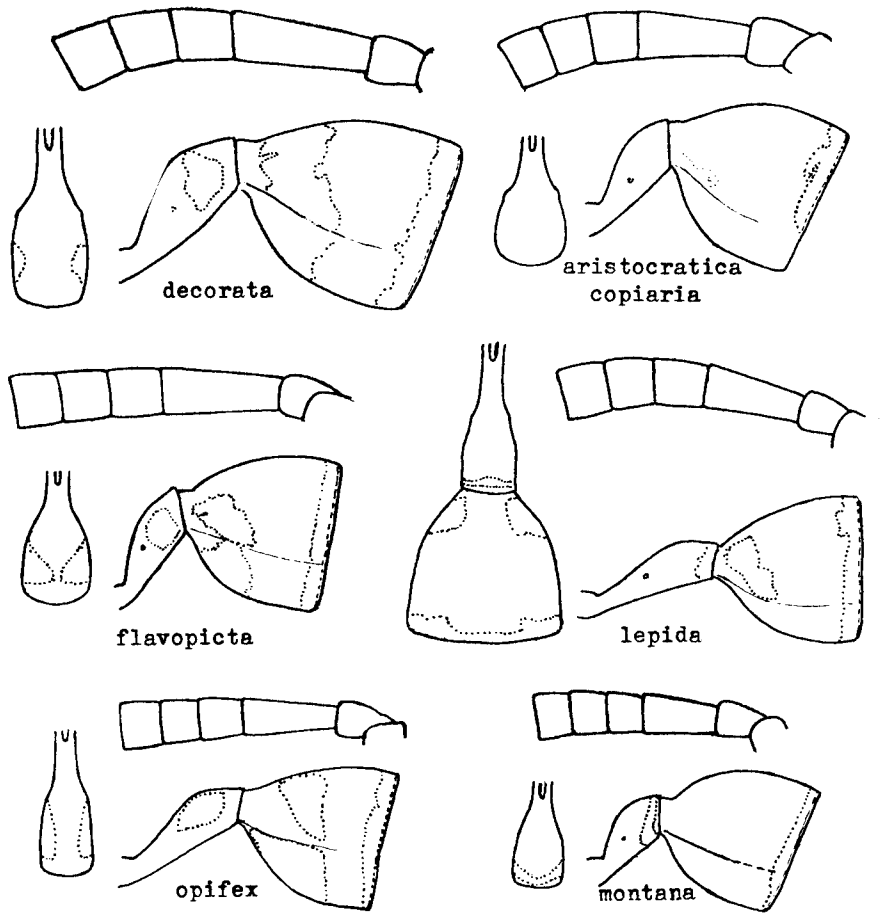

Fig. 3. Antennal segments 2-6 and gastral segments 1 and 2 of six species of *Ropalidia*, subgenus *Icarielia* Dalla Torre.

Borneo: 2 ♀ "Sar" (Sarawak, leg. Wallace) (1 ♀ with blue label of Smith = lectotype, OUM); 2 ♀ "Sar, 57/36" (Sarawak, leg. Wallace) (BM); 2 ♀ Sandakan, leg. Baker (coll. von Schulthess, ETHZ; ML); 2 ♀ Samawang, July 1927, 1 ♀ Bettotan, Aug. 1927, C. Boden Kloss & H. M. Pendlebury (BM, 1 ♀ Samawang in ML); 1 ♀ Sarawak, Kuching,

leg. Shelford (type of *Icaria xanthopoda* Cameron, BM); 2 ♀ "Borneo", leg. Shelford, 20 Oct. 1901 and 21 July 1903 (BM); 1 ♀ Sarawak, foot of Mt. Dulit, junction of rivers Tinjar and Lejok, 15 Sept. 1932, Oxford Univ. Exp. (BM); 1 ♀ Bandjermasin, coll. Gribodo (MCG); 1 ♀ East Borneo, Kariorang, April 1937, Mrs. M. E. Walsh (ML); 2 ♂ East Borneo, Babidjulan, June 1937, Mrs. M. E. Walsh (ML); 1 ♀ Balikpapan, Mentawir River, Oct. 1950, A. M. R. Wegner (MZB).

Sumatra: 1 ♀ Sukaranda, leg. Dohrn, coll. von Schulthess (ETHZ).

The occurrence of this species in Burma requires confirmation.

Bionomics. — Nothing is known about the habits of *I. decorata*, but on the basis of its morphology it seems probable that it builds a covered nest.

Ropalidia aristocratica (Saussure)

This species is regarded here as comprising two subspecies, which may be distinguished as follows.

1. Body with relatively rich colour pattern; the following parts rather dark yellow: clypeus (black band at base; disk with more or less distinct brownish mark), a large mark on the mandibles, a spot on lower part of temples (often reduced or absent), a line at inner orbits which ends at a short distance from the centre of the eye-emargination, a broad band at anterior margin of pronotum (narrowed laterally), two large subquadrate spots on the scutellum, a broad band at base of postscutellum; the tegulae and a large mark below them on the mesepisternum, two indistinct spots on the propodeum, broad apical fasciae of gastral tergites 1 and 2 (on 2 twice narrowly incised anteriorly, and extending on posterior angles of the sternite); anterior face of coxae I, and a small spot on outer side of coxae II and III. Gastral petiole bright red; base of second gastral segment more or less reddish . subsp. *copiaria* (Saussure)
— Markings of body less extensive and paler in colour; clypeus with V-shaped band at anterior margin; scutellum and propodeum usually black; apical bands of gastral tergites 1 and 2 narrow or absent . . . . . subsp. *aristocratica* (Saussure)

Ropalidia aristocratica aristocratica (Saussure)

Icaria aristocratica Saussure, 1853, Ét. fam. Vesp., vol. 2, p. 37, ♀ — "Les Indes-Orientales. Pulo-Pinang. (Collect. de M. Spinola)". Smith, 1857, Cat. Hym. Br. Mus., vol. 5, p. 97 (cat.); 1871, Jl. Proc. Linn. Soc. Zool., vol. 11, p. 378 (cat.). Dalla Torre, 1894, Cat. Hym., vol. 9, p. 117 (cat., "India or."); 1904, Gen. Insect., vol. 19, p. 73 (cat.) ["Indien"!].

Ropalidia aristocratica; Dover, 1929, Bull. Raffles Mus., vol. 2, p. 47 (Singapore Island).

This species has been misidentified by Bingham (1897, p. 391), who stated to have seen it from Tenasserim.

When I visited the Museum in Turin in 1957, I had some trouble in finding the type, mainly because it is in the Spinola collection under a label "*Icaria constitutionalis* de Saussure, D. Westermann, Pulo-Pinang"; more-

over the gaster of the specimen was lacking. Apparently de Saussure identified and returned this specimen, and then changed the name which in his monograph is used for a species from Madagascar in the Paris Museum.

There is no doubt that this specimen is indeed the type; it agrees perfectly with de Saussure's description; this is also true for the greater part of the gaster (segments 2-6) which was found on the bottom of the box.

The following notes on the type were made during my visit to the Zoological Museum of the University of Turin, in October 1957.

♀ — Head wider than high, with thick temples, which in the middle are broader than the eye (head seen in profile); occipital carina everywhere distinct and not irregular. Clypeus wider than high, rather coarsely, but shallowly and not very densely, punctate, the interspaces generally larger than the punctures. Third antennal segment slightly longer than the segments 4 and 5 together.

Pronotal carina distinct, laterally reaching the anterior margin in a slight curve.

Frons, vertex, pronotum, mesoscutum, scutellum, and anterior part of postscutellum dull with rather superficial sculpture, reticulately rugosopunctate; the posterior part of the postscutellum very strongly shiny. Anterior part of mesepisternum (epicnemium) impunctate (apart from the microscopical basic sculpture), the transition to the posterior, convex, part distinctly indicated by the difference in sculpture (this part being rather densely punctate), but not marked by a carina. Upper part of metapleura dull and finely rugose, lower part more finely sculptured, moderately shiny, with a few scattered, very superficial, punctures.

Propodeum dull, with rather shallow, median, pear-shaped, impression (widest above), but without impressed median line, rather irregularly transversely rugose, the rugae most distinct on the convex parts on each side of the median impression, and here anostomosing so frequently as to render the sculpture almost reticulately rugose; laterally the rugae disappear gradually.

Second gastral segment about as long as wide, slightly wider than high, dull, densely, but very superficially, somewhat rugosely, punctate; its strongly depressed apical margin thin, very narrow and testaceous.

Black; the following parts pale yellow: a large mark on the mandibles, a V-shaped band at anterior margin of clypeus, a short line at inner orbits, a very narrow line along the transverse carina of the pronotum, an irregular spot on mesepisternum below the tegulae, two large transverse spots, hardly separated in the middle, on the postscutellum, a large spot on anterior face of coxae I; a narrow band at apex of second gastral tergite brownish yellow.

Tegulae dark brown; legs partly brownish; tibial spurs yellowish; wings subhyaline, the apex of the subcostal cell and the whole marginal cell strongly infuscated; the dark area extending slightly beyond the outer half of the cell.

In the original description the first gastral segment (now lacking in the type) is said to be "noir, liseré de jaune, roux au milieu; et orné de deux points jaunes imperceptibles sur le noir de la partie renflée".

The female specimens recorded below agree well with this description. The series from the type locality shows that the colour varies somewhat in specimens from the same nest. The spot on the mesepisternum is lacking in three out of four specimens; the gastral petiole is reddish, the base beneath and the posterior half to two thirds of the swollen part more or less suffused with blackish, the apical band distinct in two specimens from Penang, but practically absent in three specimens which have the swollen part predominantly reddish posteriorly. The specimens from the mainland of Malaya partly show a conspicuous reduction of the yellow markings, but they have the petiole rather brightly red.

♂ — Similar to the female; head wider and flatter, and the eyes more strongly converging below; face below the eye-emarginations with short and rather dense silvery pubescence. Antennal segments 3-13 with tyloids at under side. Colour pattern as in the female, but the band at anterior margin of the clypeus narrower. In the specimens from Singapore Island the scutellum bears two small yellow spots.

Length (h. + th. + t. 1 + 2) ♀♂ : 7-8 mm.

Peninsular Siam: 1 ♀ Nakon Sri Tamarat, Khao Lung, 2000 ft., April 1922, H. M. Pendlebury (BM; lines at inner orbits very narrow; coxae I and mesepisternum black; gastral segment 1 red, 2 black, without apical bands).

Malaya: Pahang, 1 ♀ Gunong Benom, 6000 ft., at light, 24 July 1925, I. H. N. Evans (BM; first gastral segment red, second reddish at base, its apical band reduced to the middle third of the tergite), 1 ♀ Gunong Tahan, 5400 ft., 13 Dec. 1922, H. M. Pendlebury (ML; spots on postscutellum small, mark on coxae I restricted to apical half; gastral segments as in the specimen from Peninsular Siam). Penang, 4 ♀ Sungei Pinang, from enclosed nest on Garcinia (mangosteen), 22 May 1956, H. T. Pagden (coll. Pagden; ML), 1 ♀ Tanjong Bunga, Sungei Kechil, 22 Aug. 1958, H. T. Pagden (coll. Pagden). Singapore, 5 ♂ Selitar, Aug. 1911 (BM; ML).

Sumatra: 1 ♂ Balimbingan, April 1920, J. B. Corporaal (ML; gastral petiole only slightly reddish at base).

Ropalidia aristocratica copiaria (Saussure)

(figs. 2 h and 3)

Icaria copiaria Saussure, 1862, Stett. Ent. Ztg., vol. 23, p. 135, ♂ — Java (ML). Dalla Torre, 1894, Cat. Hym., vol. 9, p. 118 (cat.); 1904, Gen. Insect., vol. 19, p. 73 (cat.).

The subspecies *copiaria* agrees in structure and sculpture with typical *aristocratica,* but the gastral petiole appears to be a trifle more slender.

Java: 1 ♂ (type), 2 ♀, "Java", leg. S. Müller (ML), 1 ♂ "Java" (MP); 1 ♂ "Java", van Lansberghe (ML). West Java: 7 ♀ Udjong Kulon, Teluk Peutjang and Tjigeunteur, July 1955, A. M. R. Wegner (MZB, ML); 2 ♀ Mt. Pantjar near Bogor, 27 Sept. 1936, J. van der Vecht (ML); 1 ♀ Bolang, May 1930, M. A. Lieftinck (MZB); 1 ♀ Bogor (MZB); 1 ♀ Tjiburial near Bogor, 8 Nov. 1936, J. van der Vecht (ML); 1 ♀ Bogor, Cultuurtuin, 30 July 1939, J. van der Vecht (ML); 1 ♀ 1 ♂ Sukabumi, March 1933, leg. F. Verbeek (ML); 2 ♀ Tapos on Mt. Gedeh, 800-1000 m, 1933, 1935, J. van der Vecht (ML); 2 ♀ Sindanglaja, T. Barbour (ML); 7 ♀ Djampang Tengah, 1934, Mrs. M. E. Walsh (ML); 11 ♀ 1 ♂ Bibidjilan, July and Oct. 1935, Mrs. M. E. Walsh (ML); 1 ♀ Djampang Wetan, Mt. Besser, March 1938, Mrs. M. E. Walsh (ML); 1 ♀ Tjiguha, May 1938, Mrs. M. E. Walsh (ML); 2 ♀ Djampang Tengah, Mt. Malang, Mrs. M. E. Walsh (MZB; ML). Central Java: 3 ♀ Japara, Dec. 1917, W. Roepke (LEW); Mt. Muria, 5 ♀ 1 ♂ Dec. 1935, Mrs. M. E. Walsh (ML); 3 ♀ Tjolo, 20-24 Oct. 1939, M. A. Lieftinck (MZB; ML); 1 ♀ Rembang, Klino, Mt. Pandan, 4 Febr. 1940, Mrs. M. E. Walsh (ML). East Java, 1 ♀ Bajukidul, 14 March 1931, H. Lucht (ML). — An old series in the Leiden Museum with label "Ploem, Sumatra" is evidently incorrectly labelled.

Bionomics. — A small nest of this form (fig. 2, h) was found in October 1947 in the Experimental Garden ("Cultuurtuin") of the Agricultural Station at Bogor, West Java. It consisted of a single comb, which was attached by a short petiole to a leaf of a species of *Eugenia*; this comb was partly protected by some neighbouring leaves, partly by a paper-like cover which held the tops of the leaves together.

Ropalidia scitula (Bingham)

Ropalidia scitula (Bingham); van der Vecht, 1941, p. 142 (N. E. India; description of male).

In 1941 I have erroneously placed this species in the group with epicnemial carina on the mesepisternum. At that time only the male was available for study, but examination of a series of females from Burma has now shown that *R. scitula* is without doubt closely allied to *R. flavopicta* (Smith).

The female agrees in many respects with the male, but the face is often

entirely black (in one specimen with ill-defined yellow spot at apex of clypeus and short yellowish lines at inner orbits near the antennae; in some others only the latter marks are present in more or less reduced form); the temples are wider than the eyes (9 : 8), eyes relatively less far apart on the vertex than at the clypeus (22 : 17). Two specimens have a small reddish spot in the upper part of the mesepisternum.

This species is perhaps more closely allied with *R. aristocratica* than with other species of *Icarielia*; the sculpture is even slightly coarser than in that species; the clypeus is rather coarsely, though not densely, punctate, the propodeum is more coarsely and irregularly rugose, and the marginal cell is less strongly infuscated.

Length (h. + th. + t. 1 + 2): 7-8 mm.

Burma: 1 ♀ North East Burma, Sadon, 1200 m, June-July 1934, R. Malaise (NRS); 7 ♀ Carin Chebà, 900-1100 m, May-Dec. 1888, L. Fea (MCG; ML).

Ropalidia flavopicta (Smith)

(figs. 3 and 4)

Although I have spent much more time on the study of this species than on that of the other *Icarielia* species discussed in this paper, I cannot say that I am entirely satisfied with the results. This is mainly because the available material is not sufficiently extensive to form a reliable basis for a complete analysis of the variation of the species throughout its area of distribution. The colour pattern of this wasp is subject to considerable variation, and although it is possible to distinguish certain patterns which are correlated with the geographical distribution, the limits of the variation within certain local populations cannot be determined with sufficient certainty. Thus, for example, I am unable at the moment to say whether the type of the rather dark *Icaria sericea* Cameron, described from Sikkim, is correctly labelled, for many years ago I noted that other specimens from Sikkim in the British Museum are brightly coloured like those from Burma; however, I have not seen enough material from this locality to form an opinion on the possibility of the occurrence of a dark form there.

The Northern part of the Malay peninsula (including Peninsular Siam) appears to form the transitional zone between a brightly coloured northern or continental form, inhabiting Sikkim, Assam, Burma, Indo-China, and Siam, and a darker southern or Sunda-shelf form, which occurs in Malaya, Sumatra, and Borneo. These forms are discussed below under the subspecific names *ornaticeps* (Cameron) and *flavopicta* (Smith), respectively. Specimens from Java and Flores are remarkable for resembling *ornaticeps*

in certain characters, whereas they agree with subsp. *flavopicta* in some other respects; they are described below as a new subspecies, which eventually will probably be found also on the interlying islands. The representative inhabiting Sumba is remarkable for the ochreous colour of its markings and is also regarded as a separate subspecies. The study of the variation of *R. flavopicta* in the Philippine Islands presents considerable difficulties, which I have discussed in a separate paragraph.

It should be noted that none of the characters used in the following key is absolutely constant, and that the subspecies can be characterized only by a combination of characters.

Key to the subspecies (♀), excluding the Philippine Islands forms

1. Clypeus entirely yellow, rarely with weakly developed dark line or spot at the base. Frons with yellow mark extending from base of clypeus to anterior ocellus. Vertex with narrowly interrupted post-ocellar line. Temples with broad yellow band which usually covers the lower part of the occipital carina. Mandibles entirely yellow or very narrowly black at their base below. Mesoscutum with long median lines and a short lateral line on each side above the tegula. Scutellar spots large, separated by a narrow dark median line, which in relatively dark specimens may be dilated posteriorly; propodeum yellow except for a narrow median band and some more or less distinct marginal incisions. Gastral petiole on each side with elongate spot which encloses the stigma. Second gastral tergite with well developed basal spots; gastral segments 3-6 broadly yellow posteriorly, sometimes more or less suffused with brownish. Tibiae III black. — Continental South East Asia to Northern Malaya . . . . . *ornaticeps* (Cameron)

— Clypeus with dark basal line or band, or entirely yellow; in the latter case the markings on vertex, temples, and gastral petiole less extensive; the lateral lines of the mesoscutum absent (in some specimens from Java more or less faintly indicated) 2

2. Frontal mark reduced to a spot between the antennal bases, or entirely absent. Vertex black or with small yellow spot near the top of each eye. Gastral segments 3-6 as a rule with more or less distinct yellow band at apical margin. Hind tibiae often extensively marked with yellow. — Malaya; Sumatra; Borneo . *flavopicta* (Smith)

— Frontal mark extending from base of clypeus to anterior ocellus, often strongly dilated above the antennae and then rather suddenly narrowed to a point which reaches the anterior ocellus, sometimes confluent with the broad lines at the inner orbits. Clypeus without dark line or spot at the base. Gastral segments 3-6 entirely dark, brownish 3

3. Markings yellow. — Java-Flores . . . . . *javanica* subsp. n.

— Markings ochreous to orange-brown. — Sumba . . . . . *ochracea* subsp. n.

Ropalidia flavopicta ornaticeps (Cameron)

Icaria ornaticeps Cameron, 1900, Ann. Mag. Nat. Hist., ser. 7, vol. 6, p. 496, ♀ — Khasia Hills, Assam, leg. Rothney (OUM); 1903, Jl. Straits Br. Roy. As. Soc., vol. 39, p. 173 [erroneously recorded from Sarawak, Borneo]. Meade-Waldo, 1911, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 100 (syn. of *I. flavopicta* Smith).

?*Icaria sericea* Cameron, 1905, Tijdschr. v. Ent., vol. 48, p. 73, ♀ — Sikkim (BM).

Sikkim: Several years ago I examined the type of *Icaria sericea*

Cameron, 1905 (nec *I. sericea* Cameron, 1911) in the British Museum, and noted that this is a rather dark specimen, in contrast to other specimens from this locality in the same collection. In the type the lines on the mesoscutum are small, the spots on the propodeum truncate above, triangular with rounded angles, the spots on the petiole small, hardly visible from above, the basal spots of tergite 2 small, and the apical band of tergite 2 with two small incisions. — 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.

Assam: N. E. Assam, 1 ♀ Sadiya, Abor Exp., 23 Nov. 1911, S. W. Kemp (Zool. Mus. Calcutta); 1 ♀ Puging, 3000 ft., J. C. Brown (Zool. Mus. Calcutta; discoloured by cyanide, gaster lacking; clypeus at base with small dark spot). — Concerning the type of *Icaria ornaticeps* Cameron from the Khasia Hills, Mr. Ernest Taylor, Oxford University Museum, kindly informed me that, as I had suspected, the bracket in Cameron's description should stand behind "above" instead of behind "edges" (l.c., p. 497, line 8 from above); "there is a dark longitudinal line at the base of the clypeus (reaching about the middle) and there are two lines on the sides of the mesoscutum just above the tegulae in addition to the two median lines mentioned in the description."

Burma: 6 ♀ Rangoon, May 1887 and Dec. 1888, L. Fea (MCG; 1 ♀ ML); 6 ♀ Palon, Pegù, Aug.-Sept. 1887, L. Fea (MCG; 1 ♀ ML); 1 ♀ Carin Chebà, 900-1100 m, May-Dec. 1888 (MCG). 1 ♀ N. Shan States, Maymyo, 1500 m, 28 Febr. 1934, R. Malaise (NRS); 1 ♀ N. E. Burma, Kambaiti, 7000 ft., 9 March 1934, R. Malaise (ML); 4 ♀ North Burma, Myitkyina, 175 m, 1-14 March 1934, R. Malaise (NRS; ML). — All specimens have the typical pattern of the continental form: clypeus yellow; lower part of occipital carina yellow; mesoscutum with median and lateral lines, petiolar spots enclosing the stigmata; hind tibiae black.

Tenasserim: 9 ♀ Moulmein, May 1887, 1 ♀ do., Nov. 1886, L. Fea (MCG; 2 ♀ ML); 73 ♀ Kawkareet, Jan.-Febr. 1887, L. Fea (MCG; 8 ♀ ML); 9 ♀ Meetan, Febr. 1887, L. Fea (MCG; 1 ♀ ML; all reddish discoloured); 2 ♀ Sukli, 75 km east of Moulmein, 600 m, 27-31 Oct. 1934, R. Malaise (NRS; ML); 1 ♀ Malvedaung, 30 km south of Ye, 300 m, 15-25 Nov. 1934, R. Malaise (NRS). — Colour pattern as in the Burma specimens; in the females from Sukli the clypeus has a short black line at the base, and the markings on temples and scutellum are less extensive than usual.

Indo-China: 1 ♀ Cochinchine, P. Candora, 5 Aug. 1924, R. Vitalis de Salvaza (IRSNB).

Siam: 2 ♀ Nan, 26 Dec. and 22 Jan., leg. Cockerell (ML); 1 ♀ Phukac, 3 Dec. 1957, L. D. Brongersma (ML). — Colour pattern as in the Burma specimens.

Malaya: Kelantan, 6 ♀ Kota Bahru, 18 May 1951, R. A. Lever (coll. Pagden; 4 ♀ ML) (with label "from rather large open nest on leaf", but Mr. Pagden regards this as incorrect). — This series agrees in most respects with the specimens from Burma, Tenasserim, and Siam; the clypeus is not entirely yellow, but the dark line at the base is poorly developed; as compared with other Malayan specimens head and thorax are more extensively marked with yellow; the hind tibiae are entirely black.

Ropalidia flavopicta flavopicta (Smith)

(plate 5)

Icaria flavopicta Smith, 1857, Cat. Hym. Brit. Mus., vol. 5, p. 99, ♀ — Sarawak, Borneo, leg. Wallace (BM, type no. 18.857). Saussure, 1862, Stett. Ent. Ztg., vol. 23, p. 135 (Borneo). Smith, 1871, Jl. Proc. Linn. Soc. Zool., vol. 11, p. 379 (cat.). Dalla Torre, 1894, Cat. Hym., vol. 9, p. 118 (cat.); 1904, Gen. Insect., vol. 19, p. 73 (cat.). Bingham, 1905, Fasc. Malay., vol. 3, p. 50 (Malaya). Meade-Waldo, 1911, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 100 (syn.: *I. ornaticeps* Cameron; data on distribution (incl. subsp. *ornaticeps*)); 1913, Ann. Mag. Nat. Hist., ser. 8, vol. 11, p. 46 (designated as type species of subgenus *Icarielia* Dalla Torre). Schulthess, 1914, Zool. Jahrb. Syst., vol. 37, p. 259 (Sumatra).

Ropalidia flavopicta (Smith); Bequaert, 1918, Bull. Amer. Mus. Nat. Hist., vol. 39, p. 246. Dover, 1931, Jl. Fed. Malay St. Mus., vol. 16, p. 257 (Peninsular Siam; Malaya).

Siam: Peninsular Siam, 2 ♀ Nakon Sri Tamarat, Kha Ram, 750 ft., 2 March 1922, H. M. Pendlebury (BM); 5 ♀ 1 ♂ Banzai Pap, April 1924, L. H. N. Evans (BM; ML). — These specimens agree with typical *flavopicta* from Borneo (clypeus of female with black line at base, occipital carina dark, mesoscutum without lateral lines, petiolar spots small).

Malaya: Kedah, 5 ♀ nr. Jitra, Catchment Area, 4 April 1928, H. M. Pendlebury (BM; 1 ♀ ML). — Penang, 3 ♀ Sungei Pinang Hills, ex nest on rock (see pl. 5), 7 Oct. 1956 (coll. Pagden; 2 ♀ ML), 1 ♀ Batu Feringgi catchment area, 5 July 1957 (coll. Pagden), 1 ♀ Sungei Pinang Hills, ex nest on Hevea, 24 Sept. 1957 (ML); 1 ♀ Penang Hill, 2500 ft., 17 Jan. 1959 (ML); all collected by H. T. Pagden. — Pahang, 1 ♀ Kuala Tahan, Nov. 1921, H. M. Pendlebury (BM); 1 ♀ Kuantan/Jerantut, 28 April 1957, H. T. Pagden (coll. Pagden). — Selangor, 1 ♀ Kuala Lumpur, Ampang, 15 Aug. 1926, C. Dover (BM). — Negri Sembilan, 7 ♀ Port Dickson, Jan. 1935, H. M. Pendlebury (BM; 2 ♀ ML).

Sumatra: 2 ♀ Si-Rambé, 10 ♀ Pagaranpisang, Oct. 1890-March 1891, E. Modigliani (MCG; 2 ♀ ML), 1 ♀ Aer Mantjur ("Mantcior"), Aug. 1878, O. Beccari (MCG); 4 ♀ Toba Lake, 8 ♀ Tandjong Morawa, Serdang, Dr.

B. Hagen (ML); 2 ♀ Habinsaran, Simanimbo, 1 Aug. 1928, J. C. van der Meer Mohr (ML); 2 ♀ Tebing Tinggih, 20 Dec. 1954, J. van der Vecht (ML); Sibolangit, 400-500 m, 1 ♀ 12 Nov. 1950, M. A. Lieftinck (ML), 11 ♀ 3 ♂ 4-5 January 1955, Mrs. E. van der Vecht—B. and J. van der Vecht (ML); 1 ♀ Tandj. Andalas, May 1914, E. Jacobson (ML); 2 ♀ Alahan Pandjang, Oct. 1877, Sumatra-Exp. (ML); 2 ♀ Fort de Kock, 920 m, 1925, E. Jacobson (ML); 1 ♀ Buo, "Padangse Bovenlanden", Febr. 1914, E. Jacobson (ML); 2 ♀ Suban Ajam, July 1916, E. Jacobson (ML); 2 ♀ Air Njuruk, Dempu, 1400 m, Aug. 1916, E. Jacobson (ML); 1 ♀ "Boenga Mau", J. C. van Hasselt (ML); 1 ♀ Rawas, May 1878, Sumatra-Exp. (ML); Djambi, 1 ♀ Sarolangun, 1 ♀ Selemuku, July-Aug. 1925, O. Posthumus (ML); Benkulen, 2 ♀ (1 ♀ Tandjong Sakti), June-July 1935, Mrs. M. E. Walsh (ML); Lampong Districts, 2 ♀ Kedaton, 150 m, 2 ♀ Mt. Betung, Sungeilangka Estate, March 1937, Mrs. E. van der Vecht—B. and J. van der Vecht (ML). — Most of these specimens agree well with Bornean *flavopicta,* but in the females from Habinsaran the yellow markings are much reduced; in one specimen the mesoscutum is even entirely black.

B o r n e o: 1 ♀ "Sar. 56/14" (BM, type of *Icaria flavopicta* Smith, no. 18.857). 3 ♀ "Borneo", leg. Müller (ML); Sarawak, 4 ♀ Mt. Dulit, at junction of rivers Tinjar and Lejok (1 ♀ "cultivated land now waste", and 1 ♀ "recent clearing in old secondary forest"), Aug. 1932, 1 ♀ in moss forest at 3500 ft., 17 Oct. 1932, 2 ♀ R. Kapah Trib. of R. Tinjar, 25 Sept. and 8 Oct. 1932, all leg. Oxford Univ. Exp. (BM; ML); 2 ♀ Mt. Matang, leg. Bryant (BM);; 1 ♀ Kuching, 21 Sept. 1950, M. A. Lieftinck (ML). East Borneo, 1 ♀ Kaliorang River, April 1937, Mrs. M. E. Walsh (BM), 7 ♀ Balikpapan, Mentawir River, Oct. 1950, A. M. R. Wegner (MZB; 2 ♀ ML), 5 ♀ Tabang, Bengen River, Aug. 1956, A. M. R. Wegner (ML). South East Borneo, 7 ♀ Berangas, 25 Nov. 1930, J. van der Vecht (ML). South Borneo, 1 ♀ Sampit, Jan. 1954, A. H. G. Alston (BM).

B i o n o m i c s. — In a letter dated October 17, 1956, Mr. Pagden wrote me concerning this species:

"The first nest was burnt by an ill-disposed person before I knew about it, but a second nest [see pl. 5] has now come to light, once more through the efforts of my friend Paul Lim. It was built on a granite boulder; the outer covering was 13.7 cm long by 7.5 cm wide; within this was a rosette of about 212 cells ... After making a number of exposures of the whole nest, I approached the nest with some timidity and placed an ethylacetate killing tube over the exit. Wasps immediately started to emerge like bullets from a machine-gun. After an interval during which no more wasps emerged, though a few foragers returned, but showed no signs of attacking me, I

removed the outer cover and exposed the comb. A single, somewhat dizzy wasp remained and was sprayed with ethyl chloride, and the camera was set up once more and a further series of exposures was made. While making these further exposures ten wasps returned to the nest and tended the brood, so I left the comb undisturbed. A week later the wasps were still attending it, but had made no attempt to reconstruct the envelope. The total number of wasps collected on this occasion was 76.

This nest would never have been found but for the fact that my friend was stung, only once, when he was dragging a lopped off tree branch which must have brushed against the nest. It took him half-an-hour to find the nest after he was stung and he must almost have leant against it during his search".

Two weeks later, Mr. Pagden wrote: "The wasps which returned to the nest after I had removed the covering remained with it until the inmates of all the sealed cells had emerged, when the whole lot deserted."

Another nest was found by Mr. Pagden in Nov. 1957 beside the tapping panel on the trunk of a rubber tree on Sungei Pinang Hills, Penang. The nest was collected with 104 females, a few specimens were lost and some were out foraging. No males were found. The nest consists of a single comb, which was attached with at least 10 short supports to the stem; the comb was protected by a paper-like covering, oval in shape and about 14 cm long and 7 cm wide. The comb is flat and also approximately oval, but rather irregular on one side; it contains about 250 open cells, nearly all with bottom window (lacking in a few marginal cells only), and 75 closed cells.

It is of interest to note that the nests of *R. flavopicta* hitherto found in Malaya are rather different from those collected in Java, the former consisting of a single comb (plate 5), whereas the latter have two or more combs (fig. 4). Evidently this is not merely a matter of the age of the nests, for the smaller nest from Java does not appear to be older than those from Malaya. The choice of the nesting site may be of importance, for whereas the Java nests were fixed to a leaf and to a branch, the Malayan wasps show preference for a broad and solid surface. The tendency to construct a second comb on the inner side of the covering, observed in the Javan wasps, might be delayed if the structure is attached to a rock or a stem. The observed differences may be purely accidental, but they indicate that further observations on this subject are highly desirable.

Ropalidia flavopicta javanica subsp. n.

(fig. 4)

Ropalidia flavopicta (Smith); van der Vecht, 1940, Ent. Meded. Ned. Indië, vol. 6, p. 47, textfigs. and pl. 5 (nesting habits in Java).

♀ — Head brownish black, the following parts yellow: mandibles, except for lower and apical margins; clypeus; a large spot on the frons, gradually dilated from the level of the antennal insertions to a point near the level of the centre of the eye-emarginations, from here rather abruptly narrowed to a sharp point which usually reaches the anterior ocellus; a broad band at inner orbits, reaching the upper end of the eye-emarginations or slightly above it, separated by a narrow dark line from the lower, dilated, part of the median frontal mark; a more or less widely interrupted post-ocellar line; a band on the temples which is more or less narrowed or even narrowly interrupted near the middle and which is everywhere well separated from the dark occipital carina. Antennae dark brown, pale brown beneath.

Markings of thorax and gaster somewhat variable, but the general pattern not distinctly different from that of typical *flavopicta;* lateral lines of mesoscutum usually absent, but in some specimens faintly indicated; gastral segments 3-6 not marked with yellow; hind tibiae brownish, with or without yellowish mark near the middle.

♂ — Antennal scape yellow anteriorly, otherwise the colour pattern similar to that of the female. Face with short whitish pubescence.

Length (h. + th. + t. 1 + 2): ♀ 8 mm, ♂ 7 mm.

The holotype is a female from East Java, Blawan, Sept. 1939, ex nest (ML); the allotype is a male from the same nest (ML); the other specimens recorded below are paratypes.

Java: 1 ♀ "Java", leg. Müller (ML). West Java, 3 ♀ Udjung Kulon, 2-5 Dec. 1958, A. M. R. Wegner (ML); 2 ♀ Djampang Tengah, Aug.-Sept. 1935, 1 ♀ Mt. Tjisuru, Dec. 1935, leg. Mrs. M. E. Walsh (ML); about 80 ♀ Sukanegara, with nest, Indonesian collector (MZB; ML). East Java, 1 ♀ Blawan, Bondowoso, Dec. 1935, L. J. Toxopeus (ML); 7 ♀ 9 ♂ Blawan, Bondowoso, ex nest, Sept. 1939, H. Lucht (ML), 1 ♀ Djerukundjur, Febr. 1940, H. Lucht (ML).

Flores: 16 ♂ Wolawaru, swarming around a shrub, 14 Aug. 1950, J. van der Vecht (ML).

Bionomics. — In 1940 I published a short paper on two nests of this form, found in Java, a young nest which was fixed to the underside of a leaf, probably of some kind of palm, and a much larger nest which was attached to a branch of a tree, about five meters above the ground. Since this paper may not be available to some users of this revision, the

descriptions of these nests are copied here, together with the accompanying drawings (fig. 4).

Description of the younger nest, from Sukanegara: "General shape elliptic; measurements: length 6 cm, width 4 cm, height 2.5 cm. The external cover consists of a single sheet of very thin, light brownish-grey paper, showing

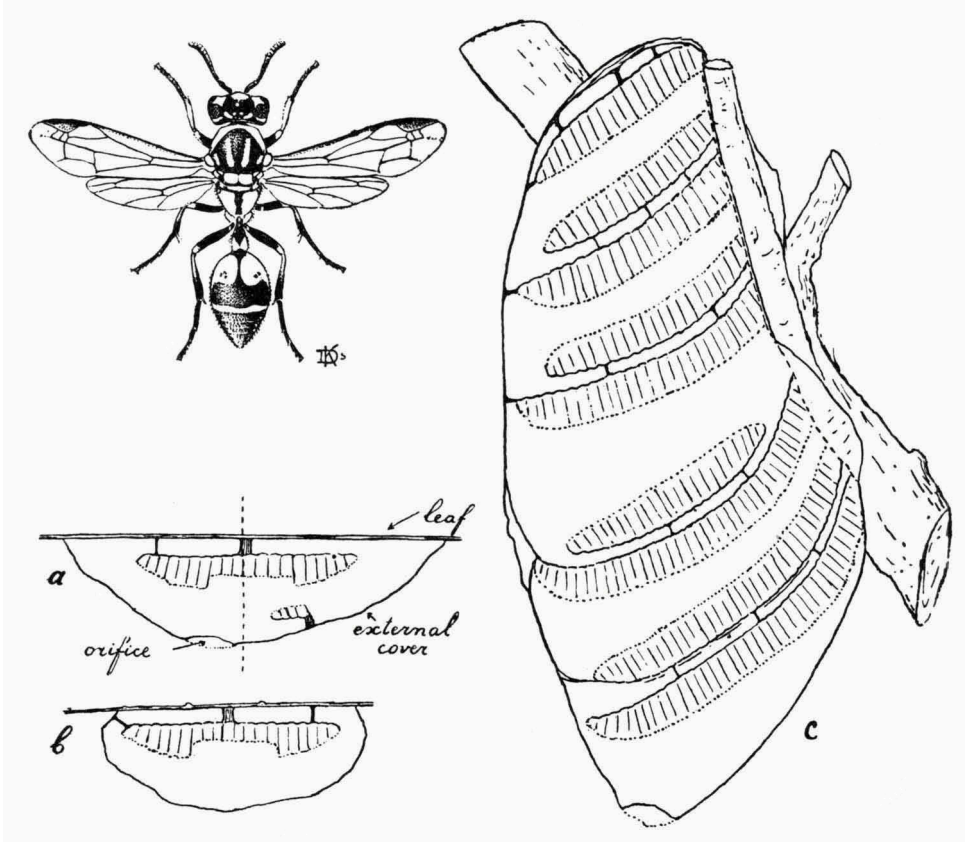

Fig. 4. Female of *Ropalidia* (*Icarielia*) *flavopicta javanica* subsp. n. (3.5 ×) and schematic drawings of two nests of this form (all 0.7 ×). — a: longitudinal section through young nest from Sukanegara, West Java; b: transverse section through the same, along the dotted line of fig. a, showing one of the stalks fixing the comb to the cover; c: section through a nest from Blawan, Idjen Mountains, East Java; the dotted lines indicate the open sides of the cells. (From van der Vecht, 1940, p. 48).

darker and lighter lines, concentrically arranged around the opening (orifice). The shape of the latter is rather irregular, its length about 1 cm, the width 0.5 cm. The cover is fixed with its entire margin to the leaf and encloses two combs, a large one which is fastened to the leaf, and a very small one, attached to the inner side of the cover, about in its median line

at some distance from the opening. Both combs consist of a single layer of cells. The large comb has a thick central pedicel and 7 thinner marginal stalks, connecting it with the leaf; in addition there are three such stalks fixing the comb to the side of the external cover.

The larger comb consists of more than 200 cells; from about 60 cells in the central part of the comb the wasps had already emerged and these were apparently used for the second time when the nest was collected. The smaller comb contains 10 incomplete cells. All cells are very neatly hexagonal; they are 2.5 mm wide and, when complete, 7-8 mm high".

The structure of this nest is of considerable aid to understand the development of the larger nest from Blawan (fig. 4). "The nest is attached to a forked branch; it consists of an external cover, in the top of which some leaves are interwoven, and of nine almost circular combs, which vary somewhat in size and, accordingly, in the number of cells (about 200-400). The arrangement of these combs is very remarkable: laterally they are all fixed to the branch, furthermore the upper comb it attached to the cover by a number of stalks, whereas the following combs are two and two connected with each other by similar stalks. The lower comb of each pair is directed downwards, it is strongly fixed to the side of the cover, either by stalks or by thin lamellae, and it is generally larger than the upper comb, the cells of which open upwards.

A comparison of the two *flavopicta* nests makes it probable that during the development of the colony the cover is expanded from time to time at its lower side in order to enclose the new combs; this view is supported by the fact that the space between the two lower combs (nearest to the orifice) shows distinct traces of a former cover.

From the larger nest I obtained nearly 800 adult wasps, but it is impossible to say how many of these were present in the adult stage when the nest was collected. Probably a number of wasps managed to escape at that moment, and most of the wasps received with the nest had emerged later from the pupal cells. A small percentage of the wasps consisted of males; no differences between queens and workers could be found."

Ropalidia flavopicta ochracea subsp. n.

♀ — Similar to *R. flavopicta javanica,* but the markings ochreous to orange-brown and in some places more extensive; face below the anterior ocellus almost entirely ochreous, in some specimens with a dark line on each side above the antennal insertion, dilated above; the vertex on each side between ocellus and eye with an ochreous spot which is narrowly separated from the markings at inner and outer orbits; pronotum almost entirely

ochreous, mesoscutum with only the median two lines, which are rather broad and confluent posteriorly; markings on scutella as usual, on mesepisternum, metapleura and propodeum less extensive than in most specimens of *flavopicta javanica*; spots at apex of petiole small and not enclosing the stigmata; second tergite on each side at the base with an ochreous mark which extends over the middle of the segment; the sternite with similar, but smaller spots; apical band of this segment as usual; legs black, coxae I more or less extensively brownish yellow anteriorly, coxae II and III with or without a small ochreous mark on the outer side.

Length (h. + th. + t. 1 + 2): 7.5-8.5 mm.

Sumba: West Sumba, 1 ♀ Rara, 340 m, 5-10 Aug. 1949 (ML), 1 ♀ 1 ♂ Pogobina, 500 m, 12-19 Sept. 1949 (ML; NMB); Central Sumba, 2 ♀ Lokojengo, 400-600 m, 20-27 Sept. 1949 (NMB; ML), 2 ♀ Langgaliru, 400-500 m, 4-15 Oct. 1949 (NMB; ML); East Sumba, 1 ♀ Mau Marru, 500 m, 18-23 July (NMB). — The holotype is a ♀ from Lokojengo, the allotype a ♂ from Pogobina (both in NMB); the other specimens are paratypes.

Ropalidia flavopicta (Smith) in the Philippine Islands

Ropalidia flavopicta is distributed throughout the Philippine archipelago, but it shows considerable variation there, and on the basis of the available material it is impossible to determine with certainty to what extent the variation of the colour pattern is correlated with the geographical distribution. As there is also some variation in the degree of coarseness of the sculpture of head and thorax, I have even considered the possibility that the specimens recorded below as *flavopicta* belong to more than one species. However, for the moment I have discarded this idea, since I have been unable to find structural differences associated with the colour characters.

Without doubt the solution of this problem would be facilitated if we could examine more extensive samples from a greater number of localities; yet it seems doubtful whether a completely satisfactory analysis can be obtained without special field studies. I wish to use this opportunity, therefore, to bring this subject to the notice of entomologists in the Philippines. A detailed study of the taxonomy, the distribution, and the nesting habits of these wasps in the various islands would certainly yield very interesting results.

In the material now at hand I have distinguished four colour forms, which I have provisionally given the status of subspecies. The most common and widely distributed form is called *flavobrunnea*; it is rather variable and takes an intermediate position between the dark *nigrescens* and the very

brightly coloured form *extrema*. The subsp. *bipartita*, discovered by the Townes family in the Mountain province of Luzon, is of particular interest since it shows rather abundant yellow markings on head and thorax associated with a reduction of this colour on the gastral segments.

The following key may serve to distinguish the females of these subspecies.

1. Second gastral segment black, with narrow yellow apical fascia, rarely with small and vague spots on the basal half; legs beyond the coxae black, at most sparsely marked with yellow. — Probably restricted to Luzon 2
— Basal half of second gastral segment with distinct, though ill-defined, brownish yellow spots or transverse band; legs often more extensively marked with yellow . 3
2. Clypeus entirely yellow; frons with yellow line between anterior ocellus and clypeus; postocellar line narrowly interrupted; mesoscutum with median and lateral lines . . . . . *bipartita* subsp. n.
— Clypeus with median black band which usually reaches the anterior margin; markings on frons and vertex reduced or absent; mesoscutum without lateral lines . . . . . *nigrescens* subsp. n.
3. Propodeum yellow, except for a dark median line and a short dark incision on each side at apex. Clypeus yellow; mesoscutum with broad lateral lines; all coxae yellow, femora I and II almost entirely yellow; apical half of femora III yellow . . . . . *extrema* subsp. n.
— Propodeum on each side with dark band running from close to the stigma to the apical valvula and separating the yellow markings of the propodeum from the spots on the metapleura. Clypeus with more or less distinct dark spot. Lateral lines of mesoscutum mostly absent, sometimes present in reduced form. Basal half of mid femora dark; at most about the apical third of femora III yellow . . . . . *flavobrunnea* subsp. n.

Ropalidia flavopicta flavobrunnea subsp. n.

Clypeus (♀) with dark median spot, often connected with the base; frontal mark extending from the anterior ocellus to the antennal bases, usually separated by dark area from the clypeus; lower part of occipital carina dark; mesoscutum without lateral yellow lines. Gastral petiole with complete yellow apical band; second tergite with two ill-defined orange-yellow or brownish yellow spots at a short distance from the base; very often these spots are confluent and form a complete transverse band. Legs black; coxae mainly yellow, femora with yellow mark at apex (smallest in hind femora), fore tibiae yellow anteriorly.

In some particularly brightly coloured specimens (connected by various transitions with the specimens having the pattern as described above) the frontal mark extends further downwards, the lower part of the occipital carina is yellow, the mesoscutum has narrow lateral lines, the apical band of the second gastral segment is wider than usual and sometimes almost confluent with the subbasal brownish yellow band; in these specimens the second sternite is often almost entirely pale brownish yellow, with some

darker areas in front of the yellow apical margin (in the darker specimens the apical band distinctly separated from the yellowish spots or band on the basal half). Apical half of mid femora and apical third of hind femora yellow.

The holotype is a female from Calapan, Mindoro (coll. Townes); the other specimens from Mindoro have been labelled as paratypes.

Luzon: Mountain Province, 1 ♀ 1 ♂ Talubin, 27 Dec. 1953, Townes family (ML), 1 ♂ nr. Kias, 24 Nov. 1953, Townes family (coll. Townes); 1 ♀ Bontoc, J. W. Chapman (ML) (dark form); 1 ♀ Antipolo, 1 March 1953, Townes family (coll. Townes) (mesoscutum with lateral yellow lines); 3 ♀ Montalban (MCG; 1 ♀ ML) (mesoscutum with lateral yellow lines).

Mindoro: 7 ♀ (including the holotype) Calapan, 25 Aug. 1952, 4 ♀ San José, 19 April 1953, 2 ♀ Alcate, Vict., 7-8 April 1954, 4 ♀ S. Luis Calapan, 14-17 April 1954, all leg. Townes family (coll. Townes, incl. the holotype; 8 ♀ ML). — Mesoscutum as a rule without lateral lines; only one female from Calapan and one from S. Luis have a much reduced yellow line at the lateral margins of the mesoscutum.

Negros: 1 ♀ Dumagnete, Nov. 1917, leg. Böttcher (ML).

Samar: 1 ♀ 2 ♂ Catbalogan (ML) (1 ♀ 1 ♂ brightly coloured; mesoscutum with narrow lateral yellow lines; apical band of tergite 2 wide).

Mindanao: 2 ♀ Surigao (MCG); 1 ♀ Butuan (ML); Davao, 5 ♀ Panabo, 12 May 1936, L. B. Uichanco (ML), 1 ♂ Exp. Station, 9 Febr. 1953, H. Townes (coll. Townes); Cotabato, 1 ♀ Kidapawan, 24 March 1953, H. Townes (ML), 2 ♀ 6 ♂ Pikit, 20 March 1953 and 13 June 1953, H. Townes (coll. Townes; 1 ♀ 3 ♂ ML), 4 ♂ Aroman Exp. Station, 11 Sept. 1952, H. Townes (coll. Townes; 2 ♂ ML), 1 ♀ Cotabato, 11 Oct. 1953, H. Townes (coll. Townes), 1 ♀ 1 ♂ Port Banga, leg. Böttcher (ML), 1 ♀ 1 ♂ Banga, 7 Oct. 1953 and 11 Febr. 1953, H. Townes (coll. Townes); Lanao, 1 ♂ Dansalan, 3600 ft., 27 April 1936, L. B. Uichanco (ML); Bukidnon, 1 ♀ Tangcolan, leg. Baker (ML); 4 ♀ 2 ♂ "Momungan, Mindanao", from Staudinger (ML). — Mesoscutum as a rule with only the median lines; narrow lateral lines are present in specimens from Surigao (2 ♀), Butuan (1 ♀), and Cotabato (1 ♀ Kidapawan, apical band of tergite 2 very wide; 1 ♀ Pikit is transitional to subsp. *extrema*: central spot of clypeus very vague, lateral dark lines of propodeum interrupted).

Ropalidia flavopicta nigrescens subsp. n.

♀ — Dark brown to blackish; similar to *flavobrunnea,* but the yellow markings much reduced: clypeus on each side with triangular yellow area; frons with only a small inter-antennal spot; line at inner orbits reduced

above, not filling the entire eye-emargination; vertex with traces of post-ocellar line; band on temples reduced to a mark behind the upper half of the eye and a small spot near the mandible base; pronotal band very narrow laterally, moderately dilated in the middle; median lines of mesoscutum reduced, lateral lines absent (in one specimen the mesoscutum entirely black); tegulae with only a small yellow mark posteriorly on inner side; mesepisternum with yellow mark in upper half only; scutellar spots rather far apart (small spots on lateral depressions of both scutellum and postscutellum are present, as in *flavobrunnea*); metapleura entirely dark; markings on propodeum pear-shaped, separated by a dark band from each other and by a dark margin from the sides; first gastral tergite with fairly wide apical band, second gastral segment dark brown, with narrow apical yellow band with the usual dilated part on each side of the middle; segments 3-6 immaculate; coxae I with large yellow mark on apical half to two-thirds of anterior surface, II with small yellow mark on outer side, III entirely dark, femora I and II slightly yellowish at apex, tibiae I partly yellowish anteriorly.

Some specimens (indicated below as var. A) have the yellow markings slightly more extensive: mark on temples entire; lower part of mesepisternum and of metapleura marked with yellow; coxae mainly yellow, femora and tibiae more extensively yellow.

Luzon: 2 ♀ Los Baños, 10 Jan. 1954, H. and M. Townes (holotype, coll. Townes, and paratype, ML); 1 ♀ Los Baños, 20 May 1954, H. and M. Townes (var. A; coll. Townes); 1 ♀ Mt. Maquiling, 180 m, 16 April 1930, G. B. Viado (var. A; ML); 2 ♀ Montalban (paratypes, ML); 9 ♀ "Manille", coll. Saussure (paratypes; MHNG; 2 ♀ ML); 1 ♀ Mt. Arayat, Sept. 1914, leg. Böttcher (var. A; ML). — Some specimens of the series from "Manille" are transitional to var. A.

Ropalidia flavopicta extrema subsp. n.

♀ — Similar to subsp. *flavobrunnea,* but more abundantly marked with yellow; head yellow, except for an inverted U-shaped mark on the frons, connecting the ocellar area with the antennal bases, the occiput (the area around the hypostoma extensively yellow) and an oblique band on each side of the vertex, connecting the top of the eye with the dark occiput; antennae brownish above, scape yellow anteriorly; pronotum yellow, except for an interrupted dark band on anterior surface, and a dark area on each side at the posterior margin; mesoscutum with relatively wide median and lateral lines; mesepisternum yellow, except for an oblique longitudinal band, narrowed posteriorly, on each side between lateral and ventral areas; scutella

yellow, except for median line on scutellum and the dark, shining, posterior part of the postscutellum; metapleura and propodeum yellow, except for anterior margin of metapleura, median line on propodeum and a small incision on each side above the apical valvula. Apical band of gastral tergite 1 much dilated laterally, extending beyond the stigma; second tergite with ill-defined pale brownish sub-basal band and the usual yellow apical band, the sternite almost entirely brownish yellow; segments 3-6 with irregular yellowish markings. Legs yellow; the following parts brownish: a line on outer side of basal half to two thirds of tibiae II, tarsi II, trochanters III, base of femora III, and tibiae and tarsi III.

Philippine Is.: 1 ♀ 1 ♂ "Ins. Philipp." (ML).

Luzon: 1 ♀ Atimonan, 21 July 1928, A. P. Varona (holotype, ML); 1 ♀ Tagaytay, Btg., 9 Nov. 1952, Townes family (paratype, coll. Townes); 1 ♀ Mt. Maquiling, leg. Baker (paratype, ML); 2 ♀ "Dorf Taal" (MHNG); 2 ♀ "Manille", ex coll. Saussure (paratypes, MHNG).

Negros: 1 ♀ Mt. Canlaon, 3600 ft., 8 May 1953, Townes family (coll. Townes).

Ropalidia flavopicta bipartita subsp. n.

♀ — Black; the following parts yellow: clypeus; mandibles, except at apex and at lower margin, a mark between anterior ocellus and clypeus; a broad line at inner orbits, above the eye-emargination narrowly continued to near the middle of the top of the eye, here narrowly separated from the curved post-ocellar line which is narrowly interrupted in the middle; a broad stripe on the temples, near the base of the mandible extending over the carina to the postgena; the greater part of the pronotum (dark band at anterior surface and a dark spot on each side at posterior margin); two long lines near the middle of the mesoscutum, a short line on each side at lateral margin above the tegulae; tegulae (except for brown spot on outer side), a large and irregular mark on mesepisternum, and a spot in the middle on the ventral side; two subquadrate spots on the scutellum, and a smaller spot on each side of these on the axillae; a curved band on postscutellum (emarginate posteriorly) and an irregular spot on each side of it in the lateral depression; the propodeum, except for a median dark line and a triangular incision at apex above the valvula (the yellow areas extend below over part of the metapleura); a band at apex of gastral tergite 1, angularly incised in the middle anteriorly; a narrow band at apex of second gastral segment; more or less reduced apical bands on following tergites; coxae I almost entirely, anterior and lateral surfaces of coxae II, outer side of coxae III,

a short and narrow line at apex of femora I and II, and a line on anterior side of tibiae I.

Wings hyaline, apical angle of basal cell and anterior half of marginal cell rather strongly infuscated.

Length (h. + th. + t. 1 + 2): 8-9 mm.

Luzon: Mountain Province, 2 ♀ Mt. Polis, 27 Dec. 1953 and 2 Jan. 1954, 5500 ft., H., M., & D. Townes (holotype, coll. Townes; paratype, ML); 1 ♀ nr. Basiwag, Abra, 7 March 1953, M. C. Townes (coll. Townes); 1 ♀ Babalasang, Kalinga, 3 March 1953, M. C. Townes (ML).

Ropalidia timida spec. n.

(plate 6)

♀ — Head in frontal view distinctly wider than high (46 : 39), in dorsal view more than twice as wide as long (46 : 21), distinctly wider than the thorax (46 : 39). Temples well developed, nearly as wide as the eyes (10 : 11) as the head is seen in profile. Inner orbits farther apart on the vertex than at the clypeus (26 : 19). Frons slightly convex; ocelli in an almost equilateral triangle, the posterior ocelli about 2½ times as far from the eyes as from each other, the latter distance distinctly exceeds their diameter. Marginal carina of vertex and temples fine, but distinct, not unusually dilated below. Clypeus only very slightly convex, as wide as long; anterior part distinctly shorter than the basal interocular portion (7.5 : 11.5). Antennae rather thick, third segment only twice as long as it is wide at apex, scarcely longer than segments 4 and 5 together, segment 4 about square in outline, 5th-11th segments wider than long, 12th segment as long as its width at base.

Thorax about 1½ times as long as wide; pronotum roundly truncate anteriorly, its sides nearly straight, distinctly converging; transverse carina sharp and distinct. Scutellum and postscutellum moderately convex, the former with a very feeble median carina at the base. Propodeum short, rounded in dorsal view, nearly straight in profile, without carinae, teeth or projecting angles; median impression triangular, rather wide at base, but very shallow.

Gaster: first segment nearly twice as long as high, and about 1½ times as long as its width at apex; spiracles scarcely projecting; second segment slightly wider than long, its apical margin very narrowly depressed.

Body rather dull; the posterior part of the postscutellum, and the sixth gastral sternite, shiny; second gastral segment less dull than the thorax. Clypeus sparsely punctate, the punctures superficial and ill-defined; frons, vertex, pronotum, mesoscutum, scutellum and anterior part of postscutellum

very closely, reticulately, punctate, the punctures shallow, with flat bottom which is finely sculptured (on the frons most punctures have a small pustule in the middle). Mesepisternum with fine and well separated punctures; propodeum very finely, obliquely, rugose (40 × !). Second gastral segment rather densely covered with fine and superficial punctures, which are not defined posteriorly. The whole body is covered with an extremely fine greyish tomentum; in addition there are some longer erect hairs on the clypeus, the propodeum and the gaster.

Black; antennae partly brownish, flagellum reddish beneath; mandibles brown, with a yellow spot on the basal half to two thirds; furthermore are yellow: a rather wide V-shaped fascia at anterior margin of clypeus; a line at inner orbits, from the clypeus to the level of the upper part of the antennal insertions, a transverse band on the pronotum, dilated on the sides, a spot on mesepisternum below the tegulae, two subquadrate spots on the scutellum, a transverse fascia on the dull part of the postscutellum, two large suboval spots (truncate anteriorly) on the propodeum, a transverse fascia in front of the testaceous, apical margin of the first gastral tergite (gradually widening from the middle to the sides), and a narrower fascia at the apex of the second segment (more or less reduced on the sternite). Tegulae and coxae I mainly yellow, mid coxae with a yellow spot. Legs brownish black, tarsi brown. Wings hyaline, with greenish and purple iridescence, veins and stigma dark brown, apex of costal cell and anterior part of marginal cell fuscous.

♂ — Head in frontal view wider than high (43 : 36), as seen from above more than twice as wide as long, distinctly wider than the thorax (43 : 37). Temples narrow, only slightly more than half as wide as the eyes. Eyes much more convex than in the female. Inner orbits farther apart on the vertex than on the clypeus (24 : 17). Posterior ocelli only about two times as far from the eyes as from each other. Clypeus wider than long, scarcely convex, anterior margin bluntly pointed. Antennae rather short and thick, third segment nearly 2½ times as long as wide at apex, and distinctly longer than the following two segments together, fourth segment scarcely longer than wide, fifth segment nearly square in outline, sixth to twelfth segments distinctly wider than long, ninth segment 1½ times as wide as long. Third and following segments with distinct tyloids, but not serrate.

Thorax and gaster very much as in the female; the striae on the propodeum more distinct; last sternite slightly convex and shiny.

Sculpture about the same as in the female, but particularly on the frons more distinct.

Pubescence on the clypeus denser than in the female.

Coloration mainly as in the female; clypeus yellow in front and at the sides, so that only an abbreviated stripe in the middle, about twice as long as wide, is black; markings on scutella and propodeum smaller, the apical fascia on the first segment narrower, that on the second sternite may be widely interrupted in the middle. However, it is probable that these differences are not constant.

Length ♀ and ♂ (h. + th. + t. 1 + 2): 6½-7 mm.

Holotype: ♀, Singapore, H. N. Ridley (BM, 1901-145); allotype: ♂ Sumatra, Deli (BM, 96-30); the other specimens recorded below are paratypes.

Malaya: Selangor, Kuala Lumpur, 1 ♀ 11 Sept. 1934, H. M. Pendlebury (BM), 3 ♀ 20 June 1947, from enclosed nest on leaf in garden, nrs. 0924, 0926, 0927, R. B. Jagoe capt., coll. H. T. Pagden (1 ♀ ML); Penang, Sungei Pinang Hills, 4 ♀ 9 June 1957, from enclosed nest on nutmeg leaves (pl. 6), H. T. Pagden (coll. Pagden, 2 ♀ ML), 4 ♀ 15 Aug. 1958, from enclosed nest on Nephelium leaf (pl. 6), H. T. Pagden (coll. Pagden, 2 ♀ ML); 1 ♂ Waterfall Gardens, 12 June 1956, H. T. Pagden (ML); Singapore, several ♀♀ (including the holotype), H. N. Ridley (BM, 1901-145; 4 ♀ ML). — Several years ago I saw a ♀ from Perak, Lubok Tamang, 4000 ft., Sept. 1922, E. Seimund; the specimen was sent to me by Dr. J. Bequaert and probably is now in the collection of the Museum of Comparative Zoology, Boston, Mass., U.S.A.

Borneo: North Borneo, Bettotan near Sandakan, 1 ♀ 23 Aug. 1927, 2 ♀ 27 July 1927, C. Boden Kloss & H. M. Pendlebury (BM, 1 ♀ ML) (coloration very variable: 1 ♀ (23 Aug.) is as richly marked as the holotype, the spots on the scutellum even larger, confluent; 1 ♀ is almost entirely black, the yellow markings reduced to small spots on mandibles, clypeus and postscutellum; 1 ♀ is intermediate: head and thorax as in the holotype, but the markings slightly reduced and the spots on the propodeum very small, gaster black with only a vague and narrow orange-yellow apical band on tergite 2); East Borneo, 1 ♀ Ketapan, May 1937, Mrs. M. E. Walsh (ML; coloration as in the third specimen from Bettotan, but first gastral tergite with two small lateral spots at apex); South Borneo, 1 ♀ Pemanten-Sampit, July 1953, M. A. Lieftinck (ML).

Sumatra: 1 ♂ Deli, 1894, Dr. L. Martin, ex coll. C. T. Bingham (BM, 96-30, allotype).

Bionomics. — This species constructs an enclosed nest on or between leaves; the photographs of the nests discovered near Penang by Pagden

(plate 6) clearly show the entrance to the nest, in the upper figure at the apex of the leaf, in the lower figure at the lower end of the nest.

Concerning the nest on the *Nephelium* leaf (see above) Mr. Pagden wrote me: "I took the whole nest on 17th, after I was sure that my photographs were all right. Inevitably a few specimens were absent when I collected the colony, but I got almost all (45 ♀♀) .... This species was very docile and I had to tap the nest to make the wasps come out and even then they just sat around the nest without appearing aggressive. Specimens from the K.L. nest, however, attacked and stung Jagoe when he collected it."

Ropalidia malaisei spec. n.

Closely related to *I. flavopicta* (Smith); sculpture very similar, but the body distinctly more slender, the antennae shorter and stouter, and the colour pattern rather different.

♀ — Occipital carina conspicuously thickened in its lower half. Third antennal segment only twice as long as its width at apex, slightly longer than the two following segments together, fourth segment slightly wider than long (8 : 7), the tenth segment more than 1½ times as wide as long (11 : 7). Pronotal carina distinct, rounded at the shoulders. Median concavity of propodeum not conspicuously dilated in its upper part. Gastral petiole rather slender, flask-shaped, its length (from end of muscular slit to apex) more than twice the greatest height (25 : 11), the sides of the dilated, posterior, part in dorsal view very slightly diverging towards the apex, where the width is half the length. Second gastral segment as long as wide, and slightly longer than high.

The larger punctures of the clypeus scattered and ill-defined; on the frons the coarser puncturation denser, but there are distinct interspaces separating the characteristic flat-bottomed punctures which as a rule have a central pustule. Puncturation of thorax mainly as in *R. flavopicta*; the shiny area of the postscutellum in the middle almost reaches the anterior margin; the propodeum is very finely and rather irregularly transversely rugose, the gastral petiole almost impunctate, the second segment densely covered with superficial punctures which are not margined posteriorly. Pubescence slightly more conspicuous than in *R. flavopicta,* particularly the clypeus, the propodeum and the petiole with conspicuous erect hairs.

Black, mandibles, antennae and legs partly brownish, tibial spurs and depressed apical margin of second gastral segment testaceous, antennae pale brownish yellow beneath; the following parts yellow: a large mark on the mandibles, a broad V-shaped band at anterior margin of clypeus, extending on the sides to near the base, a line at inner orbits (from clypeus to level

of upper margin of antennal sockets or slightly higher), a mark between the antennae, a line at the under side of the antennal scape, an elongate spot on the temples, near the top of the eye, an irregular line along the pronotal carina (dilated on each side of the middle), a spot on the posterior part of the tegulae, an irregular mark on the mesepisternum below the tegulae (may be lacking), a small mark in the concavity on each side of the scutellum, two transverse, almost coalescent, spots on the punctate base of the postscutellum, two large subtriangular spots on the propodeum, a narrow, partly reduced or indistinct line at the apex of the second gastral segment (least distinct on the sternite), the anterior face of coxae I, and elongate marks on outer side of coxae II and III.

♂ — Similar to the female; head flatter, with narrower temples, antennae more slender, the segments 3-13 with distinct tyloids, the yellow markings more extensive. In the series before me the coloration shows much variation: the pattern of the most extensively marked specimen (from Sadon) suggests that it is derived from the pattern of *flavopicta*: there are two yellow lines on the disk of the mesoscutum, and lateral spots on the swollen part of the petiole and on the base of the second gastral segment; these markings are lacking in the other specimens (one male has small spots on the petiole) which, however, agree with this male in having all coxae, the fore and mid femora, and the ventral part of the mesepisternum rather extensively marked with yellow; the mandibles and the lower half of the face are entirely yellow, with extensions along the eyes (filling the emarginations) and between the antennae (truncate above), temples with yellow line from mandible to near the top of the eye. In two specimens the clypeus has a dark median line on the basal two thirds. The apical band of tergite 2 is present in five specimens, but remarkably enough it is absent in the otherwise most extensively marked specimen described above.

I have been unable to find any striking differences between the male genitalia of this species and those of *R. flavopicta* (Smith).

Length (h. + th. + t. 1 + 2): ♀ 8-8.5 mm, ♂ 7-8 mm.

Burma: North East Burma, 2 ♀ Punkataung, Road Sadon-Myitkyina, 8 July 1934, R. Malaise (holotype, NRS; paratype, ML); 1 ♀ 8 ♂ Sadon, 1200 m, 28 June-5 July 1934, R. Malaise (allotype and paratypes, NRS; 4 ♂ paratypes, ML).

Ropalidia lepida spec. n.

(fig. 3)

A slender species, distinguished by its delicate sculpture and by the reduced pronotal carina; body richly marked with yellow, but mesoscutum without yellow lines.

♀ — Head fairly large, wider than the thorax including the tegulae, not very thick, the temples distinctly narrower than the eyes (in lateral view); occipital carina distinct, very slightly thickened in its lower half. Posterior ocelli more than three times as far from the eyes as from each other. Antennae not very thick, the third segment slightly more than twice as long as wide at apex, fourth segment a little longer than wide, tenth segment less than 1½ times as wide as long.

Pronotal carina fairly distinct in the middle, but absent on the sides, except for a short and blunt ridge near the lower angle. Scutellum strongly convex. Outline of propodeum straight as seen in profile, the median furrow shallow and rather narrow, not widened at base.

Gastral petiole slender (fig. 3); second gastral segment slightly wider than high, and about as long as high, its apical margin strongly depressed, thin, narrow, and translucent.

Head moderately shiny, slightly duller on the frons than elsewhere; pronotum, mesoscutum, scutellum, anterior part of postscutellum, and the gastral segments, dull; the mesepisternum and the metapleura less dull, the posterior part of the postscutellum, and the propodeum, rather shiny; the dull areas have a microscopically fine surface sculpture, but the body is nowhere distinctly punctate. Pubescence sparse and very fine; eyes with scattered, erect, hairs.

Black or dark brown, under side of antennae, mandibles, and part of the legs pale brown; the following parts bright yellow: a large spot at the base of the mandibles, clypeus, except for an oval median mark coalescent with the dark supraclypeal area, a trapezium-shaped mark between and above the antennal insertions, a broad band at the inner orbits, filling the eye-emarginations, and ending in a narrow point at the level of the anterior ocellus, a broad band on the temples, narrowed above and ending behind the top of the eye, the dorsal surface of the pronotum, and a narrow transverse band, dilated below, on the sides, a large irregular mark on the mesepisternum, nearly the whole scutellum (a dark band at posterior margin, widened in the middle), a band at base of postscutellum (narrowed towards the middle, and here slightly interrupted), a spot on lower part of metapleura, two large marks on propodeum, a small spot in its anterior lateral angles, an irregular spot on each side of the base of the second tergite, a narrow band at the apical margin of the second segment, the greater part of coxae I, and large marks on coxae II and III. The gastral petiole may have traces of a yellow apical band, the apex of the femora and the inner side of the fore and mid tibiae may be more or less yellowish. Wings

subhyaline, the apex of the costal cell and the anterior part of the marginal cell slightly infuscated.

♂ — Very similar to the female; eyes more swollen, temples narrower, clypeus smaller, flatter, and more bluntly pointed anteriorly; antennal segments 3-13 with tyloids, those on the basal segments rather indistinct. Colour pattern hardly different from that of the female.

Length (h. + th. + t. 1 + 2): ♀ 7.5-8.5 mm, ♂ 7-8 mm.

Luzon: 8 ♀ 3 ♂ Damalon (holotype ♀, allotype ♂, and paratypes 4 ♀ 2 ♂, ML; paratypes 3 ♀, MCG); 1 ♂ Los Baños (paratype, MCG).

Ropalidia opifex spec. n.
(plates 7 and 8; fig. 3)

A slender species, extensively marked with yellow, distinguished by the superficial sculpture, and differing from the similar *R. lepida* in having a complete pronotal carina.

♀ — Head wider than the thorax including the tegulae, as seen from above slightly convex anteriorly, but distinctly concave posteriorly, rather strongly narrowed behind the eyes; in lateral view the temples narrower than the eyes; interocular distance on the vertex larger than that at the clypeus (27 : 22); ocelli in an almost equilateral triangle, posterior ocelli about three times as far from the eyes as from each other, the latter distance about equal to their diameter; occipital carina distinct and normal.

Pronotum with complete carina, which is rounded at the shoulders; scutellum and postscutellum convex; propodeum obliquely sloping towards the petiole, as seen in profile the outline almost straight, median furrow rather narrow, not conspicuously dilated in its upper part.

Gastral petiole (fig. 3) slender, as seen from above its greatest width only about one third of that of the second segment.

Body dull, the face below the antennae, the propodeum, and the gastral segments, moderately shiny, posterior part of postscutellum polished. The dull aspect is caused by a microscopically fine superficial sculpture; there are no distinct punctures, and the propodeum is only very finely and indistinctly, transversely, striate.

Brownish black, antennal flagellum brownish yellow beneath; the following parts bright lemon yellow: mandibles, clypeus, a line at the inner orbits, filling the eye-emarginations and often connected with two obliquely transverse lines on the vertex behind the ocelli, a median band, narrowed above, from clypeus to anterior ocellus, the temples and the lower part of the occiput, the under side of the antennal scape, the pronotum except for an irregular dark band at the posterior margin (angularly dilated in front

of the tubercle), four lines on the mesoscutum: two long ones near the middle (dilated and curving outwards anteriorly), and a short one on each side above the tegula, two large, subquadrate spots on the scutellum, tegulae (partly brownish), most of the lateral areas of the mesepisternum and a median mark on its ventral side, a transverse band on the dull part of the postscutellum (posteriorly with median emargination), the propodeum, except for a narrow, median, dark band and a triangular dark area on each side in front of the apical lamella, an elongate spot on each side of the petiole, two large spots on the basal half of the second tergite, the basal half of the sternite, a narrow band at apical margin of both tergite and sternite, some ill-defined bands and spots on the following segments, only partly visible in dried specimens. Metapleura more or less extensively marked with yellow. Legs yellow, marked with black as follows: femora I with black mark on inner side near apex, trochanters II and III and base of femora II and III blackish, tibiae II with dark line on basal three fourths of outer side, tibiae III entirely black or with indistinct yellow stain on outer side; tarsi of mid legs brownish, of hind legs blackish, but all apical segments yellowish.

Wings hyaline, apex of costal cell and anterior margin of marginal cell slightly infuscated.

Length (h. + th. + t. 1 + 2) : ♀ 6.5-7.5 mm.

M a l a y a: Selangor, 1 ♀ Kuala Lumpur, Ampang, 26 June 1932, H. M. Pendlebury (holotype, BM); 1 ♀ Bukit Kutu, 3300-3500 ft. 19 March 1931, H. M. Pendlebury (paratype, ML); 1 ♀ Gombak Valley, 15 Oct. 1931, H. M. Pendlebury (paratype, BM); Penang, 4 ♀ from nest on *Dipteris*, Tiger Hill, Penang, 2500 ft., 27 Jan. 1959, H. T. Pagden (paratypes, coll. Pagden, 2 ♀ ML).

B o r n e o: 1 ♀ Bettotan near Sandakan, 15 Aug. 1927, C. Boden Kloss & H. M. Pendlebury (paratype, BM); 1 ♀ (head and prothorax lacking) Sarawak, 16 Dec. 1913, G. E. Bryant, 1914-382 (paratype, BM); 1 ♀ East-Borneo, Tabang, Bengen River, 26 Oct. 1956, A. M. R. Wegner (paratype, ML).

B i o n o m i c s. — Mr. Pagden informed me that when walking along the road between Tiger Hill and Western Hill with two botanist friends, Mr. E. J. H. Corner, F. R. S., and Mr. Cheang Kok Choy, on January 17, 1959, Mr. Corner accidentally disturbed a *Ropalidia* nest when examining some *Dipteris* ferns at the roadside. The insects flew out in some numbers and eight were collected. After the wasps had settled down Mr. Pagden located the nest which was on the underside of the *Dipteris* frond which Mr. Corner had actually handled. The frond was folded over, perhaps by the wasps themselves, and the nest comb, which had a number of supports,

was enclosed by a silk-like canopy closely resembling polythene in colour and degree of transparency. This covering was very delicate and the handling of the leaf had torn it slightly.

A letter, dated February 4, 1959, contained the following paragraph: "I have now photographed the *Ropalidia* nest [pls. 7 and 8] referred to in the post script to my letter of 17th Jan. While doing this a ♀ *Vespa tropica* flew to the nest and started to extract larvae (at least I think it was larvae she was after, but it may have been pupae) and I got two fairly good shots of her robbing the nest. On one occasion I saw several of the rightful occupants alight on her but she soon shook them off. Apart from this the *Ropalidia* kept well clear of the raider and, indeed, paid little attention to her as far as I could see. I tried to capture the *Vespa*, but she was too alert while I, on my side, was hampered by the surrounding vegetation and could not make a real swipe at her until she was clear of the herbage. I prepared other means of dealing with her, but she did not return though I waited until just on sunset. Since the *Vespa* would clearly have destroyed the colony and was breaking up the cells I decided that I had a better claim so took the nest, or as much of it as was left, and a further 17 specimens. I left quite a number in the hope that they might start a new colony nearby, but they did not do so.

My photograps clearly show the polythene-like covering of the nest. It is very fragile and was damaged when Corner took hold of the frond to examine it on 17th, and the wasps had either not repaired it at all or the *Vespa* had further damaged it. It has been still further damaged as the fern frond dried out and curled".

Ropalidia montana Carl

(fig. 3)

Icaria montana Carl, 1930, Memoires du "Globe", vol. 49, p. 22 (nomen nudum).
Ropalidia montana Carl, 1934, Rev. Suisse Zool., vol. 41, p. 676, ♀ ♂, figs 1-6, 8-13 — Coonoor, Southern slopes of Nilgiri Hills, South India (types MHNG).

South India: 4 ♀ Coonoor, 1927, leg. Carl (ML), series Coonoor, 1902, M. Maindron (MP, 1 ♀ 1 ♂ ML); 2 ♀ Coonoor, April 1937, 3 ♀ Top Slip Camp, Nelliampathi Hills, April 1937, 4 ♀ Nadungayam, 200 ft., Malabar, Sept. 1938, 1 ♀ Tenmalai, 500-800 ft., Oct. 1938, all coll. by BM-CM Exp. to S. India (BM, 3 ♀ ML); 63 ♀ Anamalai Hills, Cinchona, 3500 ft., April, May, Sept. and Nov. 1959, April and May 1960, P. S. Nathan (ML). — Apparently the species is not rare in the mountain areas of South India.

Bionomics. — The reader may be referred to the paper by Carl (1934), who has given a detailed description of the peculiar nest of this species, illustrated by a series of photographs.

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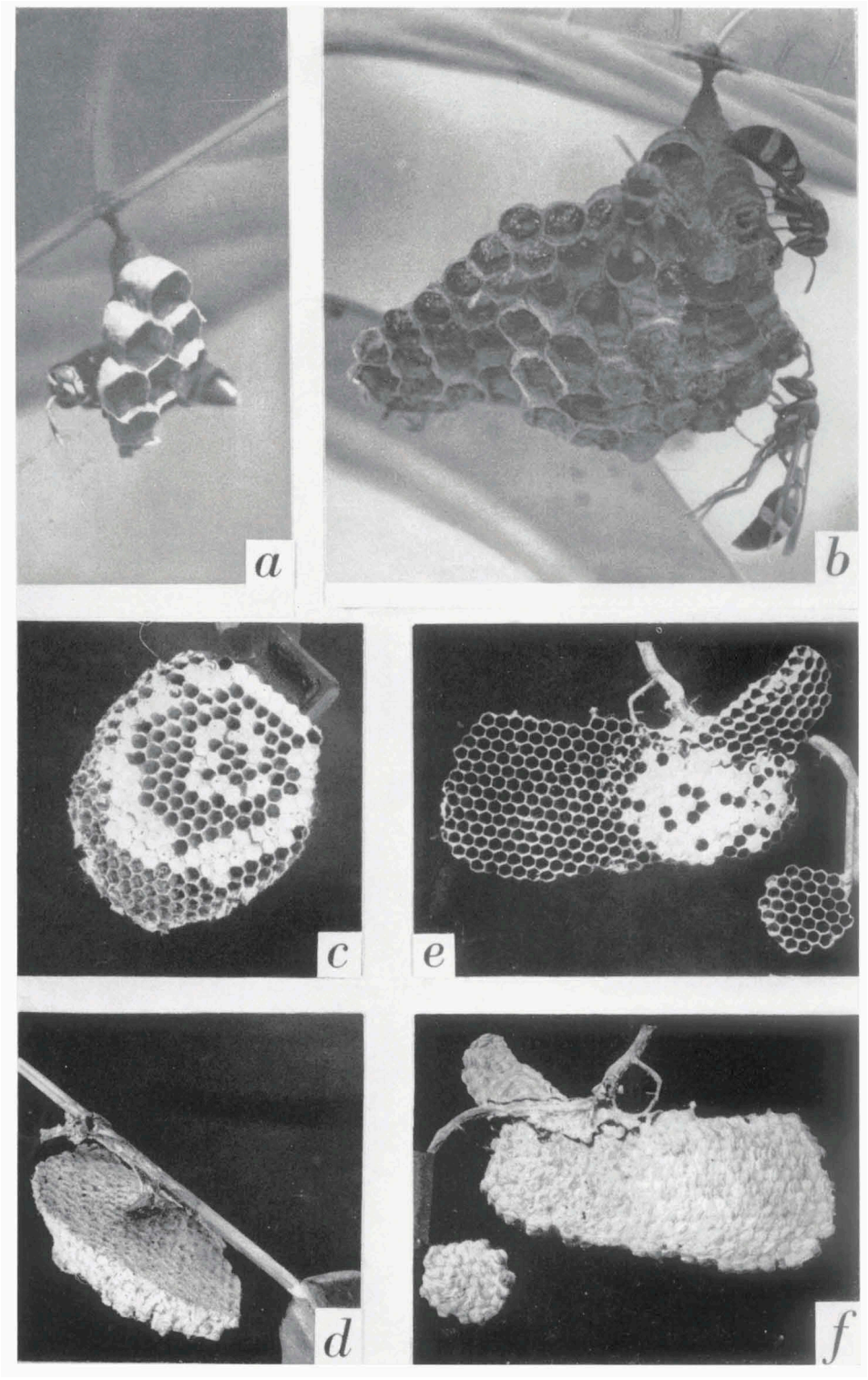
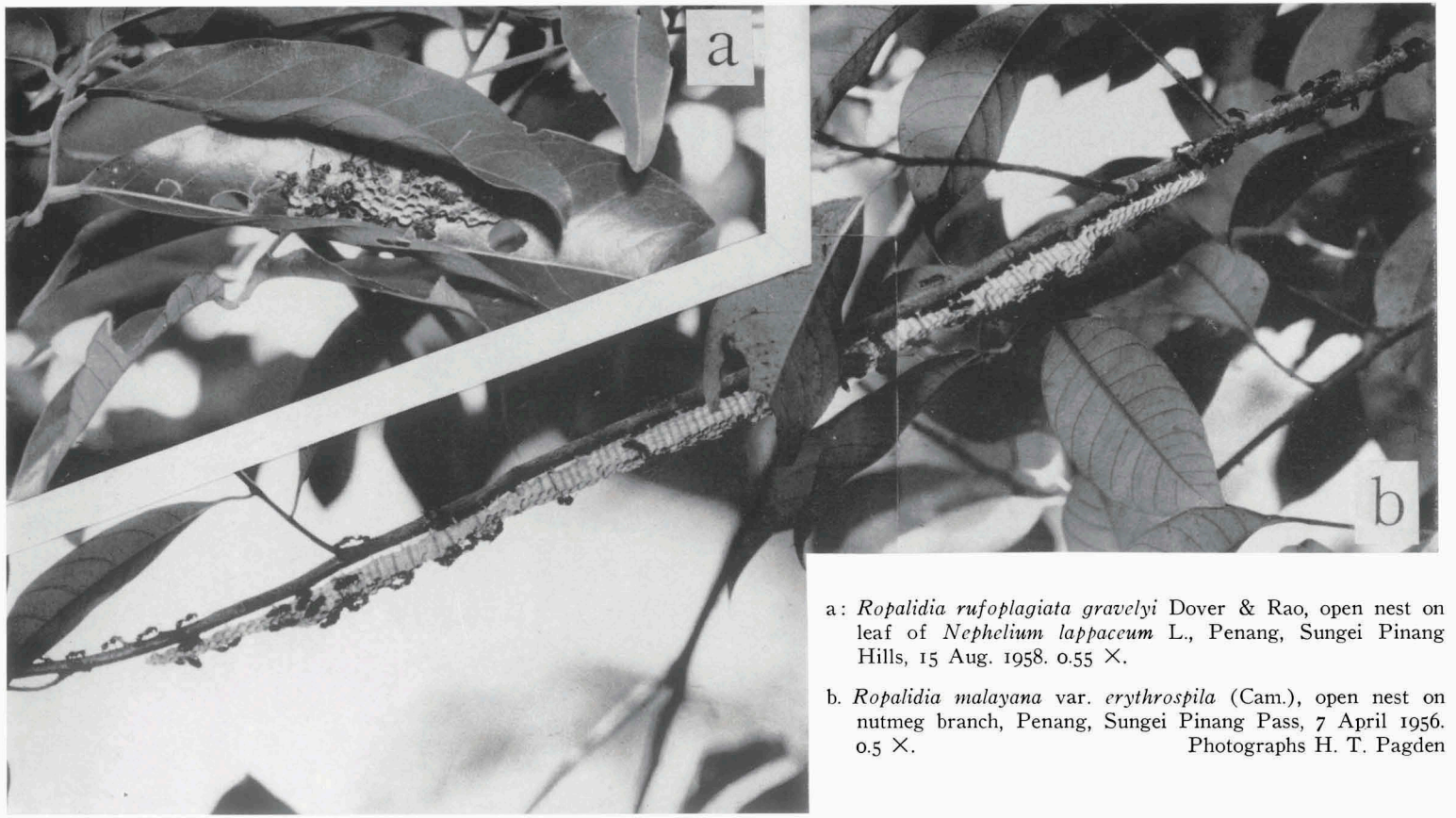


Plate 1. a: *Ropalidia fasciata* (F.), female on young nest on leaf of Gardenia, Kuala Lumpur, 17 Sept. 1950; b: the same nest on 28 Nov. 1950, phot. H. T. Pagden. — c and d: *Ropalidia marginata sundaica* van der Vecht, Java, nest with central stalk, suspended from a twig; e and f: *Ropalidia sumatrae* (Weber), Bangka Island, Dec. 1935,



a: *Ropalidia rufoplagiata gravelyi* Dover & Rao, open nest on leaf of *Nephelium lappaceum* L., Penang, Sungei Pinang Hills, 15 Aug. 1958. 0.55 ×.

b. *Ropalidia malayana* var. *erythrospila* (Cam.), open nest on nutmeg branch, Penang, Sungei Pinang Pass, 7 April 1956. 0.5 ×. Photographs H. T. Pagden

Plate 2. Open nests of two species of *Ropalidia*, subgenus *Anthrencida* White.

Plate 3. Nest of *Ropalidia sumatrae* (Weber) between buttress roots of a tree. Folly Farm, Ringlet, Cameron Highlands, Malaya, May 1939, phot. H. T. Pagden.

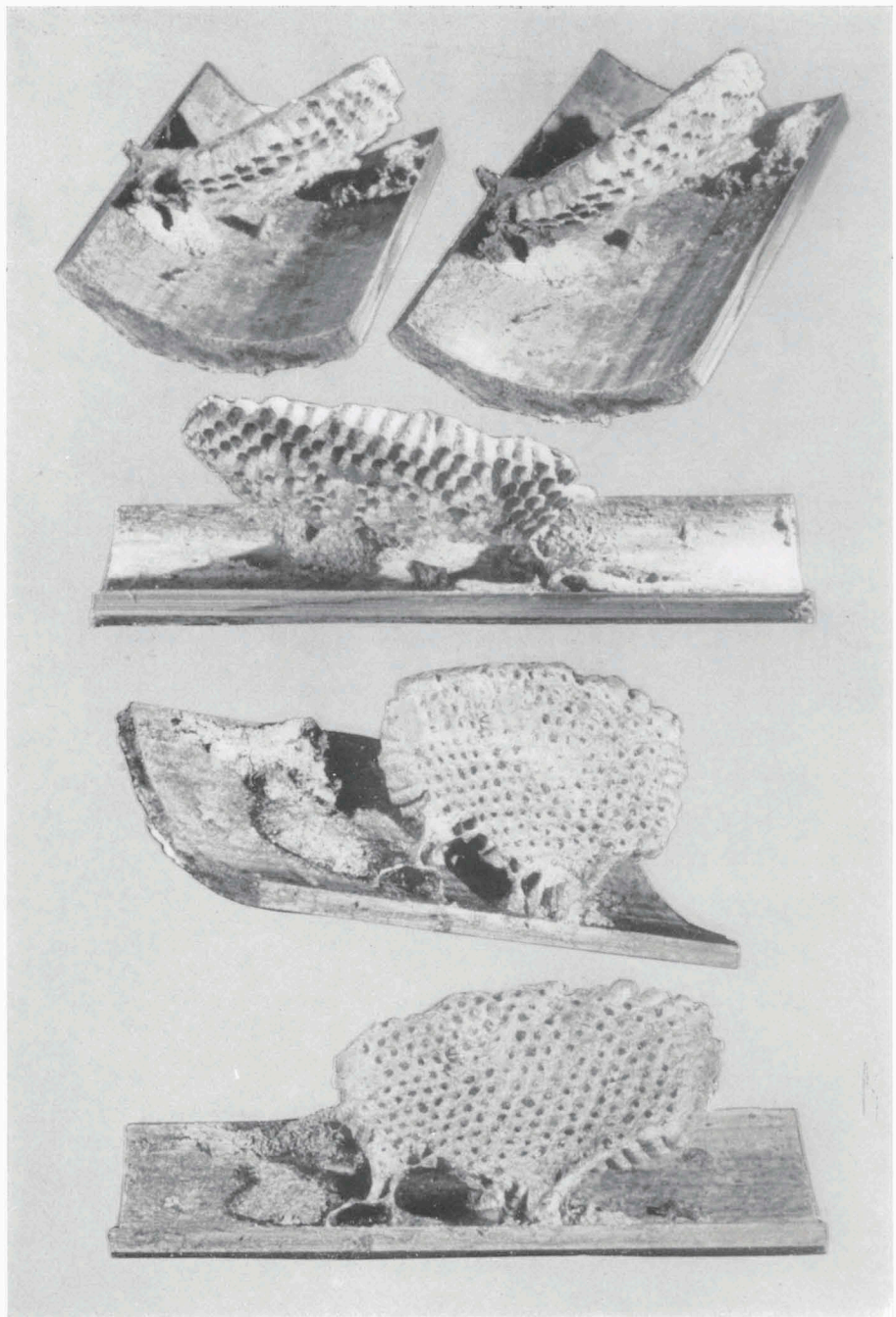


Plate 4. Nest of *Ropalidia granulata* van der Vecht, seen from different sides. The nest was inside a bamboo, one out of a stack of cut bamboos stored horizontally in an outhouse. Sungei Pinang Hills, Penang, 27 Aug. 1957. Composed from photographs made by H. T. Pagden.

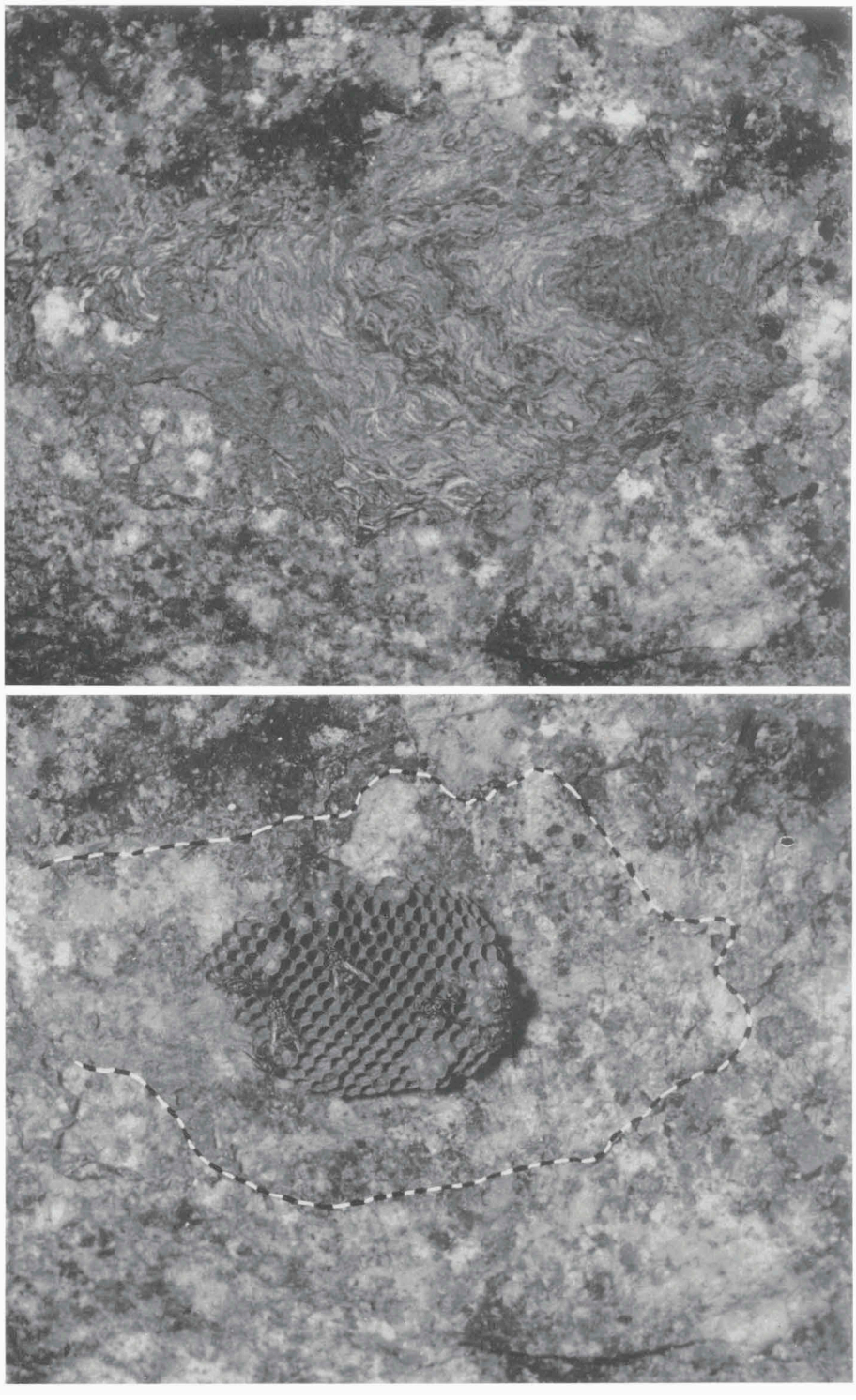


Plate 5. *Ropalidia* (*Icarielia*) *flavopicta* (Smith), nest on rock, before and after removal of the outer cover, Sungei Pinang Hills, Penang, 7 Oct. 1956, phot. H. T. Pagden. — On the lower photograph the outline of the cover is indicated by a broken line; there are eight wasps on the comb.

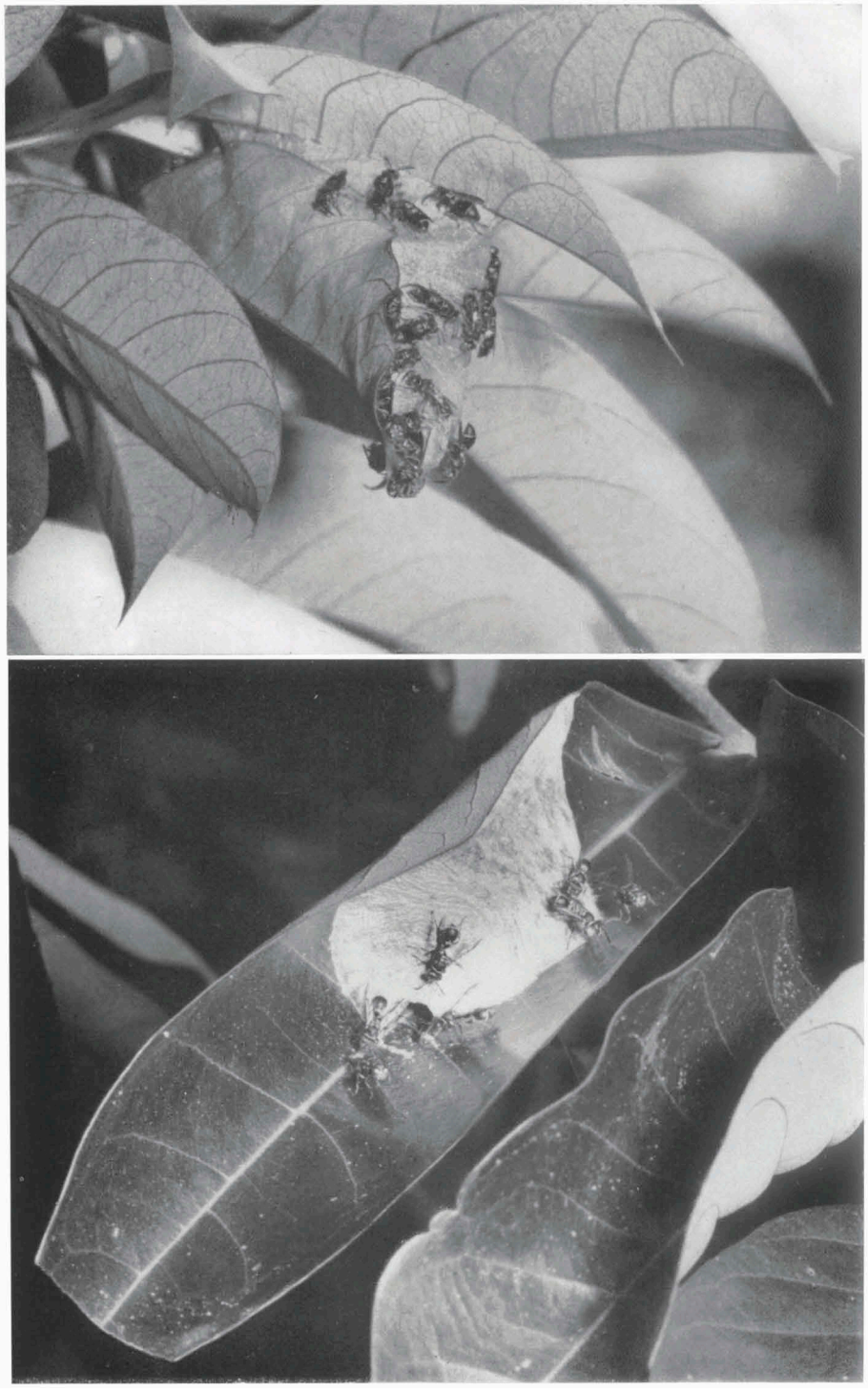


Plate 6. *Ropalidia* (*Icarielia*) *timida* sp. n., a: nest on nutmeg leaves, June 1957, b: nest on leaf of *Nephelium lappaceum* L., Aug. 1958, both nests at Sungei Pinang Hills, Penang, phot. H. T. Pagden.

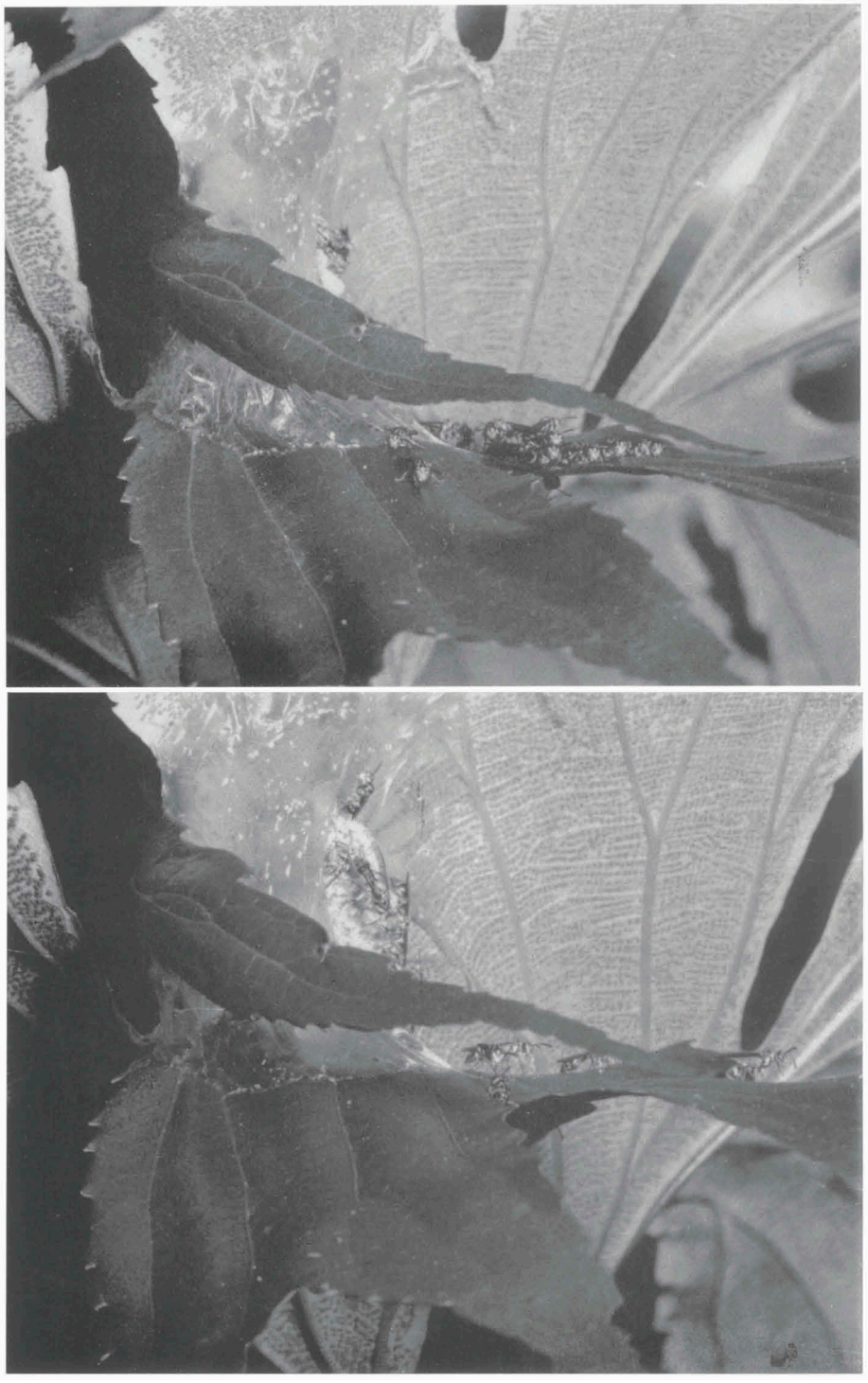


Plate 7. *Ropalidia* (*Icarielia*) *opifex* sp. n., nest enclosed by polythene-like cover, on leaf of fern (*Dipteris* sp.), Tiger Hill, Penang, 27 Jan. 1959, phot. H. T. Pagden.

Plate 8. *Ropalidia* (*Icarielia*) *opifex* sp. n., the same nest as on pl. 7; below: the nest is being attacked by a female of *Vespa tropica leefmansi* van der Vecht, which has destroyed the cover and is busy extracting the larvae or pupae from the cells; Tiger Hill, Penang, Jan. 1959, phot. H. T. Pagden.