

**THE EAST-ASIATIC AND INDO-AUSTRALIAN SPECIES OF
POLYBIOIDES BUYSSON AND PARAPOLYBIA SAUSSURE
(HYM., VESPIDAE)**

by

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With 13 text-figures and 3 plates

In 1913 A. von Schulthess published under the title "*Parapolybia* Saussure" a revision of the Old World social wasps which in general appearance are similar to certain species of the American genus *Polybia*. Only a few months later R. du Buysson described some new species of "*Polybia*" from Asia and created a new genus *Polybioides* for one African and two Oriental species.

Apart from the treatment of two African species of *Polybioides* in Bequaert's excellent work on the Vespidae of the Belgian Congo (1918; see also Bequaert, 1922) this group of wasps has since then received little attention.

A detailed study of the Oriental wasps which at different times have been described or recorded as *Polybia* has led me to the conclusion that many of these belong to the genera *Polistes* and *Ropalidia*, and that the Old World genera *Polybioides* and *Parapolybia* are represented in the Oriental region by only four and three species, respectively. The confused taxonomy of these wasps is well illustrated by the fact that Von Schulthess's genus *Parapolybia* contains, in addition to four species now regarded as correctly placed under this name, two *Polybioides*, one *Polistes* and two *Ropalidia*. Du Buysson described the two sexes of a mimetic *Polistes* (imitator of *Polybioides*) as different species of *Polybia* (actually an exclusively American genus), and he used for the true *Parapolybia* the name *Stelopolybia* Ducke, another genus which is restricted to the New World.

The relations between *Parapolybia* and *Stelopolybia* have remained obscure for a long time, and recently Richards & Richards (1951: 70) stated that no reliable character had been proposed to separate *Parapolybia* Saussure from *Stelopolybia* Ducke.

Since then, however, a detailed comparison of these wasps has revealed that such characters do exist and that the two genera appear to be not even very closely related. There are some striking differences in the shape of the terminal gastral sternite of the females as well as in the genitalia of the

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males. This subject will further be discussed in a forthcoming paper.

The majority of the specimens studied in the preparation of this revision are preserved in more than twenty museums and in a few private collections. The names of these museums and collections are listed below, together with the abbreviations used in the text. I wish to express my sincerest gratitude to the authorities of the various institutions and to the numerous hymenopterists who have assisted me in one way or another, for their kind cooperation. I am particularly grateful to Mr. H. T. Pagden, Penang, Malaya, who permitted me to illustrate this work with some of his photographs, and to Dr. A. Menke, Davis, California, who corrected part of the manuscript.

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| AMNH | = American Museum of Natural History, New York, U.S.A. |
| BISH | = Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A. |
| BM | = British Museum (Natural History), London, England. |
| CAS | = California Academy of Sciences, San Francisco, Calif., U.S.A. |
| CNHM | = Chicago Natural History Museum, Chicago, Ill., U.S.A. |
| CU | = Cornell University, Dept. of Entomology, Ithaca, N.Y., U.S.A. |
| coll. KVK | = coll. Dr. Karl V. Krombein, c/o U. S. National Museum, Washington D.C., U.S.A. |
| LACM | = Los Angeles County Museum, Los Angeles, Calif., U.S.A. |
| MCG | = Museo Civico di Storia Naturale, Genova, Italy. |
| MHNG | = Musée d'Histoire Naturelle, Genève, Switzerland. |
| ML | = Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands. |
| MP | = Muséum d'Histoire Naturelle, Paris, France. |
| MT | = Museo di Zoologia della Università, Torino, Italy. |
| MZB | = Museum Zoologicum, Bogor, Indonesia. |
| NMB | = Naturhistorisches Museum, Basel, Switzerland. |
| NRS | = Naturhistoriska Riksmuseet, Stockholm, Sweden. |
| OUM | = Oxford University Museum, Oxford, England. |
| coll. Townes | = coll. Dr. H. Townes, Ann Arbor, Michigan, U.S.A. |
| UMMZ | = University of Michigan, Museum of Zoology, Ann Arbor, Mich., U.S.A. |
| USNM | = United States National Museum, Washington D.C., U.S.A. |
| UZMC | = Universitetets Zoologiske Museum, Copenhagen, Denmark. |
| ZMAK | = Zoologisches Museum A. Koenig, Bonn, W. Germany. |
| ZSM | = Zoologische Sammlung des Bayerischen Staates, München, W. Germany. |

This paper is the first of a contemplated series of studies on Indo-Australian wasps which will include the results of my investigations on the material preserved in various American museums. Through the valuable cooperation of Dr. Karl V. Krombein, several thousands of specimens from various sources were accumulated in 1963 at the U. S. National Museum, where I had an opportunity to study these collections in August to December of that year. Special thanks are due to the National Science Foundation of the United States for the official support of my work in the U. S. National Museum ¹⁾.

¹⁾ NSF-grant GB-660 (201D-308).

The drawings in this paper have been prepared under my supervision by Mr. H. Heijn, Division of Systematic Zoology of the Leiden University. Unless otherwise stated, the specimens used for this purpose are in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden.

Measurements of the gastral petiole were taken as follows: the length is the distance from the end of the basal slit or incision to the apical edge of the petiole; width and height are measured at the widest and the highest part of the petiole, respectively. The body length is always measured from the frons to the apex of the second gastral tergite.

Key to the Old World genera of Polistinae

1. Antennae 11-segmented in the ♀, 12-segmented in the ♂. Maxillary and labial palpi 5- and 3-segmented, respectively. Transverse carina of pronotum incomplete or absent 2
— Antennae 12-segmented in the ♀, 13-segmented in the ♂. Maxillary and labial palpi 6- and 4-segmented, respectively 3
2. Mesepisternum divided by a transverse suture. Pronotum rounded, without any trace of a transverse carina. Gastral petiole not much longer than the second segment; the basal portion of the latter not strongly narrowed. Small species, not over 15 mm long *Polybioides* Buysson
— Mesepisternum without transverse suture. At least in the middle of the pronotum the transition from anterior to dorsal surface more or less distinctly angular. Gastral petiole long and narrow, much longer than the second segment, which is often strongly constricted and petiolate at the base. Larger species, at least 15 mm long *Belonogaster* Saussure
3. Posterior angles of pronotum in front of each tegula with a well-defined narrow margin, bordered anteriorly by a transverse carina. Tergite and sternite of the second gastral segment never fused 4
— Posterior angles of pronotum without well-defined apical margin. Tergite and sternite of the second gastral segment often fused. Transverse carina of pronotum rarely incomplete, as a rule almost reaching the lower angles of the propleura *Ropalidia* Guérin-Ménéville
4. Transverse carina of pronotum incomplete, abbreviated or interrupted laterally. First gastral segment much narrower than the second, narrowed and petiolate at the base, swollen in its apical portion. Propodeal orifice moderately narrow, at most twice as long as its greatest width *Parapolybia* Saussure
— Transverse carina of pronotum complete, almost reaching the lower angles of the propleura. First gastral segment as a rule short, sometimes longer than wide at the apex, but even then approximately triangular as seen from above, and gradually merging into the second segment. Propodeal orifice narrow, three to four times as long as its greatest width *Polistes* Latreille

Since there has been considerable confusion in the generic identifications of many Indo-Australian social wasps, the following list may be useful.

Indo-Australian wasps described erroneously as *Polybia* or *Parapolybia*
Polybia andrei Buysson, 1913, Bull. Soc. ent. France **1913**: 296, ♂ — Malaya =
Polistes meadeanus (Schulthess) [new synonymy].

- Polybia decorata* Smith, 1858, Jl. Proc. Linn. Soc. Zool. **2**: 114, ♀ — Sarawak, Borneo = *Ropalidia decorata* (Smith).
- Polybia limatula* Smith, 1864, Jl. Proc. Linn. Soc. Zool. **7**: 43, ♀ — Misool ("Mysol") = *Ropalidia conservator* (Smith), var. or subsp.
- Polybia loriana* Buysson, 1913, Ann. Mus. Stor. nat. Genova (3) **4**: 314, ♀ — New Guinea = *Ropalidia loriana* (Buysson) [new combination].
- Polybia luctuosa* Smith, 1858, Jl. Proc. Linn. Soc. Zool. **2**: 114, ♀ — Borneo = ?*Polistes luctuosus* (Smith) [type lost; identity uncertain].
- Polybia mathematica* Smith, 1861, Jl. Proc. Linn. Soc. Zool. **5**: 90, ♀ — Celebes = *Ropalidia mathematica* (Smith).
- Parapolybia meadeana* Schulthess, 1913, Mitt. Schweiz. ent. Ges. **12**: 153 (key), 161, fig. 2, 12, 13, ♀ — Borneo and Malaya = *Polistes meadeanus* (Schulthess) [new synonymy].
- Parapolybia novaeguineae* Schulthess, 1913 (April), Mitt. Schweiz. ent. Ges. **12**: 154 (key), 162, ♀ — New Guinea = *Ropalidia novaeguineae* (Schulthess) [new combination].
- Polybia novaeguineae* Buysson, 1913 (July), Bull. Soc. ent. France **1913**: 297, ♀ — New Guinea = *Ropalidia novaeguineae* (Schulthess) [new synonymy].
- Polybia papuana* Cameron, 1913, Bijdr. Dierk. **19**: 77, ♀ — Waigeu = *Ropalidia papuana* (Cameron).
- Polybia shelfordi* Buysson, 1913, Bull. Soc. ent. France **1913**: 297, ♀ — Borneo = *Polistes meadeanus* (Schulthess) [new synonymy].
- Polybia stigma* Smith, 1858, Jl. Proc. Linn. Soc. Zool. **2**: 114, ♂ — Borneo = *Ropalidia stigma* (Smith).

Genus **Polybioides** Buysson

Polybioides Buysson, 1913, Bull. Soc. ent. France **1913**: 299 (genus, three species, no type species designated).

Type species: "*Polybioides tabidus* F." [= *Vespa tabida* Fabricius, 1781] (designated by Ducke, 1914, Zool. Jahrb. Syst. **36**: 330).

In addition to the characters enumerated by Bequaert (1918: 238) and those given in the foregoing key, it may be mentioned that in all known species the occipital carina is only moderately distinct and disappears entirely at a considerable distance from the base of the mandibles. The sides of the pronotum show a distinct pit near the anterior margin, the space below it (between the pit and the lower angle) is slightly swollen.

My studies show that the Oriental species differ from their African relatives in the venation of the hind wing. In both *P. tabidus* and *P. melainus* the transverse cubito-anal vein (cu-a) meets the cubital vein after its separation from the medial vein (fig. 3a); in all Oriental species, however, cu-a meets M + Cu in or before the point of separation. Within the species there may be considerable variation in this respect, as is shown by fig. 4a-c, which are all drawn from Bornean specimens of *P. raphigastra*. In *P. psecas* the venation is often as is shown in fig. 5, the distance between cu-a and the separation of M and Cu usually being 2-2½ times the length of cu-a.

The male genitalia of the African species have not been described. Those of the two Oriental species of which I have seen males, *P. raphigastra*

and *P. psecas*, are shown in fig. 6 and 7. The two species prove to be very similar in this respect. The parameres bear a curved spine which is devoid of hairs; the shape of aedeagus and volsella is not much different from that in certain species of *Ropalidia*.

The geographic distribution of this genus is of special interest because it is discontinuous: two species occur in the forest regions of tropical West- and Central Africa (compare the map given by Bequaert, 1922: 314), the others in the rain forests of the Oriental tropics, from Burma to Sumatra, Borneo and Palawan.

This could raise the question whether the Oriental species are correctly placed in this genus. It is true that they differ from the African representatives in the venation of the hind wing and apparently also in the nesting habits; yet the characters which the two groups have in common are so numerous that in my opinion at most a separation on the subgeneric level would seem justified.

Nesting habits. — The nest of the African species *P. tabidus* was first described by Du Buysson in 1902 (under the name *Polybia bucula* Buysson). Subsequently Bequaert (1918) published extensive descriptions and some photographs (pl. 4 fig. 2; pl. 5 fig. 1-2) of the nests of both the African species, *P. tabidus* and *melainus*. His discussion is based on field notes made by Mr. H. Lang, who also supplied the photographs published in his paper. A few years later, this same author (1922) reported on three nests of *P. tabidus* in the Congo Museum and in 1927 Bischoff published some notes on a nest which was probably also built by this species. Recently, Walrecht (1963) discussed and figured a large nest ($58.5 \times 28 \times 9.5$ cm) from the former Belgian Congo, which must probably be attributed to *P. melainus*.

The nests of these wasps consist of a number of vertical combs of hexagonal cells, which are fixed side by side to the under side of a branch and are freely hanging down, parallel to each other; the group of combs is surrounded by a thin and fragile envelope. The combs are not connected with each other nor with the outer cover of the nest. It is of interest to note that the two central combs hang with the closed sides facing each other, and that all combs have the open sides facing outwards.

The nests of *P. tabidus* are relatively small, and the envelope is composed of two valves between which a split-shaped opening gives access to the combs. In *P. melainus* the nests may grow to a considerably larger size, according to Bequaert "some of them reaching three feet in length". The envelope of the larger nests consists of several irregularly adjusted layers of paper. Bequaert noted that the numerous "openings" in the cover all give

access to the nest, but I agree with Walrecht (1963) that this statement is almost certainly incorrect.

In Bequaert's first paper, he stated, on the authority of H. Lang, that in a nest of *P. tabidus* the two central combs "had cells on both sides", and that this exceptional architecture was "apparently" also found in the nest of *P. melainus*, figured on his plate 5. Walrecht (1963) correctly criticized this conclusion, but he overlooked that this had already been done in 1919 by Bouvier, who re-examined the nest described by Du Buysson. In 1922 Bequaert wrote: "Dans tous les cas les rayons se composent toujours d'une couche unique d'alvéoles. . . . Je me range donc complètement à l'avis de M. Bouvier, que mon ami M. H. Lang, en observant les hexagones du contour alvéolaire sur les deux faces des rayons, a été victime d'une illusion . . .". The error is ascribed to the fact that the bottom of the older cells has disappeared and that these cells are open on both sides of the comb²). Apparently these wasps remove the larvae after pupation in the same way as has been observed in *Ropalidia* (van der Vecht, 1962: 6-7); Bischoff noted for the nest described by him: "Die Zellböden sind abgesehen von den jüngsten Waben, nur im distalen Zuwachsteil erhalten, im übrigen aber von den Wespen offensichtlich selbst abgetragen, so dass sich die einzelnen Zellen nach beiden Seiten öffnen. Dadurch wird mit Entfernung des Larvenkotes auch der Kokon freigelegt, so dass schliesslich an beiden Seiten der Zelle Kokonfetzen hervorragen". Walrecht (1963) was inclined to ascribe the damage of the cell bottoms to the fact that the combs were hanging so close to each other (11 combs on a distance of 9.5 cm!), that the emerging wasps had to destroy the cell bottoms of the adjoining comb in order to escape from their cells. I find this hard to believe, and wonder whether the shape of the nest studied by him may have changed as the structure was dried.

A remark made by Walrecht (1963: 257) concerning the position of the immature stages in the cells needs correction. He claims to have been informed by me that the larvae (and pupae) of *Polybioides* do not need a cell which is as long as the body, since their abdomen curves back. Actually I told this author that the recurved position of the postpetiolar part of the abdomen is to be observed only in pupae (not in larvae!) of *Eumenes* and of the *Stenogastrinae*.

As regards the use of the cells there remains a problem to be solved. In

2) Apparently this correction was also overlooked by Richards & Richards (1951), who based their schematic figure of the nest of *Polybioides* (1951: 7, fig. 10) on the erroneous description published by Bequaert in 1918.

nests of *Ropalidia* the bottoms of the cells are closed again by a transparent "window" after removal of the faeces; the cells are often used again but always on the same side as the first time. For the African *Polybioides* Bequaert (1922: 315) noted: "Il n'en reste pas moins intéressant de noter que *Polybioides* a acquis l'habitude d'utiliser ses rayons de cellules indifféremment par chacune de leurs deux faces, ce qui est, semble-t-il, le résultat de leur position verticale". I must admit that the meaning of this sentence is not entirely clear to me. If the author believes, however, as he seems to do, that the cells from which wasps have emerged can be used for a next generation in either direction, it must be said that no facts are given to support this idea. One would expect in that case that certain combs would show cell caps at both sides or that one would find larvae and pupae oriented in both directions, but such observations appear not to have been made. From the existing literature it remains even uncertain that the cells are ever used more than once, and although — judging from what we know about other social wasps — this is certainly very probable, some reliable evidence on this point appears most desirable.

Concluding, it may be said that the vertically suspended combs of the African *Polybioides* consist of a single layer of cells, that the bottoms of the older cells are usually damaged, and that it is uncertain if and how such cells are used again for a next brood.

For a long time our knowledge of the nesting habits of the Oriental species was restricted to the fact that *P. raphigastra* was observed nesting in hollow trees and that the environs of the nest were very fiercely defended by the aggressive wasps. Many years ago I received this information from Edward Jacobson, who observed and collected the species in several localities in the Sumatra rain forest. During the last field trip which my wife and I made in Indonesia in 1955 I was able to confirm it by personal observation. While collecting in the nature reservation "Sibolangit" above Medan, Sumatra, where *Polybioides raphigastra* was very common, I was suddenly attacked by a few of these wasps, a clear indication that I had come too close to a nest. After a rapid retreat I ventured to come back to the same spot shortly afterwards, and indeed I could then observe considerable numbers of this wasp flying to and from a hole in a tree, only about a meter above the ground. Unfortunately it was the last day of our stay in this locality, and it proved impossible to collect the nest.

Soon after my return to Leiden I drew the attention of Mr. H. T. Pagden in Malaya to this lack in our knowledge. His first reply, written in March 1956, was that he had never seen a nest of *Polybioides raphigastra* or *P.*

psecas. Fortunately, however, only a few months later he had occasion to collect the nest which is shown on the plates 1 and 2 of this paper.

In 1958 Pagden published a short paper on this discovery, from which I have derived the following notes. The nest was situated "in a large cave in which a man could stand". The inhabitants of the nest were killed by placing a Gammexane smoke canister in the cave on the evening of July 7, 1956. The next morning over 2600 wasps could be collected from the floor of the cave, furthermore a small number was found to have died within the nest. As many wasps had crept into crevices, under small pieces of rock and beneath other litter, the author estimates that "at least ten per cent, perhaps as much as twenty per cent, were missed". "The nest... was pear-shaped, flattened from back to front, and was firmly attached to the rock by one face (pl. 2). It was 13.5" long, 8.5" across at its widest part and 5.25" from front to back at its greatest thickness. It consisted of ten tiers of cells, which were arranged in a spiral³⁾, and was enclosed in an envelope, except for the last two tiers which were largely exposed. The combs were entirely supported by the outer envelope and the nest may therefore be classed as phragmocytтарous. Unlike the majority of social wasps' nests the combs are double sided and brood may be found in the cells on both sides of the comb at the same time".

It appears desirable to add a few comments. First, the photographs clearly indicate that the nest of this wasp represents a previously unknown type of architecture. Pagden speaks of "ten tiers of cells", but actually there appears to be only a single comb which winds from top to bottom in a continuous spiral. To class such a structure as "phragmocytтарous" implies a degree of similarity with the nest of South American *Polybia* (for which this term was originally devised) that actually does not exist. It is evident that *Polybioides* never builds its cells on the envelope, whereas this is the normal procedure for the second and following combs of *Polybia* nests.

From Pagden's description it is not clear that the bottom of the nest was damaged, but in a letter dated October 17, 1956, he confirmed my suspicions on this point: "You are correct in believing that a portion of the nest of *P. raphigastra*, of which I sent you photographs, is missing, and it is the portion indicated in your sketch". This sketch referred to the break in the spiral which is most distinctly seen in the upper side of pl. 1 fig. b. I have been wondering to what extent the outer cover had been damaged, but as unfortunately some photographs taken of the nest in situ had failed,

3) In a letter dated July 11, 1956, Mr. Pagden described the "tiers" as being "actually arranged in a continuous spiral".

this remains uncertain. It seems probable to me, however, that the under side of the nest (the side shown in pl. 1 fig. b) must have been partly covered by the envelope.

Finally I must remark that a careful study of the photographs has failed to convince me that "the combs are double sided". On the contrary, wherever the comb is photographed sharply in profile, as in pl. 2 fig. b, it is distinctly only a single cell thick. Moreover the caps spun by the larvae in closing the cells before pupation are exclusively visible on the under side of the comb (= upper side in pl. 2 fig. b). It is of interest to note that such caps are clearly visible in the oldest part of the nest (just above the oval hole in the top of the nest, at bottom of pl. 2 fig. b). This suggests that this species, like the other social wasps, uses its cells more than once.

Composition of the colonies. — Concerning this subject very little is known with certainty. It is evident that the colonies can become quite large, particularly those of *P. melainus* and *P. raphigastra*.

In view of this fact and of the exclusively tropical distribution of these wasps, I suspect that they agree with most of the South-American Polistinae in founding their colonies by a group of individuals of which at least one is a fertilised female (= colony-foundation by "swarming", see Richards & Richards, 1951: 4-5). It seems also fairly certain that the colonies are pleiometrotic, i.e. that there are two or more egg-laying, fertilised females in the same nest. However, detailed data on this point are lacking.

Pagden (1958) was apparently the first to examine a nest population. He counted all the wasps collected from the "cave nest" of *P. raphigastra*, and found that nearly 25% of the specimens (661 out of 2675) were males. "There appeared to be no obvious division into queens and workers, and all specimens which were not males were grouped as females. There was, however, a considerable variation in the size of those grouped as females and it is possible that this may indicate a division into workers and queens. Only a detailed study of a large number of specimens, which must be properly fixed and preserved so that they can be dissected at leisure, can solve this problem. My own opinion, based on the very inadequate evidence available at present, is that there is no distinct queen and worker caste in this species, all females being potential reproductives".

Although Mr. Pagden's discovery means a great step forward in our knowledge of the nesting habits of this genus, there remain various questions which cannot be satisfactorily answered at present. It is still uncertain whether the adult wasps close the cells directly after removal of the larval excrements (as in *Ropalidia*), or whether, and how, they do this when the

cells are used again for another brood. It would also be very interesting to know something about the early stages of the nest, whether the first cells are directly built on the substratum or suspended from a petiole, whether new colonies are founded by swarming, etc. Furthermore it would be of great importance to learn to what extent the other Oriental species of *Polybioides* agree with *P. raphigastra* in their nesting habits. Naturalists in South-East Asia are therefore urgently requested to pay attention to this subject whenever possible!

Mimicry. — While collecting at Sibolangit in North Sumatra in December 1955, I was struck by the presence of some imitators of *P. raphigastra*. There was an extremely similar Stratiomyid fly (identified in 1957 by Prof. E. Lindner as *Massicyta bicolor* Walk.), flying together with the *Polybioides*, and also a Mantispid with the same habitus and coloration. Another mimic, not observed by me in Sumatra, is *Cerceris polybioides* Pendlebury, described in 1927 from Bukit Kutu, Selangor, Malaya. Finally attention may be drawn to *Polistes meadeanus* (Schulthess), originally described by Von Schulthess (1913) as *Parapolybia meadeana*, and in the same year by Du Buysson as *Polybia andrei* (♂) and *Polybia shelfordi* (♀) (new synonymy). This wasp mimicks *Polybioides* so perfectly that both these experienced hymenopterists failed to recognize it as a *Polistes*. This is particularly due to the fact that in addition to the similarity in colour pattern the general aspect of the insect is very “*Polybia*-like”, the gastral petiole being more slender than in any other known species of *Polistes*.

Key to the Oriental species of *Polybioides* Saussure

1. Gastral sternites entirely yellow. Mesepisternum yellow, at most with ill-defined brownish spot on ventral side. Clypeus often entirely yellow; if a median black line is present it rarely reaches far beyond the middle. Gastral petiole more slender than in *P. psecas*, but less so than in *P. gracilis*, approximately 4.5 times as long as its greatest width. Mesoscutum without yellow spot. Length (h. + th. + t. 1 + 2): 10-11 mm. — Malaya; Sumatra; Borneo *raphigastra* (Saussure)
- Gastral sternites dark brown with yellow apical margin. Mesepisternum dark brown to blackish, with a large and usually well-defined yellow mark, often divided by a dark line or band along the transverse suture 2
2. Gastral petiole approximately 4 times as long as its greatest width, laterally with yellow line running from base to apex. (Mesoscutum with yellow spot in front of scutellum). Small species, length (h. + th. + t. 1 + 2): 8-9 mm. — Occurs together with *P. raphigastra* in Malaya, Sumatra and Borneo *psecas* Buysson
- Gastral petiole short, only about 3.2 times as long as wide: see under *P. angustus*.
- Gastral petiole 4½-5 times as long as wide, laterally with yellow line on posterior two-thirds only. (Mesoscutum with or without yellow spot). Length (h. + th. + t. 1 + 2): 10-12 mm 3
3. Hind femora and tibiae dark brown, the tibiae in some specimens with a short pale

brown streak on inner side. Mesoscutum with yellow spot in front of scutellum. Yellow line on pronotal collar interrupted laterally. — Palawan . *angustus* sp. n. — Hind femora entirely brown or dorsally with yellow mark at apex; hind tibiae pale yellow, dark brown at base and apex. Mesoscutum without yellow spot. Yellow line on pronotal collar not interrupted. — Burma; Tenasserim; Vietnam
 *gracilis* sp. n.

***Polybioides raphigastra* (Saussure)**

(fig. 1, 4, 6; pl. 1-2)

Polybia raphigastra Saussure, 1854, *ft. Fam. Vesp.* **2**: 204, ♀ — “L’Amérique? Etiqueté par erreur de Pulo-Pinang (Asie)” [the label was undoubtedly correct!] (holotype ♀ leg. D. Westermann, coll. Spinola, MT). — Dalla Torre, 1894, *Cat. Hym.* **9**: 165 (cat.). — Dalla Torre, 1904, *Gen. Ins.* **19**: 78 (cat.; “*rhaphigastra*”; “Amerika”). — Schulz, 1911, *Zool. Ann. Würzburg* **4**: 201 (syn.: *Icaria sulciscutis* Cameron). — Schulthess, 1914, *Zool. Jahrb. Syst.* **37**: 261 (Malaya; Sumatra; said to be aggressive). — Dover, 1931, *J. Fed. Mal. St. Mus.* **16**: 259 (“*rhaphigastra*”; “widely distributed all over the Indo-Malayan region”) [incorrect!].

Parapolybia raphigastra!; Schulthess, 1913, *Mitt. Schweiz. ent. Ges.* **12**: 153 (key), 156, pl. 11 fig. 4, pl. 11b fig. 10 (revision; Burma — Sumatra).

Polybioides raphigastra!; Schulthess, 1927, *Suppl. ent., Berl.* **16**: 84 (Sumatra).

Polybia sumatrensis Saussure, 1855, *Rev. Mag. Zool.* (2) **7**: 374, “♂” — “Sumatra” (type ♀ BM, no. 18.737, labelled “Sumatra, S.R., 54/36” (or 54/76?)). — Smith, 1858, *J. Proc. Linn. Soc. Zool.* **2**: 113 (Sumatra; Borneo; Malaya). — Dalla Torre, 1894, *Cat. Hym.* **9**: 166 (cat.). — Bingham, 1897, *Fauna Brit. India, Hym.* **1**: 385, ♀ (Burma; Tenasserim; Sumatra) [pro parte]. — Dalla Torre, 1904, *Gen. Ins.* **19**: 78 (cat.). — Bingham, 1905, *Fasc. Malay.* **3**: 49 (Malaya). — Meade-Waldo, 1911, *Ann. Mag. nat. Hist.* (8) **7**: 108 (in subg. *Parapolybia*; syn.: *Icaria sulciscutis* Cameron, 1901; *Icaria rubricutis* Cameron MS). — Dover, 1927, *Proc. ent. Soc. Lond.* **1**: 40 (compared with *P. pendleburyi* sp. n.). — Dover, 1929, *Bull. Raffles Mus.* **2**: 46 (Malaya; Sarawak, Borneo).

Polybioides sumatrensis; Buysson, 1913, *Bull. Soc. ent. France* **1913**: 299 (in key).

Icaria leptogaster Cameron, 1901, *Proc. Zool. Soc. Lond.* **1901** (2): 29, ♀ — “Patalung, Malay Peninsula” (*Mus. Zool. Cambridge*). — Dalla Torre, 1904, *Gen. Ins.* **19**: 74 (cat.; err.: “Malaysische Inseln”). — Schulthess, 1913, *Mitt. Schweiz. ent. Ges.* **12**: 164 (perhaps identical with *Parapolybia sulciscutis* = *raphigastra*).

Icaria sulciscutis Cameron, 1901, *Proc. Zool. Soc. Lond.* **1901** (2): 30, ♀ — “Bukit Tomah, Singapore” [correctly: Bukit Timah] (type ♀ BM, no. 18.729, “Singapore, Cameron coll. 1902-1905”). — Dalla Torre, 1904, *Gen. Ins.* **19**: 74 (cat.).

Polybia sulciscutis; Schulz, 1906, *Berl. ent. Zeitschr.* **51**: 328-331, fig. 4 (description of ♀ ♂; Perak).

The type of *Icaria leptogaster* Cameron, a species which hitherto had remained unrecognized, is in the Museum of Zoology of the University of Cambridge. It forms part of a series of nine specimens, which was kindly sent to me for study by Dr. J. Smart. One of the specimens is labelled “Patalung, Malay Pen., Skeat, 30.xi-1900”; the type bears a label in Camerons’ handwriting: “*Icaria leptogaster* Cam., type, Malay Pen.”. All specimens are strongly discoloured, very probably due to the action of moist cyanide; the dark parts are pale brownish, the originally yellow parts show

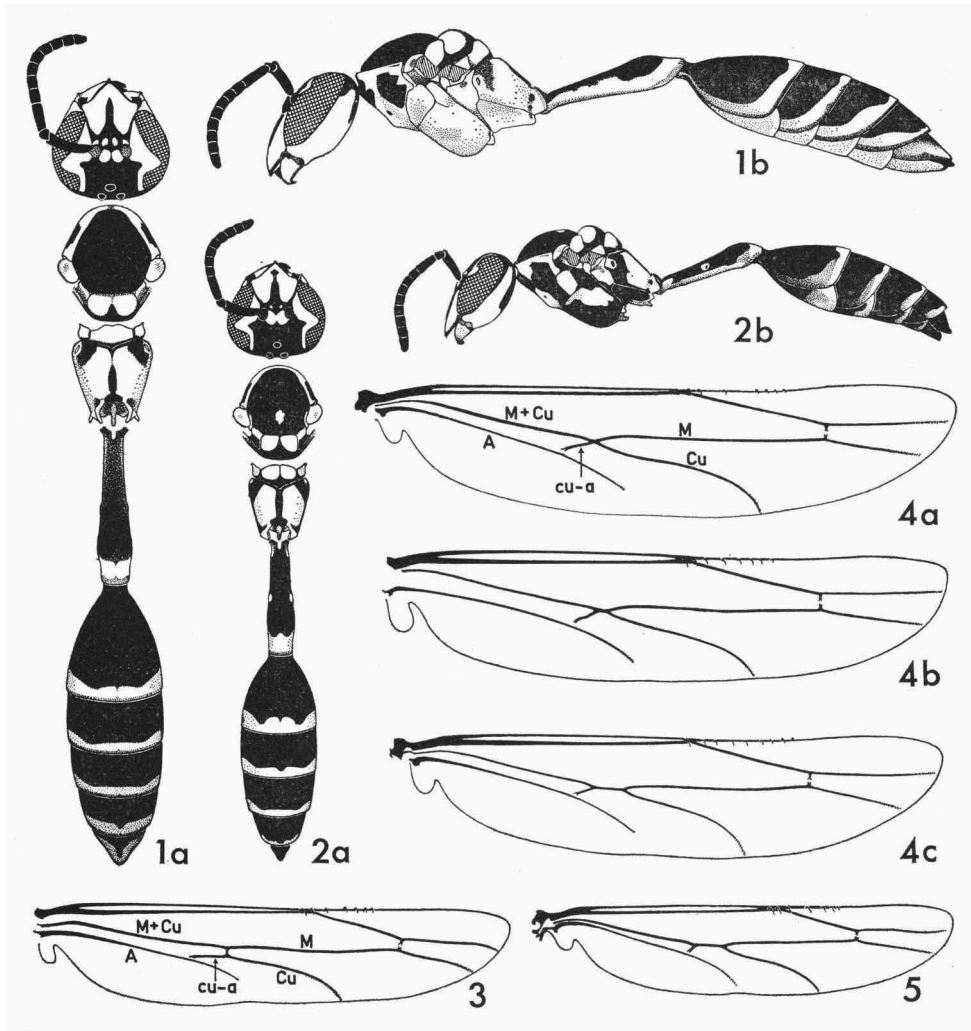


Fig. 1. Colour pattern of *Polybioides raphigastra* (Saussure), ♀, Sibolangit, Sumatra.
a, dorsal, b, lateral aspect.

Fig. 2. Do. of *Polybioides psecas* Buysson, ♀, Tabang, Bengen River, East Borneo.

Fig. 3. Hind wing of *Polybioides tabidus* (Fabricius), ♀, Malela, Lower Congo, showing the normal type of venation in the Vespidae: *cu-a* meets *Cu* after *M* and *Cu* have separated. *M* = medial vein, *Cu* = cubital vein, *A* = anal vein, *cu-a* = cubito-anal cross-vein.

Fig. 4. Variation in hind wing venation of *Polybioides raphigastra* (Saussure) from Borneo. a, *cu-a* meets *Cu* where it separates from *M*; b-c, *cu-a* meets *M + Cu* at different distances from the point of separation of these two veins (a, North Borneo, 10 km South of Tenom; b, East Borneo, Tabang, Bengen River; c, North Borneo, 19 km North of Kalabakan).

Fig. 5. Hind wing of *Polybioides psecas* Buysson, ♀, East Borneo, Tabang, Bengen River.

various shades from pale dirty yellow to yellowish or brownish red. Six specimens of the series, including the type, are *Polybioides raphigastra* (Saussure), the remaining three belong to *P. psecas* Buysson.

Malaya: 1 ♀ "Malay Peninsula", F. Muir (BISH). — Kedah, 1 ♀ S. Kedah, Bading, Badenoch Estate, 21 Febr. 1963, M. A. Lieftinck (ML). — Penang, 4 ♀ leg. C. F. Baker (USNM); 9 ♀ 600-800 m, Febr. 1889, Loria and Fea (MCG; 2 ♀ ML); ± 70 ♂♂ from nest at Sungei Pinang, 8 July 1956, H. T. Pagden (ML); 5 ♀ Batu Feringgi, 25 Febr.-1 March 1963, M. A. Lieftinck (ML). — Perak, 1 ♀ coll. Gribodo (MCG). — Pahang, Cameron Highlands, 3 ♀ July 1948, N. L. H. Krauss (USNM); 1 ♀ Sungei Telom area, 12-1300 m, 9 March 1963, 1 ♀ Jor Road, milestone 23, 700 m, 13 March 1963, M. A. Lieftinck (ML); 3 ♀ Fraser's Hill, Oct. 1948, N. L. H. Krauss (USNM); 1 ♀ Tasek Bera, 28-31 March 1963, M. A. Lieftinck (ML). — Selangor, 3 ♀ Bukit Kutu, H. M. Pendlebury (ML); 2 ♀ Kuala Lumpur, 1950 (KVK); 1 ♀ Pahang Road, 16 miles North of Kuala Lumpur, April 1949 (KVK); 5 ♀ Ulu Langat, 300-390 m, T. C. Maa (BISH); 3 ♀ Kepong, Aug. 1949, Army Scrub Typhus Unit (USNM); 1 ♀ Ampang Reservoir, Kuala Lumpur, 17-19 March 1963, M. A. Lieftinck (ML); 1 ♀ Gombak, April 1949, R. Traub and B. Insoll (USNM). — Singapore, 1 ♀, March 1907, F. Muir (BISH). — A series from several localities throughout Malaya, including 1 ♂ from Kedah Peak, 3000 feet, March 1928, mainly collected by H. M. Pendlebury (BM). — Recorded by Schulthess (1914) from the Taiping Hills.

Sumatra: 4 ♀ "Sumatra", leg. Müller (ML); 1 ♀ "Sumatra", leg. Ludeking. — Atjeh (Atchin), 3 ♀ Blangkedjeren, 1000-1500 m, 2 ♀ Pendeng, 400 m, 1 ♀ Mt. Leuser, 1500 m, Jan.-March 1937, A. Hoogerwerf, Leuser Exp. (MZB; ML). — N. E. Sumatra, a series from Habinsaran, Simanimbo and Tangga (MZB; 1 ♀ ML); 1 ♀ Bandar Baru (MZB); series Sibolangit, leg. Docters van Leeuwen (MZB); 18 ♀ 1 ♂ Sibolangit, 4-5 Jan. 1955, J. van der Vecht (ML; one ♀ is stylopized!); 1 ♀ environs of Medan, 1923-4, W. F. van Hell (ML); 13 ♀ Serdang, Tandjong Morawa, Dr. B. Hagen (ML); 1 ♀ Pematang Siantar, June 1937, C. T. and B. B. Brues (MCZ). — Tapanuli, 6 ♀ Si-Rambe, Dec. 1890-March 1891, E. Modigliani (MCG; ML); 1 ♀ Siboga, April 1886, E. Modigliani (MCG). — West Coast, 2 ♀ "Westkust", J. W. van Lansberge (ML); 1 ♀ Padang, H. von Hayek (ZSM); 2 ♀ Pajakombo, H. Rouyer (ML); 1 ♀ Alahan Pandjang, Oct. 1877, 2 ♀ Muara Labu, Nov. 1877, 1 ♀ Surulangun, Jan. 1878, 8 ♀ Rawas, May 1878, all leg. Sumatra-Exp. 1877-8 (ML); 1 ♀ Tanangtalu, May 1915, E. Jacobson (ML); 3 ♀ Aer Mantjur, Aug. 1878, O. Beccari (MCG; 1 ♀ ML); 5 ♀ Fort de Kock, 920 m, 1925, E. Jacobson (ML; 1 ♀

USNM); 1 ♂ Mt. Ophir, Ampu Gading, J. G. Betrem (ML); 1 ♀ Mt. Kerintji, 1 March 1954, 2 ♀ above Muara Sako, 8 March 1953, A. H. G. Alston (BM). — Indragiri, 6 ♀ Pankalan Kasai, Muara Padjanki and Lankut, April-July 1939, P. Buwalda (MZB; ML). — Benkulen, 1 ♀ Mt. Dempo, 4000 ft., Aug. 1923, C. J. Brooks (BM); 1 ♀ Benkulen, 19-21 May 1935, 8 ♀ Tandjong Sakti, May-June 1935, Mrs. M. E. Walsh (ML); 11 ♀ Marang, coll. Gribodo (MCG; 1 ♀ ML). — Djambi, series from Djambi Expedition, Mt. Mongko, 1925, O. Posthumus (MZB). — Lampong, 4 ♀ Wai Lima, Nov.-Dec. 1921, H. H. Karny (MZB; ML); 6 ♀ Mt. Betung, Sungeilangka Estate, 27 March 1937, E. van der Vecht-B. and J. van der Vecht (ML); 12 ♀ 1 ♂ Mt. Tanggamus, 450-700 m and 2100 m, 1934-5, 1939, Mrs. M. E. Walsh, M. A. Lieftinck, and L. J. Toxopeus (MZB; ML; the 4 ♀ collected at 2100 m, on the top of the mountain, on 31 Dec. 1934 and 1 Jan. 1935 by Lieftinck and Toxopeus, have all been stylopized). — Recorded by Schulthess (1914) from East Sumatra (T. Slamet and Bandar Baru) and in 1927 from West Sumatra (Fort de Kock).

N i a s: 1 ♀ Mt. Sitoli, coll. Magretti (MCG).

N a t u n a I s.: 2 ♀ Anambas, 1928, C. G. G. J. van Steenis (MZB; 1 ♀ ML).

B o r n e o: Sarawak, 1 ♀ "Sar" (= Sarawak, leg. Wallace) (OUM); 5 ♀ "Sarawak", 1865-66, G. Doria (MCG); 1 ♀ Bidi, 1907-08, C. J. Brooks (BM); 2 ♀ Sarawak, leg. Shelford (coll. Baker, USNM); 2 ♀ Kuching, 1903-249 (OUM; marked "*Icaria rubriscutis*, cotype"; the label indicates that the type is at Cambridge); 36 ♀ Mt. Dulit, from foot to 4000 ft., Oxf. Univ. Exp. (BM; 4 ♀ ML); 1 ♀ Batu Kawa, 5 Oct. 1950, M. A. Lieftinck (ML); 2 ♀ Sarikei District, Rejang Delta, July 1958, T. C. Maa (BISH); 4 ♀ Nanga Pelagus near Kapit, 180-585 m, August 1958, T. C. Maa (BISH); 1 ♀ Gunong Matang, 120 m, Sept. 1958, light trap, Gressitt and Maa (BISH); 1 ♀ Bau District, Bidi, 90-240 m, Sept. 1959, T. C. Maa (BISH). — 4 ♀ Brunei, coll. Gribodo (MCG). — Sandakan, 13 ♀ 1 ♂ "Sandakan", C. F. Baker (USNM); 5 ♀ "Sandakan" (ML); 39 ♀ Samawang nr. Sandakan, 9-28 July 1927, in jungle, 9 ♀ Bettotan nr. Sandakan, 22 July-18 Aug. 1927 (BM; ML); 9 ♀ Sandakan Bay, Sepilok Forest, 1-10 m, Oct. 1957, J. L. Gressitt (BISH); 5 ♀ Sandakan Bay, Sapagaya Lumber Camp, 2-20 m, Nov. 1957, J. L. Gressitt (BISH); 3 ♀ Tenompok, 1460 m, Jesselton, 30 miles East, Oct. 1958, T. C. Maa (BISH); 1 ♀ Ranau, 8 miles North Paring Hot Springs, 500 m, Oct. 1958, L. W. Quate and T. C. Maa (BISH); 2 ♀ Tawau, Kalabakan River, 30 and 48 miles West, Nov. 1958, primary forest, L. W. Quate (BISH); 5 ♀ Gomatong Caves, 20 miles South of Sandakan, Nov. 1958, T. C. Maa (BISH); 6 ♀ Singkor,

2 ♀ Sensuron, Jan. 1959, T. C. Maa (BISH); 33 ♀ 3 ♂ Forest Camp, 19 km North of Kalabakan, 60 m, 10 Oct.-21 Nov. 1962, 8 ♀ Forest Camp, 9.8 km Southwest of Tenom, 18-20 Dec. 1962, all Y. Hirashima and K. J. Kuncheria (BISH; 3 ♀ 1 ♂ ML). — West Borneo, 1 ♀ Mowong, Sept. 1907, 2 ♀ Pontianak, F. Muir (BISH). — Central Borneo, 1 ♀ Liang Kubung, cave, leg. Buttikofer (ML); 3 ♀ Central East Borneo, Sept. 1925, H. C. Siebers (MZB; 1 ♀ ML); 6 ♀ 1 ♂ Liangtelang, coll. Gribodo (MCG; 2 ♀ ML). — East Borneo, 2 ♀ Balikpapan (MZB); 2 ♀ do., leg. Kampmei-nert (received 8 July 1912) (ML); 33 ♀ Balikpapan, Wain and Mentawir Rivers, Oct.-Nov. 1950, A. M. R. Wegner (MZB; ML); 161 ♀ Tabang, Bengen River, Sept.-Oct. 1956, A. M. R. Wegner, collected on 38 different days during this period, with a maximum of 20 per day (MZB; ML); 2 ♀ Dagaunan, 400 ft., June 1937, Mrs. M. E. Walsh (BM).

***Polybioides psecas* Buysson**

(fig. 2, 5, 7)

Polybioides psecas Buysson, 1913, Bull. Soc. ent. France **1913**: 299, ♀ — “espèce indo-malaise” (?MP). — Schulthess, 1927, Suppl. ent., Berl. **16**: 84 (Sumatra, Fort de Kock, 920 m).

Polybia pendleburyi Dover, 1927, Proc. ent. Soc. Lond. **1**: 40, ♀ — “Bukit Kutu, Malaya, 19 April 1926” [type and paratypes in BM]. — Dover, 1931, J. Fed. Mal. St. Mus. **16**: 259 (Ginting Sempak, Malaya).

S i a m: Trong, 2 ♀ Khow Sai Dow, 1000 ft., Jan.-Febr. 1899, W. L. Abbott (USNM).

M a l a y a: 1 ♀ Penang I., Batu Feringgi, 26 Febr.-1 March 1963, M. A. Lieftinck (ML). — 1 ♀ Dinding Is., H. N. Ridley (BM). — Series from Perak, Pahang, and Selangor, from F.M.S. Museum, including the type of *Polybia pendleburyi* Dover (BM). — Kelantan, 1 ♀ coll. Magretti (MCG). — Selangor, 1 ♀, H. E. Durham (BM); 1 ♀ Bukit Kutu, 3300 ft., 28 Sept. 1932, H. M. Pendlebury (ML); 1 ♀ Ulu Langat, March 1950, Army Scrub Typhus Unit (USNM); 1 ♀ do., 13 June 1958, T. C. Maa (BISH); 1 ♀ Ampang Reservoir, Kuala Lumpur, March-April 1963, M. A. Lieftinck (ML); 1 ♀ Seaport Estate, Sungei Way, 15 mi. from Kuala Lumpur, Febr., 1948 (KVK); 1 ♀ Kepong, March 1949, primary jungle (KVK).

S u m a t r a: West Coast, 1 ♀ Mt. Singgalang, July 1878, O. Beccari (MCG); 2 ♀ Fort de Kock, 920 m, 1925, Edw. Jacobson (USNM; ML). — Benkulen, 1 ♀ Tandjong Sakti, 26-31 May 1935, 1 ♀ Muara Tenam, 4-14 July 1935, Mrs. M. E. Walsh (ML). — Indragiri, 1 ♀ Muara Padjanki, April 1939, P. Buwalda (ML). — Lampong Districts, 2 ♀ Mt. Tanggamus, 800 m, Dec. 1934; 1 ♀ do., top, 2000 m, 1 Jan. 1935, M. A. Lieftinck &

L. J. Toxopeus (ML); 3 ♀ Mt. Betung, 400 m, Sungeilangka Estate, 27 March 1937, E. van der Vecht-B. and J. van der Vecht (ML).

Nias: 1 ♀ Mt. Sitoli (coll. Magretti, MCG).

Borneo: 1 ♀ "Borneo", F. Muir (BISH). — North Borneo, 1 ♀ Brunei, coll. Gribodo (MCG); 2 ♀ Samawang, 18 ♀ Bettotan, July 1927, C. Boden Kloss and H. M. Pendlebury (BM; 3 ♀ ML); 1 ♀ Sandakan, C. F. Baker (USNM); 3 ♀ Sandakan Bay, Sepilok and Sapagaya, Oct.-Nov. 1957, J. L. Gressitt (BISH); 2 ♀ W. Coast Res., Ranua, 8 mi. N. of Paring

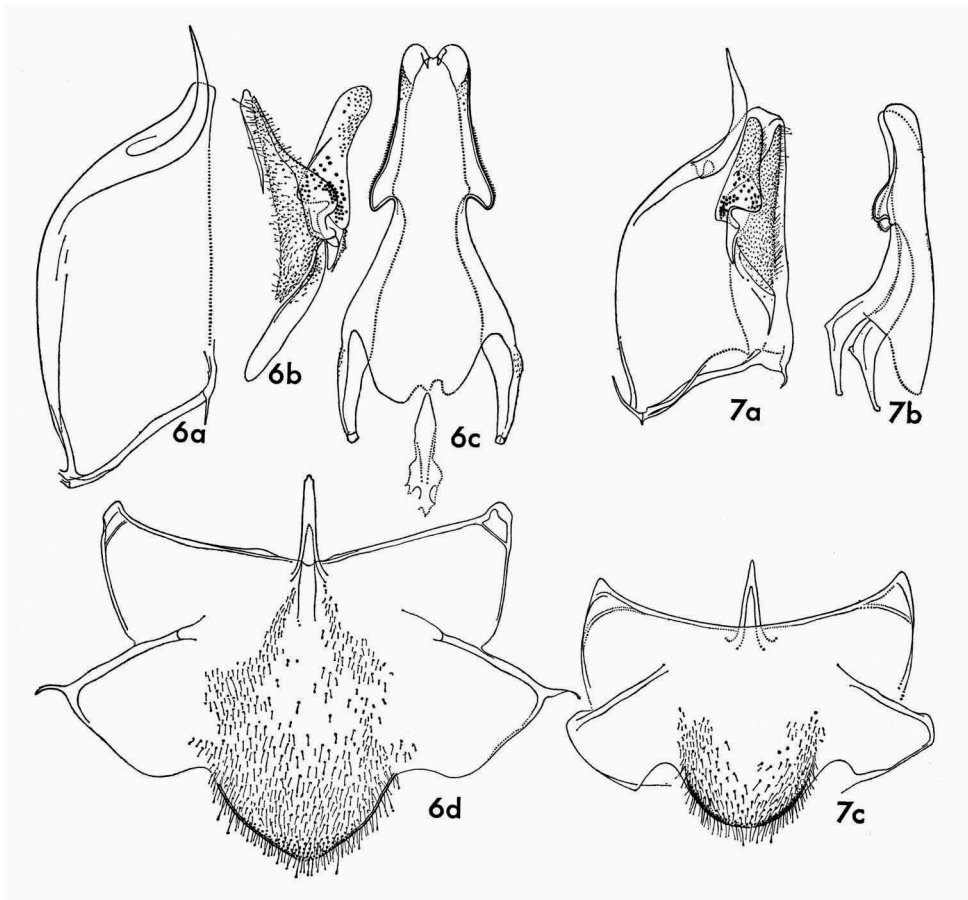


Fig. 6. *Polybioides raphigastra* (Saussure), ♂, Penang, Malaya. a, inner aspect of right paramere (volsella removed); b, volsella; c, dorsal aspect of aedeagus (flattened); d, gastral sternites 7 + 8 (= abdominal sternites 8 + 9).

Fig. 7. *Polybioides psecas* Buysson, ♂, North Borneo, Tawau, Quoin Hill (BISH). a, inner aspect of right paramere with volsella; b, lateral aspect of aedeagus (medio-posterior appendage omitted); c, gastral sternites 7 + 8 (= abdominal sternites 8 + 9).

Hot Springs, Oct. 1958, L. W. Quate (BISH); 7 ♀ Forest Camp 19 km North of Kalabakan, 11-22 Oct. 1962, Y. Hirashima and K. J. Kuncheria (BISH; 2 ♀ ML); 1 ♂ Tawau, Quoin Hill, 8-14 July 1962, in Malaise-trap, H. Holtmann (BISH). — Sarawak, 1 ♀ 1865-6, leg. G. Doria (MCG); 18 ♀ foot of Mt. Dulit, Aug.-Nov. 1932, one ♀ "on fresh deer meat drying in sun", 2 in "light trap", 2 in "fish trap", Oxford Univ. Exp. (BM; 4 ♀ MCZ; 3 ♀ ML). — East Borneo, 1 ♀ Central East Borneo, Aug. 1925, leg. H. Siebers (ML); 1 ♀ Balikpapan, received 8 July 1912, leg. Kampmeiner (ML); 2 ♀ do., Mentawir River, Oct. 1950, A. M. R. Wegner (MZB; ML); 8 ♀ Tabang, Bengen River, Sept. 1956, A. M. R. Wegner (MZB; ML).

***Polybioides gracilis* sp. n.**

This species combines certain characters of the two previously described species. While it agrees in size with *P. raphigastra*, it comes closest to *P. psecas* in colour pattern. However, the dark line on the clypeus is narrower at the base than in *P. psecas*, and it is often somewhat dilated at the apex; here it ends usually in two ill-defined and more or less coalescent spots; these spots may even be present in brightly coloured specimens in which the line is strongly reduced.

The gastral petiole is relatively long and thin, distinctly more slender than in the two other species.

The venation of the hind wing is just as variable as in *P. raphigastra*. The following conditions may be distinguished:

A. the cubito-anal vein (cu-a) meets the cubital vein (Cu) where it separates from the median vein (M) (fig. 4a): 6 ♀, Malvedaung.

B. the cubito-anal vein meets M + Cu at a short distance before the point of separation of M and Cu (as in fig. 4b): 1 ♀ Ataran Valley (holotype), 2 ♀ Malvedaung, 1 ♀ Sukli.

C. the distance between cu-a and the point of separation of M and Cu is about equal to the length of cu-a: 3 ♀ Sukli; 8 ♀ Vietnam.

D. the distance between cu-a and the point of separation of M and Cu is distinctly longer (up to 2 ×) than cu-a (as in fig. 4c): 1 ♀ Ataran Valley, 2 ♀ Malvedaung, 2 ♀ Sukli, 1 ♀ Mekane, 1 ♀ Vietnam.

Length (h. + th. + t. 1 + 2): 10.5-11.5 mm.

T e n a s s e r i m: 3 ♀ Ataran Valley, Febr. 1893, C. T. Bingham (holotype and paratype BM; 1 paratype ML); further paratypes: 2 ♀ Thagatà, April 1887, L. Fea (1 ♀ MCG; 1 ♀ ML); 9 ♀ Malvedaung, 30 km South of Ye, 300 m, 15-25 Nov. 1934, R. Malaise (NRS; 2 ♀ ML); 7 ♀ Sukli, 75 km

East of Moulmein, 500 m, 27-31 Oct. 1934, R. Malaise (NRS; 3 ♀ ML); 1 ♀ Mekane, 90 km East of Moulmein, 200 m, 2-8 Nov. 1934, R. Malaise (NRS).

Vietnam: 7 ♀ Kontum, North of Pleiku, 550 m, 2 ♀ 25 km Southwest of Pleiku, May 1960, S. Quate (BISH; 2 ♀ USNM).

Polybioides angustus sp. n.

Female. — Similar to *P. psecas*, but distinguished by the long and narrow gastral petiole, and darker coloration. The dark stripe on the clypeus occupies approximately the middle third, it is narrowed towards the broadly truncate apex, which is about as far from the apex of the clypeus as in *P. psecas*. Supraclypeal area black; interantennal spots small, about as far apart as they are wide below. Yellow line on temples slightly reduced as compared with *P. psecas*.

Transverse yellow band on anterior part of pronotum interrupted laterally, the dorsal part rather widely separated from the yellow mark in the lower angle which encloses the lateral pit. Scutellum black with narrow yellow band at anterior margin, which is narrowly interrupted in the middle and somewhat dilated laterally; other thoracic markings approximately as in *P. psecas* (fig. 2); the median dark line on the propodeum distinctly wider.

Legs dark brown; the following parts pale yellow: coxae I, greater part of trochanters I, femora I beneath, tibiae I except for dark line on inner side, coxae II (inner side and a spot at base of outer side brownish), a spot on femora II, and the middle part of tibiae II.

Apical bands of gastral segments narrow (in the specimens of the type series evidently somewhat discoloured); basal third of gastral petiole without lateral line.

Venation of hind wing intermediate between fig. 4b and 4c (cu-a about equal to its distance from the point of separation of M and Cu).

Length (h. + th. + t. 1 + 2): 11-12 mm.

Palawan: 7 ♀ S. slope of Mt. Balabag, Mantalingajan Range, 2800 ft., 4 May 1947, CNHM-Philippine Zoological Expedition (holotype and 3 paratypes CNHM; 1 paratype USNM; 2 paratypes ML).

Note. — In addition to the specimens recorded above the series collected by the CNHM-Expedition contains two female specimens from the same locality and date (1 ♀ CNHM; 1 ♀ ML), which agree in all essential characters except for the shape of the petiole which is here only about 3.2 times as long as wide. For the time being it must remain uncertain whether this difference is due to some external influence, such as parasitism, or

whether these slightly more robust specimens represent fertile females. Local investigations on this problem are very desirable.

Genus **Parapolybia** Saussure

Parapolybia Saussure, 1854, Ét. Fam. Vesp. 2: 207 (division of *Polybia* Lep., three species, no type species designated).

Type species: *Polybia (Parapolybia) indica* Saussure, 1854, by designation of Bingham, 1897, Fauna Brit. India, Hym. 1: 382 (footnote).

Clypeus (♀) pentagonal, the pointed apex slightly produced. Mandibles slightly convex, without grooves, with four teeth at apex, the inner tooth distinctly shorter than the others. Maxillary palpi 6-segmented, labial palpi 4-segmented. Oculo-malar space (♀) fairly long, about equal to the length of the fourth antennal segment or slightly shorter. Upper part of inter-antennal shield with fine median carina. Ocelli in a nearly equilateral triangle; posterior ocelli much farther from the eyes than from each other.

Pronotal carina abbreviated laterally, the end of the carina widely separated from the ridge in front of the lateral fovea; transverse carina in front of each tegula distinct. Mesepisternum with transverse suture. Scutellum convex, with more or less distinct median furrow. Propodeum, as seen in profile, only slightly convex at the base; apical orifice at most twice as long as high, its dorsal margin narrowly rounded.

First gastral segment narrowed into a petiole, which is more or less distinctly swollen at the apex; sixth sternite at base with a specialized hyaline area similar to that of *Polistes*: it is much wider than long and covered with rather long hairs.

The ♂ differs especially in the shape of the head: the eyes are large, much closer together at the narrowed and flattened clypeus than on the vertex; the temples are narrow, with a more or less distinct ridge running close to and parallel with the outer orbit. Antennal segments 3-13 each with a longitudinal ridge or carina.

The male genitalia (fig. 8-9) are characterized by the peculiar shape of the volsella and by the strongly developed lobes at the ventral side of the aedeagus. The parameral spine is bare in *P. varia*, but covered with a row of stiff hairs in *P. indica*.

The distribution area of *Parapolybia* extends from Iran in the West to Japan, the Philippine Islands and New Guinea in the East. Two species, *P. escalerae* (Meade-Waldo) and *P. persica* (Meade-Waldo), are not discussed in this paper; they have been described in 1911 from "South West Persia"; a few males of the former species were collected in 1954 in Pakistan (Chitral,

Harchin) by F. Schmid. The only species occurring East of the line of Wallace has not been found in the Moluccas, but this may be due to insufficient collecting.

In the Oriental region none of the species appears to be very common, and the usually small colonies are found there much less frequently than those of several *Ropalidia* and *Polistes*. In Java *P. varia* appears to be restricted to a few localities in the lowlands of the western part of the island where there is — or was — some primary vegetation left.

Nesting habits. — The shape of the nest is well illustrated by the figures on pl. 2 and 3. It consists of a single comb, which is attached by a petiole to a branch or to the mid rib of a leaf, and which is not protected by an envelope⁴). Initially there are only two rows of cells, but as the colonies grow, more cells are added, on each side as well as at the apex, and sometimes even a branching may occur as in the nest shown on plate 2 fig. c.

Apart from this latter complication, which may be rather unusual, the nests agree in general appearance with those of certain species of *Ropalidia* (*R. stigma*-group, *R. fasciata*). Another point of agreement is that just like in *Ropalidia* the excrements of the adult larvae are removed from the cell through a hole gnawed in the bottom, which is then closed again by a transparent membrane or "window".

However, the "paper" of which the cells of *Parapolybia* are made, is, at least in *P. varia* (the only species of which I have seen some nests), distinctly different from that prepared by *Ropalidia*. It consists of long and thin, very pale yellowish, fibers of vegetable material, which are so loosely woven together, that in various places small and irregularly shaped "windows" can be observed. The paper of *Ropalidia*-cells is made of smaller pieces of material, and it is generally darker and more compactly woven.

Foundation and composition of colonies. — The presence of only a single wasp on the nest figured on plate 3 fig. a, and the relatively small size of the colonies, suggest that new colonies may be founded by a single female. No obvious differences between queens and workers could be found in the series of wasps collected with the nest from Djasinga, Java. The presence of some distinctly larger specimens in a series of *P. indica*, from Kuantun in China,

4) Richards & Richards (1951:8) say in a footnote that according to me "some of the Javanese species make a nest of a modified stelocytтарous type, enclosed in an envelope". This is evidently based on a misunderstanding, for at the time I discussed this matter with Dr. Richards, it was already known to me that there is only one species of *Parapolybia* to be found in Java, and that this wasp does not build a covered nest.

however, is as yet unexplained (see p. 27). Further research on the numbers of fertilised females present in nest populations is therefore very desirable.

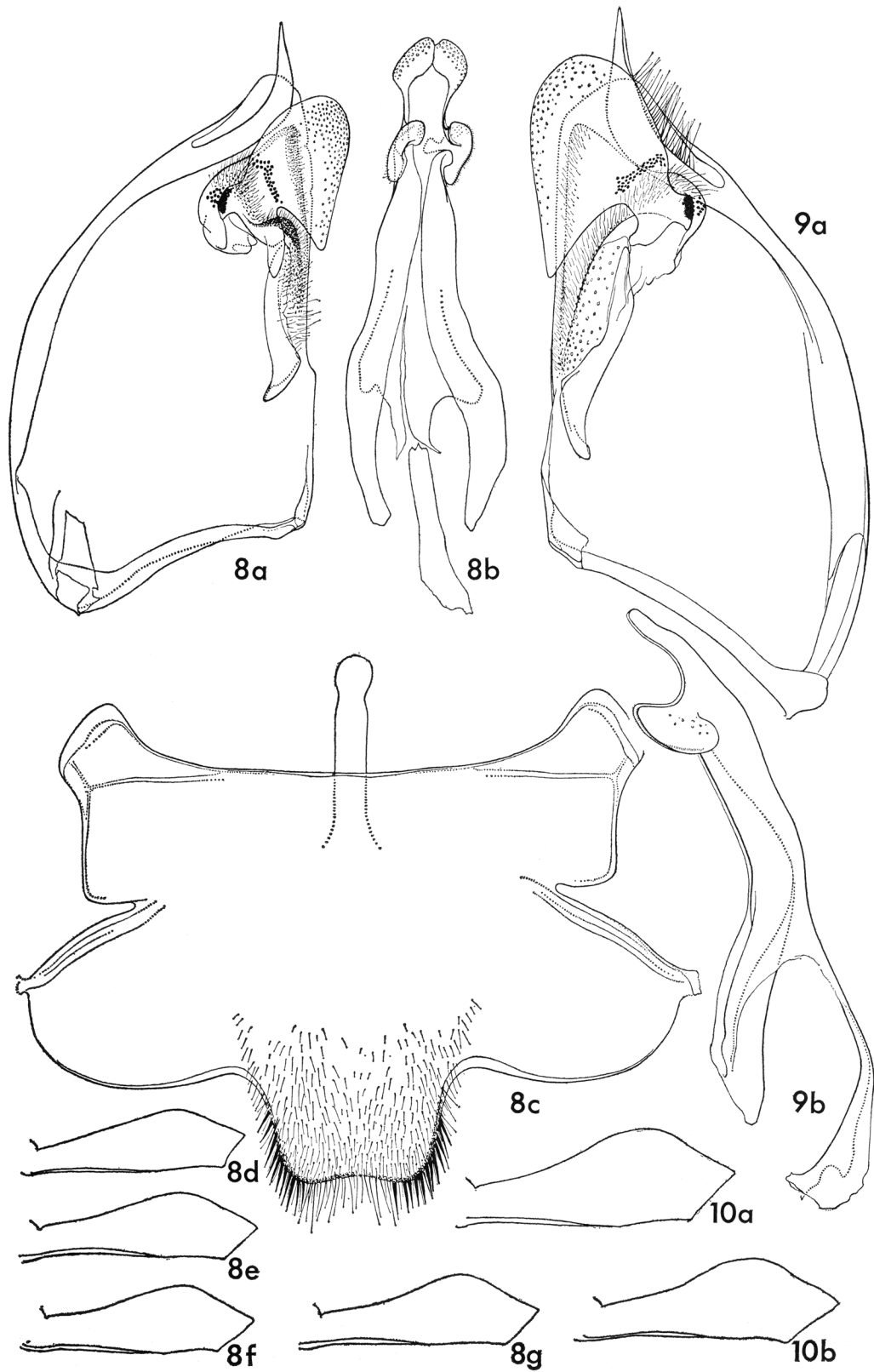
The identification of the species of this genus presents some peculiar difficulties, as may be concluded from the impressive list of synonyms given under *P. varia*. There is considerable variability of the colour pattern, but the available material is often not extensive enough to decide to what extent this is correlated with the geographic distribution. Furthermore there is no reliable information on possible caste differences within the population of a single nest, and finally the state of preservation of collection specimens is often unsatisfactory.

For a long time I have regarded all specimens with an incomplete occipital carina as belonging to *P. varia*. However, when I recently made a detailed comparative study of the available specimens, I found that the material from Formosa could be divided in two strikingly different colour forms, a smaller one with extensive yellow markings, and a somewhat larger one which is generally darker. Subsequently, when the larger form was found to differ also in the shape of the first gastral segment (petiole), it became more and more probable that two species are involved. The possibility that the larger specimens are queens and the smaller ones workers has been taken into consideration, but for various reasons it seems improbable that this is the case. One argument against this solution of the problem is that in Sumatra, Java, and New Guinea only the smaller form has been found.

Re-examination of the material from other localities has then revealed that certain specimens from continental Asia may be considered to belong to the larger form. However, the differences are here less striking than in the series from Formosa. Furthermore it must be said that at the moment no males are known which can be assigned with certainty to the larger form. It remains therefore very desirable to make a further study of this problem, preferably in Formosa where the two forms are most easily distinguished, by observing and collecting nest populations.

Key to the forms of *Parapolybia* treated as species in this paper

1. ♀ : Occipital carina complete, extending to the base of the mandibles. Length (h. + th. + t. 1 + 2) : 14-17 mm, rarely only 13 mm. ♂ : Antennae long and slender, the third and fourth segments more than six and four times as long as wide, respectively *indica* (Saussure)
- ♀ : Occipital carina absent in the lower third, where the transition from temples to occiput is smoothly rounded. Length rarely exceeding 12 mm. In the ♂ of *P. varia* the antennae are shorter and thicker, the third segment slightly less than four times as long as wide, the fourth segment less than twice as long as wide. The ♂ of *P. nodosa* is unknown 2



2. Gastral petiole moderately swollen posteriorly, as seen in profile the outline of the anterior part of the tergite straight or almost so (fig. 8d-g). Generally more brightly coloured, with extensive yellow markings and entirely yellow postscutellum. When the yellow markings are more or less reduced (often in specimens from mountainous areas in continental SE Asia and from New Guinea), the darkening of the postscutellum tends to start from a central spot (fig. 12). Length (h. + th. + t. 1 + 2): 9-10 mm *varia* (F.)
- Gastral petiole more strongly swollen, as seen in profile the outline of the anterior part of the tergite distinctly concave (fig. 10). Yellow markings less extensive, postscutellum as a rule with dark spot or band at posterior margin (fig. 13). Length (h. + th. + t. 1 + 2): 11-12 mm. *nodosa* sp. n.

Parapolybia indica (Saussure)

(fig. 9, 11)

The geographic variation of this species deserves further study, and the present arrangement of subspecific forms must be regarded as provisional.

The commonest form of China is brown with rather well defined yellow markings. De Saussure's description, however, does not apply in all respects to this form, for it says practically nothing about yellow maculation: "Insecte d'un jaune fauve; dents des mandibules noires; les antennes brunes en dessus, mais ayant les six derniers articles entièrement fauves; mésothorax portant du brun sur les côtés du disque. Tarses des quatre pattes postérieures, noirâtres. Ailes transparentes; les nervures d'un brun ferrugineux; le point assez ferrugineux". On the other hand, the accompanying figure shows a brownish insect with distinct yellow markings on pronotum, scutellum, and propodeum.

Fortunately, De Saussure's type is still preserved in the collections of the Paris Museum, and through the kind cooperation of Miss H. Kelner-Pillault I have been able to examine this specimen. It is a female (or worker), bearing a round white label (yellow on under side) "5/46", a yellow one, probably in de Saussure's handwriting "*Pol. indica* Sauss. ♀", and some undoubtedly more recently attached labels: "Museum Paris, Chine, Callery 5-46", and "*Polybia indica* Sauss. type". The specimen is rather small, measuring only about 13 mm to the apex of the second gastral segment. It

Fig. 8. *Parapolybia varia* (Fabricius), ♂, Alcate, Mindoro, Philippine Islands. a, inner aspect of right paramere with volsella; b, ventral aspect of aedeagus; c, gastral sternites 7 + 8 (= abdominal sternites 8 + 9); d-g, lateral aspect of gastral petiole of ♀ from d, Kagi, Formosa; e, Padang, Sumatra; f, Vogelkop, New Guinea (= *furva* subsp. n.); g, Mt. Dulit, Sarawak, Borneo (BM; identification doubtful).

Fig. 9. *Parapolybia indica* (Saussure), ♂, Kuanshien, Szechwan, China. a, inner aspect of left paramere with volsella; b, lateral aspect of aedeagus.

Fig. 10. *Parapolybia nodosa* sp. n., lateral aspect of gastral petiole of ♀ from a, Pilam, Formosa (paratype); b, Thagatà, Tenasserim.

agrees better with De Saussure's figure than with his description, for the posterior margin of the pronotum, the postscutellum (including its lateral areas), and two broad stripes on the posterior surface of the propodeum are pale yellow, distinctly contrasting with the more brownish remaining parts of the thorax. The gaster is rather uniformly dull yellowish-brown, the segments 3-6 somewhat darker than the petiole and the second segment.

The general appearance of the body suggests that the aberrant coloration is very probably due to poor preservation. It seems most likely that the insect was not dried rapidly enough after being captured, and that this caused the original pattern to be partly destroyed by the deteriorating body contents.

I have therefore treated the richly maculated common Chinese form as "typical", even though it does not agree well with the original description.

As explained below, the status of the two forms described by Cameron under the names *fulvinerva* and *tinctipennis* is doubtful; they may represent different species, but it seems as well possible that they are castes or colour variations of one and the same species.

Provisional key to the subspecies (?) of *P. indica*

1. Second gastral tergite with two yellow spots of variable size, sometimes also the posterior margin more or less yellowish 2
- Second gastral tergite without yellow spots 3
2. Third and following gastral tergites with two yellow spots. — Widely distributed *indica* (Saussure)
- Only the second and — less distinctly — the third gastral tergites with yellow spots; fourth and following segments entirely dark. — Tenasserim *bioculata* subsp. n.
3. Head and thorax with more or less distinct yellow markings; large specimens occurring together with typical *indica*; perhaps queens of this species.
- Head and thorax without yellow markings. — Assam 4
4. Gastral petiole more than three times as long as its greatest height (3.2 : 1). Head, thorax, legs (tarsi dark) and first gastral tergite uniformly reddish brown; first sternite fuscous, segments 2-6 brownish black. Wings with pronounced yellow tinge. Propleura distinctly vertically striate. Length (h. + th. + t. 1 + 2) : 16 mm. *fulvinerva* (Cameron)
- Larger, petiole more strongly swollen near the apex (length : greatest height = 2.65 : 1 in the lectotype, 2.8 : 1 in a paratype). Head reddish brown, somewhat yellowish at inner orbits below the eye-emarginations and at the outer orbits; clypeus with ill-defined dark spot below the middle; thorax of the same colour as the head, but the mesoscutum darker brown at the edges and in the middle, the mesepisternum brownish black except for a reddish brown spot above the transverse suture, and a much larger spot on the lower part (leaving the edges and the ventral side dark); metapleura (except posteriorly) and metasternum blackish; first gastral sternite and coxae more or less infuscated; remainder as in *fulvinerva*. Wings brownish hyaline. Propleura with only very fine striation. Length (h. + th. + t. 1 + 2) : 18 mm. *tinctipennis* (Cameron)

Parapolybia indica indica (Saussure)

Polybia indica Saussure, 1854, Et. Fam. Vesp. 2: 207, ♀, pl. 26 fig. 3 — "La Chine" (in division *Parapolybia*) (MP). — Smith, 1857, Cat. Hym. Brit. Mus. 5: 133 (cat.). — Dalla Torre, 1894, Cat. Hym. 9: 164 (cat.). — Bingham, 1897, Fauna Brit. India, Hym. 1: 384, ♀ or ♂ (Burma; Tenasserim; China) [partly = subsp. *bioculata* nov.; perhaps partly = *P. varia* (Fabr.)]. — Dalla Torre, 1904, Gen. Ins. 19: 77 (cat.). — Dover, 1926, China J. Sci. Arts 4: 234 (Hongkong). — Dover, 1929, Bull. Raffles Mus. 2: 46 (Burma).

Parapolybia indica; Schulthess, 1913, Mitt. Schweiz. ent. Ges. 12: 153 (key), 154, pl. 11 fig. 1, pl. 11b fig. 7 (revision; Assam; China).

Stelopolybia indica; Buysson, 1913, Bull. Soc. ent. France 1913: 298.

The colour pattern of the typical form is very similar to that of *P. varia*, but as a rule the coloration of the clypeus is different. It is either entirely yellow or it has two ill-defined brownish blotches in the lower half; in dark specimens these spots may be confluent, but the dark area thus formed is always wider than long, never forming a median stripe or an anchor-shaped spot as in *P. varia*.

China: Prov. Szechwan, a long series of both sexes (about 200 ♀, March-Nov., 23 ♂, July-Aug.) collected in 1921-36 in several localities, from 1000 to 13000 ft.: Mt. Omei, Kuanshien, Yachow, Suifu, Kiating, Mupin, Hongya, Fulin, Tseo-jia-Geo, Chengtu, Beh Luh Din (30 miles North of Chengtu), Ningyuenfu, Jim Gin Shien, Si Gi Pin, and Yao-Gi, all leg. D. C. Graham (USNM; 3 ♀ 3 ♂ ML); 2 ♀ Chengtu, Sept. 1938, 2 ♂ Mt. Omei, Aug. 1938, Dean Sage Jr. (AMNH); 10 ♀ Fulin (3000-7000 ft.), 10-21 Aug. 1928, D. C. Graham (USNM); 1 ♀ Soochow, D. C. Graham (USNM); 1 ♀ Tung-lu, April 1926, Mrs. Dora E. Wright (CAS); 1 ♀ Omai, July 1929 (CNHM). — 3 ♀ Teng Woo (or Ting Woo), 20-26 April 1918, 2 ♀ Luh Fau Shaon, 1-19 Sept. 1921, C. W. Howard (USNM). — Yen Ping, 4 ♀ Spring 1915, 30 ♀ 7 ♂ July-Sept. 1917 (AMNH). — Prov. Yunnan, 6 ♀ near Tsao Tong, 12 July 1934, D. C. Graham (USNM). — 43 ♀ 3 ♂ "Ngan Hoei" (Ngan Hwei) coll. Gribodo (MCG; 4 ♀ 1 ♂ ML.) — 3 ♀ Foochow, 1937-38, M. S. Yang (BM); 1 ♀ Foochow, 1926, C. R. Kellogg (CAS). — Prov. Fukien, Kuatun, 2300 m, 27° 40' N, 117° 40' E, 2 ♀ 26 Febr. 1938, 11 ♀ April 1938, 19 ♀ May 1938, 4 ♀ June 1938, 4 ♂ July 1938, J. Klapperich (ZMAK; 6 ♀ 2 ♂ Hongkong (BM). — 1 ♀ Kouy-Tchéou, Kouy-Yang, P. P. Cavalerie et Fortunat, 1906 (MP). — Two specimens of the series from Fukien, Kuatun, one collected 30 April and one 30 May, are distinctly larger than the others and have the yellow markings much reduced (no lines on mesoscutum, no distinct spots on the gastral segments); I suspect that these are queens and the others workers, but study of nest populations would be necessary to decide this with certainty.

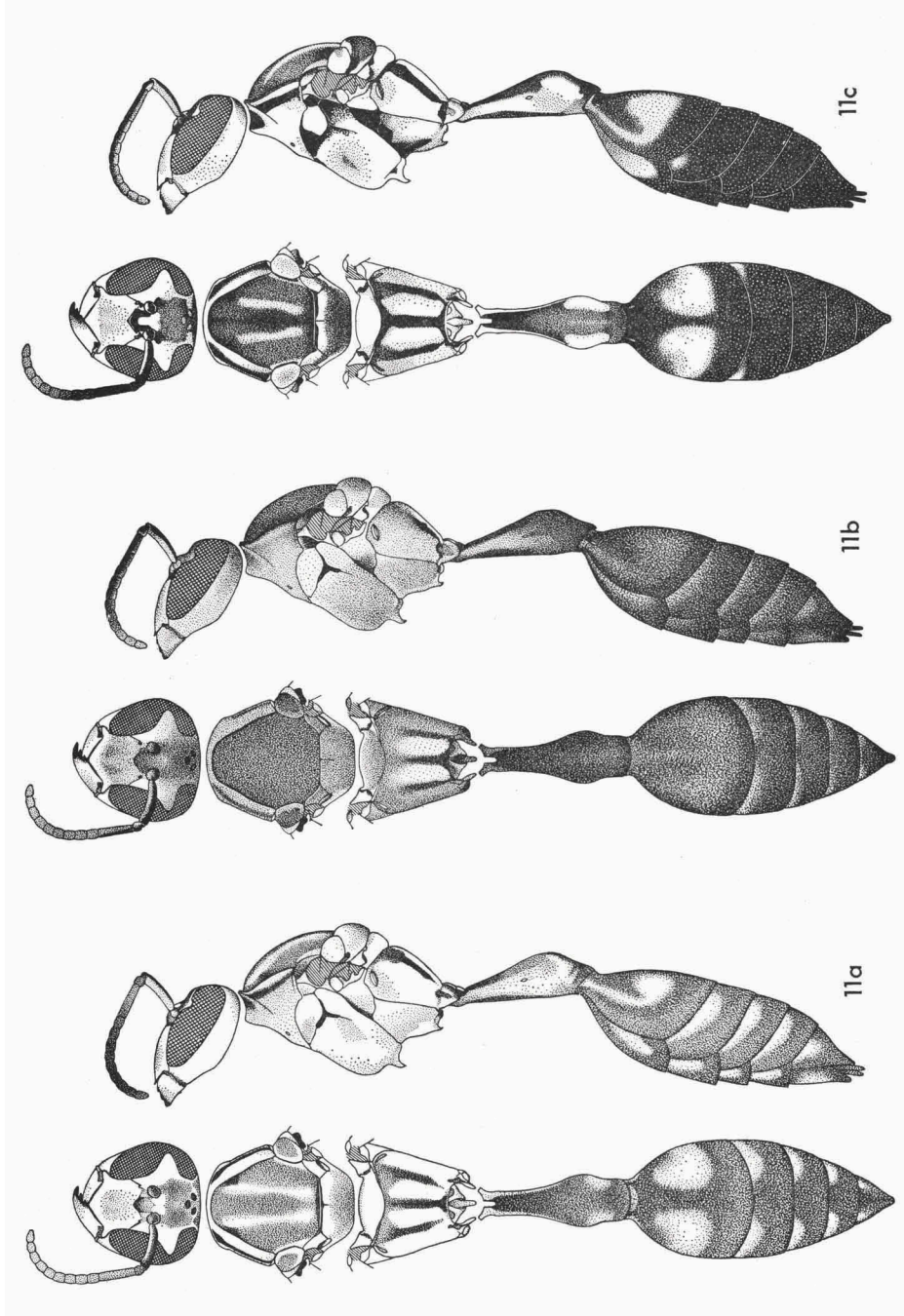


Fig. 11. Colour pattern of *Parapolybia indica* (Saussure), ♀, a, from Kuatun, prov. Fukien, China; b, more uniformly coloured (and larger) specimen from the same locality (see text); c, *bioculata* subsp. n., paratype from Tenasserim.

Korea: 1 ♀ Kwangnung, 12 May 1955, C. W. Kim (USNM); 1 ♀ Seoul, 10 July 1956, C. W. Kim (USNM).

Japan: 2 ♀ "Japan" (ML). — 1 ♀ Beppy (Oita), Oct. 1935, E. Suenson (CU); 1 ♀ Harima, May 1916 (CU), 1 ♀ Saitama, T. Fukai (CU). — 1 ♀ "Nippon Moyon, Kofou, L. Drouart de Lezey, 1906" (*Stelopolybia orientalis* (Sauss.) det. R. du Buysson, 1911 [!]) (MP). — 9 ♀ "Mitsukuri", 1922-29 (USNM). — 2 ♀ Sasayama (Tanba), 11 June 1950 and 2 June 1951, K. Iwata (ML). — 1 ♂ Kyoto, Ninnati, 20 June 1958, Y. Iwata (ML).

Burma: 1 ♀ Tingkaw, 1 ♀ Shinghwiyang, May and June 1944, resp., L. C. Kuitert (KU).

Borneo: 1 ♀ Samawang near Sandakan, jungle, 15 July 1927, C. Boden Kloss and H. M. Pendlebury (BM; the abdomen of this specimen is rather dark and is evidently somewhat discoloured).

Parapolybia indica bioculata subsp. n.

(fig. 11c)

Polybia indica (Saussure); Bingham, 1897, Fauna Br. India, Hym. 1: 383 (in key), 384 (pro parte), fig. 115, ♀.

Female. — Head and thorax generally as in Chinese specimens, but the brownish parts somewhat darker; antennae dark brown above, except at apex; the mesoscutum more or less extensively brownish black at the margins (particularly the hind margin) and in the middle; gaster brownish black, the petiole on each side with yellow line which is strongly and abruptly widened on the swollen part; second tergite on each side with a large yellow spot, from the side of which a narrow yellow line runs to the base; second sternite yellow, except for the apical fourth or fifth (at the sides) to third (in the middle); third tergite with two small yellow spots. Legs yellow; basal half of mid and hind tibiae brownish, mid and hind tarsi blackish. Wings subhyaline with yellow tinge, narrowly brownish at anterior margin.

Length (h. + th. + t. 1 + 2): 17-18 mm.

Birma: Tenasserim, 2 ♀ Haundraw Valley, April and Oct. 1894, C. T. Bingham (type and paratype, resp., BM).

Parapolybia indica tinctipennis (Cameron)

Icaria tinctipennis Cameron, 1900, Ann. Mag. nat. Hist. (7) 6: 503, ♀ — "Khasia Hills, Assam" (coll. Rothney, ! OUM). — Dalla Torre, 1904, Gen. Ins. 19: 74 (cat.).

Provisionally I regard this as a subspecies of *P. indica*, with which it agrees in the complete occipital carina. It would be desirable to compare the male of this form with that of typical *indica*. In addition to the typical specimens in the Oxford University Museum I have seen a female of this

form in the British Museum, belonging to the type series (ex coll. Cameron). I have nowhere found any more recently collected specimens.

Parapolybia indica var. (or subsp.) **fulvinerva** (Cameron)

Icaria fulvinerva Cameron, 1900, Ann. Mag. nat. Hist. (7) **6**: 504, ♀ — “Khasia Hills, Assam” (coll. Rothney, ! OUM) (on p. 503 compared with “*Icaria tinctipennis*” Cameron). — Dalla Torre, 1904, Gen. Ins. **19**: 73 (cat.).

It seems possible that this will prove to be the worker of *tinctipennis*, but the status of both forms remains doubtful until nest populations have become available for study. In addition to the type in the Oxford University Museum (lectotype by present designation), I have examined one female in the British Museum (lecto-paratype, ex coll. Cameron).

Parapolybia varia (Fabricius)

(fig. 8, 12; pl. 3)

Vespa varia Fabricius, 1787, Mant. Insect. **1**: 293 — “China”, leg. Pflug (type UZMC). — Gmelin, 1790, Syst. Nat., Ed. 13, **1** (5): 2754. — Olivier, 1791, Encycl. Méth. Insect. **6**: 690. — Fabricius, 1793, Entom. Syst. **2**: 282.

Polistes varia; Fabricius, 1804, Syst. Piez.: 279. — Saussure, 1853, Ét. Fam. Vesp. **1**: 265 (unidentified species, “*Eumenes?*”). — Dalla Torre, 1894, Cat. Hym. **9**: 135 (cat.; *varius*; unidentified species) — Id., 1904, Gen. Ins. **19**: 72 (cat.; as in 1894).

Polybia varia; Schulz, 1912, Berl. ent. Zeitschr. **57**: 86, 101 (syn.: *Polybia orientalis* Saussure).

Polybia orientalis Saussure, 1854, Ét. Fam. Vesp. **2**: 208, ♀, pl. 26 fig. 2 — “La Chine” (type BM, no. 18.738, “China”) (in subgenus *Parapolybia*). — Smith, 1857, Cat. Hym. Brit. Mus. **5**: 133 (cat.). — Dalla Torre, 1894, Cat. Hym. **9**: 165 (cat.). — Bingham, 1897, Fauna Brit. India, Hym. **1**: 383, ♀♀ [pro parte] (Burma; Tenasserim; China). — Dalla Torre, 1904, Gen. Ins. **19**: 78 (cat.). — Meade-Waldo, 1911, Ann. Mag. nat. Hist. (8) **7**: 108 (in subgenus *Parapolybia*; *Icaria fuscipennis* Cameron is a variety). — Meade-Waldo, 1914, Ann. Mag. nat. Hist. (8) **14**: 406 (syn.: *Icaria wroughtoni* Cameron, 1900, *Icaria fuscipennis* Cameron, 1900, *Icaria annulipes* Cameron, 1913) (in subgenus *Parapolybia*). — Dover & Rao, 1922, J. Proc. As. Soc. Bengal (N.S.) **18**: 243 (E. Himalayas; Assam; Burma; Hongkong). — Dover, 1926, China J. Sci. Arts **4**: 234 (Hongkong). — Dover, 1929, Bull. Raffles Mus. **2**: 46 (Malaya; syn.: *Icaria singaporensis* Cameron, 1904). — Dover, 1931, J. Fed. Mal. St. Mus. **16**: 258 (Peninsular Siam; Malaya).

Parapolybia orientalis; Schulthess, 1913, Mitt. Schweiz. ent. Ges. **12**: 153 (key), 155, ♀ ♂, pl. 11 fig. 3, pl. 11b fig. 8-9 (revision; Japan and China to Batjan, Moluccas) [the occurrence in the Moluccas needs confirmation]. — Schulthess, 1927, Suppl. ent., Berl. **16**: 83 (Sumatra).

Stelopolybia orientalis; Buysson, 1913, Bull. Soc. ent. France **1913**: 298, 299 (compared with *S. disticha* n. sp.).

Polybia artifex Smith, 1861, J. Proc. Linn. Soc. Zool. **5**: 90, ♀ — “Makassar, Celebes”, leg. Wallace (type ♀ “Mak”, OUM). — Dalla Torre, 1894, Cat. Hym. **9**: 162 (cat.). — Id., 1904, Gen. Ins. **19**: 76 (cat.). — Schulthess, 1913, Mitt. Schweiz. ent. Ges. **12**: 164 (a variety of *Parapolybia orientalis*, close to “*carinata* Smith”).

Icaria quadrimaculata Cameron, 1900, Ann. Mag. nat. Hist. (7) **6**: 496, ♂ — “Bengal, probably Barrackpore” (OUM). — Rothney, 1903, Trans. R. ent. Soc. Lond. **1903**: 107 (Bengal). — Dalla Torre, 1904, Gen. Ins. **19**: 74 (cat.).

Icaria carinata Cameron, 1900, Ann. Mag. nat. Hist. (7) 6: 499, ♂ — "Khasia Hills", Assam (OUM) [Invalid primary homonym of *Icaria carinata* Saussure, 1891].

Parapolybia orientalis var. "*carinata* Smith i. litt." Schulthess, 1913, Mitt. Schweiz. ent. Ges. 12: 156 — Sikkim; Assam (Khasia Hills) [the type is said to be a specimen of "*Icaria carinata* Smith i. litt." in OUM; evidently von Schulthess misread the label on a specimen of *Icaria carinata* Cameron].

Icaria cameroni Dalla Torre, 1904, Gen. Insect. 19: 73 (new name for *Icaria carinata* Cameron, 1900).

Icaria carinifera Schulz, 1906, Berl. ent. Zeitschr. 51: 328 (new name for *Icaria carinata* Cameron, 1900).

Icaria wroughtoni Cameron, 1900, Ann. Mag. nat. Hist. (7) 6: 500 [♀] — "Poona, leg. Wroughton" (type BM, no. 18.730, "Poona", Cameron coll. 1914-110). — Dalla Torre, 1904, Gen. Ins. 19: 75 (cat.). — Meade-Waldo, 1914, Ann. Mag. nat. Hist. (8) 14: 406 (syn. of *Polybia (Parapolybia) orientalis* Saussure).

Icaria fuscipennis Cameron, 1900, Ann. Mag. nat. Hist. (7) 6: 501, ♀ — "Khasia Hills, Assam" (OUM). — Dalla Torre, 1904, Gen. Ins. 19: 73 (cat.). — Meade-Waldo, 1914, Ann. Mag. nat. Hist. (8) 14: 406 (syn. of *Polybia (Parapolybia) orientalis* Saussure).

Icaria singaporensis Cameron, 1904, J. Straits Br. R. As. Soc. 41: 120, ♀ — "Singapore" (type in Raffles Museum, Singapore, acc. to Dover, 1929: 46).

Icaria annulipes Cameron, 1913, Ind. For. Rec. 4: 115, ♀ ♂ — "Dehra Dun" (type BM, no. 18.732 a and b, ♀ ♂). — Meade-Waldo, 1914, Ann. Mag. nat. Hist. (8) 14: 406 (syn. of *Polybia (Parapolybia) orientalis* Saussure).

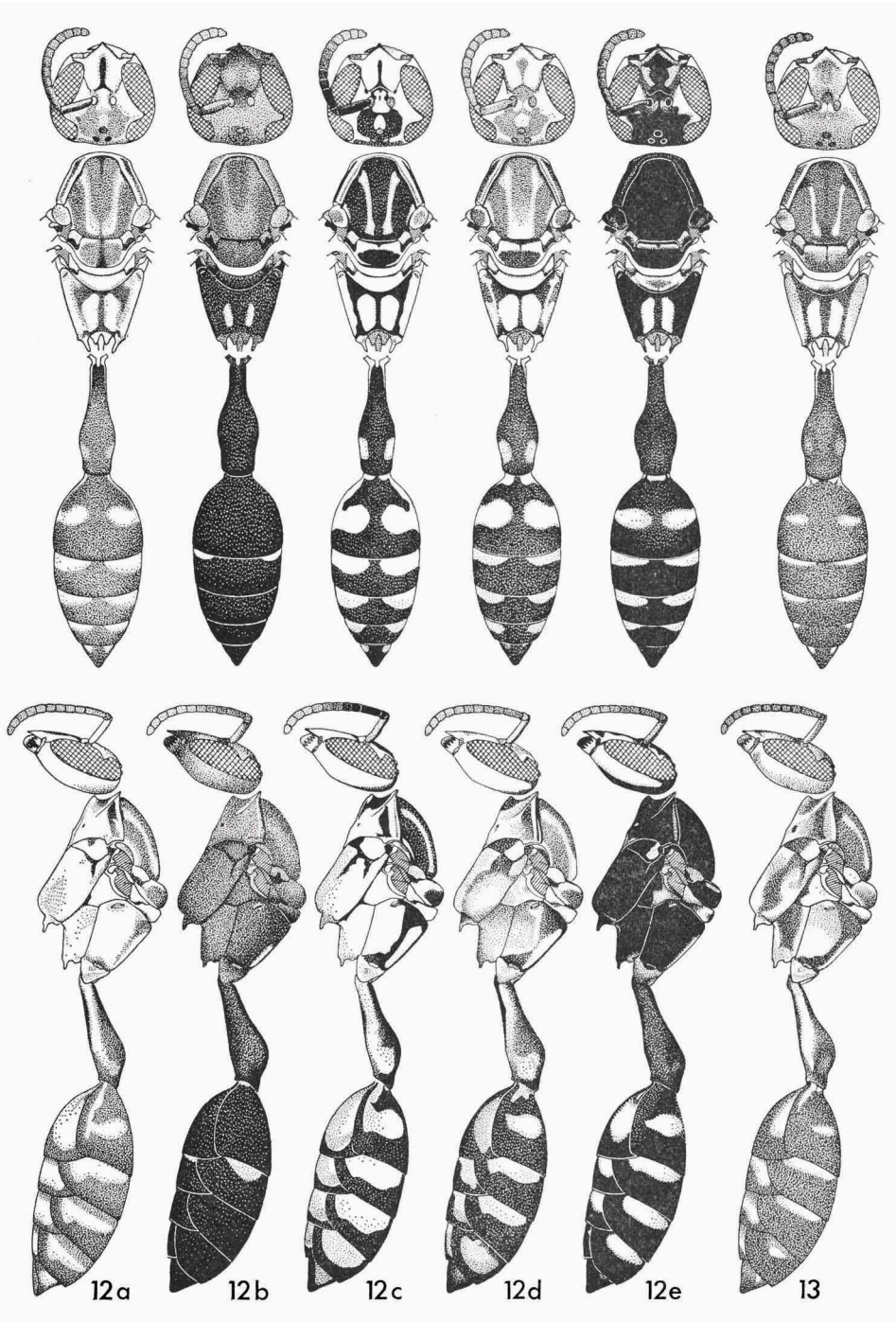
Stelopolybia disticha Buysson, Bull. Soc. ent. France 1913: 298, ♀ — "Kiang-si; Chang-hai" (MP) [new synonymy].

Parapolybia disticha; Schulthess, 1927, Suppl. ent., Berl. 16: 83 (Sumatra).

The remarkable variability of this species is very hard to describe. Although the variation is undoubtedly to some extent correlated with the geographic distribution, the material from certain localities is far from homogeneous. In some series of collection specimens the variation is very limited, but this may be due to the fact that they originate from a single nest population. The existing difficulties are undoubtedly to a considerable extent caused by the scarcity of the available material and the lack of pertinent biological data. Further field investigations on these insects are therefore urgently desired.

As I have been unable to segregate the available material into well defined subspecies, I present the results of my investigations in the form of a geographic arrangement of the recently studied specimens, annotated with remarks on the appearance of the species in each area, and illustrated by a series of drawings (fig. 12a-e). Special attention has been given to the available types of some previously described "species", because a more complete knowledge of these forms may prove to be useful for future studies of the geographic variation of *P. varia*.

Formosa: 3 ♀ Kagi, 21 Aug. 1907, 4 ♀ Kankau (Koshun), Aug. and Sept. 1912, and 1 ♀ Taihanroku, 19-26 April 1908, all leg. H. Sauter (ML);



1 ♀ Chirifu, 19 May 1934, 4 ♀ Bukai, 12 June 1934, 2 ♂ Kuraru, 5 May 1934, all leg. L. Gressitt (MCZ; 1 ♀ ML).

During my stay at Copenhagen in 1959 I compared one of the females from Kagi (ML) with the type of *P. varia* Fabricius. I noted that there was good agreement, but that in the type the spots on tergite 2 are even slightly larger than in the Formosan specimen.

China: Prov. Hopei, 1 ♀ Peiping, March, G. Liu (MCZ). — Prov. Kiangsu, 1 ♀ 1 ♂ Zi-ka-wei, 15 Sept. 1924, "nid 9", O. Piel (MCZ). — Prov. Fukien, 1 ♀ S. W. Fukien, Gang-ken, 25 July 1936, L. Gressitt (MCZ). — 1 ♀ Hongkong, 3 March 1932, leg. Herklots (LAM). — The Chinese specimens agree well with those from Formosa, but the sides of the thorax are somewhat more extensively marked with ferruginous or brown, approximately as in fig. 12c or 12d.

Bengal: 1 ♂ "Bengal" (OUM), type of *Icaria quadrimaculata* Cameron, 1900. — Eyes twice as far apart on the vertex as at the base of the clypeus (23: 11.5). Antennal segments 3-13 with blunt, shiny, longitudinal carina on inner side; length of third antennal segment slightly less than four times its width at the apex.

Gastral petiole slender and not distinctly nodose (length: width: height = 53: 18.5: 16); as seen in profile the dorsal outline of the basal part straight.

Yellow markings not very extensive: no spot in front of anterior ocellus; no distinct lines on mesoscutum, no yellow line on sides of gastral petiole. Face below upper level of antennal sockets yellow, except for dark supra-clypeal area; pronotum with yellow line along transverse carina and at posterior margin, mesepisternum with 3 yellow spots; scutellum with narrow yellow line at anterior margin, its lateral areas entirely yellow; postscutellum with narrow yellow band at anterior margin, abruptly widened laterally; propodeum with two elongately oval spots, spots on petiole and on gastral segment 2 small, spots on following tergites just visible (abdomen well extracted), gastral sternite 2 with 2 large yellow spots, 3-6 with basal yellow band, 7 with irregular yellow mark.

Legs brown, moderately variegated with yellow, hind femora yellowish beneath on apical two-thirds, hind tibiae with yellow spot (ill defined) on apical fourth above.

Length (h. + th. + t. 1 + 2): 9.4 mm.

Fig. 12. Colour pattern of *Parapolybia varia* (Fabricius), ♀, from a, Kagi, Formosa (closely resembling the type of *varia* from China); b, Pungkataung, NE Burma (very dark specimen); c, Padang, Sumatra; d, Djasinga, Java; e, Vogelkop, New Guinea (*furva* subsp. n.).

Fig. 13. *Parapolybia nodosa* sp. n., ♀ from Pilam, Formosa.

A s s a m: 5 ♀ Darjeeling, ex. coll. Fruhstorfer (MHNG; 2 ♀ ML); mostly darker than the typical form, but showing considerable variation, the darkest specimens being intermediate between fig. 12b and 12d.

1 ♂ "Khasia", coll. Rothney (OUM), type of *Icaria carinata* Cameron, 1900. — Eyes twice as far apart on the vertex as at the base of the clypeus (26:13). Antennae as in the type of *Icaria quadrimaculata*; gastral petiole slender, in shape very similar to that of *I. quadrimaculata*, length: width: height = 67 : 25 : 21.

Yellow markings less extensive than in *I. quadrimaculata*: head similar, but supraclypeal area paler, temples with only a very narrow line at outer orbits (in *I. quadrimaculata* the line broader and dilated near mandibles); thorax brown, with only faintly indicated yellowish markings on pronotum and on the sides, scutellum and postscutellum brown, their lateral areas and a narrow line at anterior margin of postscutellum yellow; spots on propodeum slightly more divergent above.

Gastral petiole entirely brown, second tergite brown except for yellow ring at extreme base, the following tergites with the usual lateral spots, but these spots with a pronounced tendency to become smaller towards the end of the abdomen (spots on tergite 6 very small, on 7 practically absent); sternites as in *I. quadrimaculata*, but the spots on sternite 2 confluent, and sternite 7 entirely brown.

Legs rather pale brownish, partly somewhat darker (femora above, tibiae on outer side, mid and hind tarsi), not distinctly marked with yellow.

Length (h + th. + t. 1 + 2): 10.2 mm.

2 ♀ "Khasia", coll. Rothney (OUM). — These rather large female specimens agree in so many respects with the *I. carinata* ♂ that they may be regarded with confidence as representatives of the same population. Cameron described only the ♂ of "*Icaria carinata*".

Gastral petiole stouter than in the ♂, length: width: height = 77 : 31 : 27.

Head, thorax and gastral petiole reddish brown, the postpetiolar segments dark brown. Yellow markings sparse, but more extensive than in the specimen figured under no. 12b; the following parts yellow: the greater part of the mandibles, a narrow band at anterior margin of clypeus, a line on temples, dilated near the mandible bases, an indistinct line at inner orbits (from clypeus to eye-emargination), a very narrow line along the pronotal carina, a spot near the lateral fovea of the pronotum, two small spots on mesepisternum, a narrow line at anterior margin of postscutellum, a large spot on upper part of metapleura, two elongate marks on propodeum (about as large as in fig. 12e), the greater part of the propodeal valvulae, the narrow

base or "neck" of the second gastral tergite, two large marks at base of tergite 3 (only partly visible unless the segment is abnormally extracted), two much smaller spots at base of tergite 4 (no markings on tergites 5 and 6!), second gastral sternite with on each side an irregular elongate spot at lateral margin, sternites 3 and 4 with a rather small spot on each side at base.

Legs reddish brown, the tarsi hardly darker than the tibiae; all femora with small yellow mark at apex above.

Length (h. + th. + t. 1 + 2): 12.8 mm.

Burma: 4 ♀ 11 ♂ Schwego Myo, Oct. 1885 ("tutti esemplari della stessa colonia") (MCG; 1 ♀ 4 ♂ ML); 28 ♀ Carin Chebà, 900-1100 m, May-Dec. 1888 (MCG; 4 ♀ ML); 10 ♀ Palou, Pegu, Aug.-Sept. 1887 (MCG; 2 ♀ ML); 2 ♀ Bhamò, Nov. 1886 (MCG), all leg. L. Fea; a few females from Carin Chebà show a tendency towards reduction of the yellow markings (absence of spot on frons, reduction or absence of lines on mesoscutum, sides of thorax brown with three yellow marks on mesepisternum, one in upper part of metapleura, and a more or less faintly indicated spot on sides of propodeum; spots on tergite 2 separated from the basal mark), hind femora and tibiae in all specimens yellow at apex. — North East Burma, 1 ♀ Sadon, 1200 m, 28 June-5 July 1934 (NRS); 4 ♀ Punkataung, road Sadon-Myitkyina, 8 July 1934 (NRS; 2 ♀ ML); 12 ♀ S. Shan States, Taunggyi, 1500 m, 22 Sept. 1934 (NRS; 4 ♀ ML); 2 ♂ 40 km East of Taunggyi, 25 Sept.-13 Oct. 1934 (NRS; 1 ♀ ML), all leg. R. Malaise; colour pattern typical, but with extreme reduction of the yellow markings in one ♀ from Sadon, one from Punkataung, and two from Taunggyi (see fig. 12b), whereas one ♀ from Punkataung is transitional (clypeus, except for band at anterior margin, frons, mesoscutum, gastral petiole, and second tergite, except for ring at base, brown; mesepisternum, dorsum of propodeum, and gastral segments 3-6 with distinct yellow spots). — Tenasserim, 2 ♀ Sukli, 75 km East of Moulmein, 600 m, 27-31 Oct. 1934, R. Malaise (NRS; 1 ♀ ML); rather dark: yellow markings on frons and on mesoscutum lacking, postscutellum yellow with transverse dark spot in centre.

Thailand: 1 ♀ Chiangmai, Doi Suthep, 1278 m, 29 March-5 April 1958, T. C. Maa (BISH).

Malaya: 1 ♂ Kuala Lumpur, 7 July 1936, H. M. Pendlebury (BM); 1 ♀ Perlis, Bukit Bintang, Forest Reserve (Kangar), 23 Febr. 1963, M. A. Lieftinck (ML). — Mr. H. T. Pagden sent me a series of photographs of a nest of this species, taken at Penang, Oct. 1950. — Dover has recorded "*Polybia orientalis*" from Pahang, Perak, and Selangor.

Riouw-Archipelago: 3 ♀ Durian I., June 1923, K. W. Dammerman (ML).

Sumatra: 2 ♀ "Sumatra", leg. Müller (ML); 31 ♀ "Sumatra", coll. Gribodo (MCG; 3 ♀ ML). — Tapanuli, 1 ♀ Siboga, Oct. 1890-March 1891, E. Modigliani (MCG). — West Coast, 20 ♀ Sidjundjung, July 1877, Sumatra Exp. (ML); 1 ♀ Padang, 1890, E. Modigliani (MCG); 2 ♀ Padang, Sept. and Oct. 1953, with nest (pl. 3), leg. Wa. Vergeest (1 ♀ coll. P. Benno; 1 ♀ ML); 1 ♀ Anei Cleft, 500 m, 1925, E. Jacobson (ML). — Lampong, 1 ♀ Mt. Tanggamus, 450-650 m, 22 July-5 Aug. 1935, Mrs. M. E. Walsh (ML); 1 ♀ Kedaton Estate near Tandjongkarang, 24 March 1937, Mrs. E. van der Vecht-B. (ML); 1 ♀ Bergen Estate near Tandjongkarang, 19 Jan. 1953, A. Sollaart (ML).

Borneo: Sarawak, 1 ♀ 1 ♂ Mt. Dulit, R. Koyau, 2500 ft., primary forest, 19 May 1932, Oxford Univ. Exp. (BM); identification somewhat doubtful: colour pattern entirely as in brightly coloured *varia* (as fig. 12c, but without yellow on each side of ocelli), but in the ♀ the gastral petiole rather strongly swollen posteriorly, see fig. 8g; 1 ♀ Nanga Pelagus, near Kapit, 180-585 m, 14 July 1958, T. C. Maa (BISH); ground colour rather dark, yellow markings on gastral tergites much reduced, postscutellum with central dark spot. — North Borneo, 1 ♀ Tawau, Quoin Hill, Cocoa Res. Station, 4 Dec. 1962, Y. Hirashima (ML); like the preceding specimen, but yellow markings on gaster slightly less reduced, spot on scutellum hardly separated from hind margin.

Philippine Is.: Mindoro, 3 ♀ 5 ♂ Alcate, Victoria, 5 and 10 April 1954, 2 ♀ 2 ♂ St. Luis Calapan, 14 and 17 April 1954, 1 ♂ Mt. Halcon, 3000 ft., 10 May 1954, H., M., and D. Townes (coll. Townes; 2 ♀ 3 ♂ ML). — Mindanao, 2 ♀ Surigao (ML); 1 ♀ Misamis Or., Mt. Empagatao, 1050-1200 m, 19-30 April 1961, H. Torrevillas (BISH) (yellow markings somewhat reduced; spot on frons linear, spots on tergites 1 and 2 small and separated from the lateral, resp. basal, markings).

Java: West Java, 16 ♀ 6 ♂ Djasinga, Dungus Iwul, Sept. 1939, with nest (lost), J. P. Rosier (ML); 1 ♀ Djasinga, 28 Sept. 1939, M. A. Lieftinck (ML); 1 ♀ Bolang, Leuwiliang, 26 July 1931, M. A. Lieftinck (ML); 1 ♀ Udjung Kulon, Tjigeunteur, 16 July 1955, A. M. R. Wegner (ML); 3 ♀ Pulu Deli ("Klapper-eiland"), 1 ♀ Pulu Tinjil ("Trouwseiland"), 27 and 29 June 1955, A. M. R. Wegner (MZB; ML).

Sumbawa: 2 ♀ Tambora, coll. Gribodo (MCG; ML).

Sumba: N. W. Sumba, 1 ♀ Laora, 100 m, April 1925, K. W. Dammerman (ML). — W. Sumba, 7 ♀ Rara, Wai Tombo, 5-9 Aug. 1949, Bühler and Sutter (NMB; 3 ♀ ML). — C. Sumba, 1 ♀ Lokojengo, 21 Sept. 1949, Bühler and Sutter (NMB).

Celebes: 1 ♀ "Mak" (= Makassar, leg. Wallace) (OUM), type of

Polybia artifex Smith, 1859. — Gastral petiole moderately slender, the basal part dorsally only very slightly concave in outline; length: width: height = 65 : 26 : 21.

Clypeus yellow, the median mark pear-shaped, rather dark brown and more extensive than in fig. 12d, its width at the level of the mandible bases about one-third of that of the clypeus; supraclypeal area dark brown, bordered above by two coalescent pale interantennal spots; no distinct spot in front of anterior ocellus; temples with yellow band which does not reach the top of the eye.

Dorsal aspect of thorax much as in fig. 12d, but the lines on the mesoscutum less distinct, and abbreviated anteriorly; the postscutellum with a transverse dark spot at the posterior margin; on the sides of the thorax the yellow markings are somewhat less extensive than in fig. 12d: pronotum more as in fig. 13, mesepisternum brown with three yellow spots, metapleura and sides of propodeum entirely brown.

Gastral petiole with two yellow spots on swollen part, but without lateral lines; second tergite not distinctly yellow at base, with a rather narrow and irregular, medially interrupted band in front of the middle (similar to fig. 12a), the following tergites with two yellow spots (as the abdomen is strongly contracted, these are only clearly visible on tergite 3); second sternite with two large yellow spots, sternites 3-5 with yellow basal band, which is mostly covered by the preceding sternite; apical sternite yellowish in the middle.

Legs brown, variegated with yellow (coxae rather extensively marked with yellow; femora yellow beneath and at apex above; mid and hind tibiae with dark streak above and yellow mark at apex), tarsi dark brown (fore tibiae and tarsi of the type specimen lacking).

Length (h. + th. + t. 1 + 2): 11 mm.

New Guinea: A series from Vogelkop differs so much from typical *varia* that I have decided, after some hesitation, to regard it provisionally as a separate subspecies (see below). My doubt concerning the status of this form is partly due to the fact that some specimens from eastern New Guinea are distinctly less aberrant. Particularly a female from Papua, Kokoda, 1200 ft., June 1933, L. E. Cheesman (BM) agrees in many respects with typical *varia*; its ground colour is darker, however, the postscutellum has a dark band at its posterior margin (rather abruptly dilated in the middle), and the petiole is entirely dark brown. A series of 11 ♀ from "Fiume Purari", Jan. 1894, L. Loria (MCG; 2 ♀ ML) has these same characters of postscutellum and petiole, but in these specimens the yellow markings are more reduced (mesoscutum without distinct yellow lines) and the ground

colour is generally somewhat paler. It is uncertain, however, to what extent the latter difference is due to discoloration.

The following material has been examined before I learned to separate *P. nodosa* from *P. varia*. Undoubtedly the majority of the specimens belongs to *P. varia*, but it will be necessary to check the identifications at the hand of the data presented in this paper.

Formosa: 6 ♀ 1 ♂ "Formosa", 1 ♀ Kagi, 1 ♀ Pilam, 1907, all leg. H. Sauter (USNM). — 9 ♀ Tsaoshan, April and July 1958, K. S. Lin (BISH).

China: Prov. Szechwan, 12 ♀ Yachow to Mupin (2-5000 ft.), 23-27 June 1929, 1 ♀ Kuanshien (1500-2000 ft.), July 1930, 8 ♀ Kuanshien (1600-2000 ft.), 26-29 July 1934, 1 ♀ Kuanshien (3000 ft.), 5-8 May 1930, 6 ♀ Suifu (20,000 ft.), June 1935, all leg. D. C. Graham (USNM). — Prov. Kiangsu, 1 ♀ Nanking, 2 Aug. 1924, 1 ♀ Tsinkiang ("Chingkiang" on label), Aug. 1924, H. A. Jaynes (USNM); 6 ♀ Nanking, Sept. 1923 (CAS); 1 ♀ Shanghai, July 1935, E. Suenson (CU). — Prov. Fukien, 13 ♀ Nanping ("Yen-ping" on label), May-June and Aug. 1917 (AMNH). — Hongkong, 1 ♀ "Novara-Reise" (CU); 1 ♀ leg. Koebele (USNM). — Hainan I., 2 ♀ Kachek, Aug. 1922, S. F. Light (CAS). — Not located: 1 ♀ Tak Hing, 5 Aug. 1920, 1 ♀ Kang, Paak Shui, 24 Oct. 1920, 1 ♂ Leh Kong, 25 Oct. 1920, 1 ♂ White Cloud, 10 Nov. 1920, 1 ♀ Ng Chuen, 19 May 1921, 1 ♂ Lok (or Luh?) Fau Shaon, Sept. 1921, all leg. C. W. Howard (USNM).

Korea: 1 ♀ 1 ♂ Hwasung, 1 Sept. 1955, G. H. Kim (USNM).

Japan: 1 ♀ Honshu, J. Sconion (or Sconiou?) (USNM).

India: 1 ♀ Sikkim, 4000 ft., 1896, C. T. Bingham (USNM); 2 ♀ Assam, Khasia Hills, July 1894, C. T. Bingham (USNM).

Burma: 1 ♀ Tingkaw, June 1944, L. C. Kuitert (CU).

Thailand: 1 ♀ Ban, Kiruwang, 13 July 1928, 1 ♀ Penin, Tha Lo, 20 Nov. 1931, Hugh Smith (USNM); Doi Suthep, 1 ♀ 24 April 1952, 10 ♀ 4-10 May 1952, D. and E. Thurman (USNM). — 1 ♀ Banna, 180 m, May 1958, T. C. Maa (BISH). — Chiangmai, 1 ♀ Fang, 500 m, April 1958, T. C. Maa (BISH); 1 ♂ Doi Suthep, 500 m, Nov. 1957, J. L. Gressitt (BISH).

North Vietnam: 1 ♀ 1 ♂ Hanoi, April 1917, J. Demange (CU).

Malaya: 13 ♀ Singapore, C. F. Baker (USNM).

Sumatra: 2 ♀ Kampong Silau Maradja, Asaban, 1918, H. H. Bartlett (UMMZ).

Borneo: 3 ♀ Sandakan, C. F. Baker (USNM). — Sarawak, 3 ♀ Nanga Pelagus near Kapit, 180-585 m, Aug. 1958, T. C. Maa (BISH).

Philippine Is.: Luzon, 2 ♀ Mt. Banahao; Mindanao, 1 ♀ 1 ♂ Butuan, 2 ♀ Surigao, 1 ♀ Dapitan, all leg. C. F. Baker (USNM).

In the British Museum (Natural History) I have seen *P. "varia"* from India (Sikkim, Runjit valley, 1000 ft., and Singhik, 3500 ft., Darjeeling, 7000 ft., Assam, Khasia Hills and Naga Hills), Burma (N. Chin Hills, Taungoo, Haundraw valley, and Ye-valley), Indo-China (Haut Mekong, Muong Sing and Vien Poukha), China (Hainan, You Boi; Hongkong), Formosa, Singapore and Sumatra.

Parapolybia varia furva subsp. (or var.?) n.

(fig. 8f)

Ground colour of body very dark brown; yellow markings much reduced, as shown in fig. 8f; legs dark brown, femora and tibiae yellowish at apex, fore tarsi pale brownish.

In the male the head is dark brown, with the following parts pale yellow: mandibles (except for a pale brown spot near the base), under side of antennae, a narrow line at outer orbits, a broader one at inner orbits (reaching the top of the eye-emargination), the face below a line through the upper margins of the antennal sockets, except for the supraclypeal area, and a median line on the basal half to three-fourths of the clypeus, which are dark brown.

New Guinea: West New Guinea, Vogelkop, 42 ♀ 4 ♂ Kebar Val., West of Manokwari, 550 m, 4-31 Jan. 1962, caught by sweeping, S. Quate (type ♀ and paratypes: BISH; further paratypes: AMNH, BM, MCG, ML, USNM).

Parapolybia nodosa sp. n.

Female. — Very similar to *P. varia*, but the gastral petiole more strongly nodose and — at least in certain parts of its distribution area — the colour pattern distinctly different.

Specimens from Formosa differ as follows from those of *P. varia* collected in the same island (compare fig. 13 and 12a).

Ground colour somewhat darker, yellow markings less extensive.

Clypeus brown, with an ill-defined U-shaped mark at anterior and lateral margins yellow; the brown area above the antennae somewhat bent outwards into the eye-emarginations; supraclypeal area brown; frons without a spot in front of the anterior ocellus.

Sides of thorax more extensively marked with ferruginous and brown; postscutellum with dark band, widened in the middle, on posterior half; legs brown, with the following parts yellow: coxae I, the greater part of coxae II and III, under side of all trochanters and femora, a more or less distinct spot at apex of femora above, and vague spots at apex of tibiae I and II.

Markings of gastral segments considerably reduced as compared with *P. varia*.

Length (h. + th. + t. 1 + 2): 11-12 mm.

Formosa: 4 ♀ Pilam, 1-15 Jan. 1908, 2 ♀ Kosempo, April 1908, 1 ♀ Taihanroku, 19-26 April 1908, 1 ♀ Taihorin, 1911, all leg. Sauter (ML); 1 ♀ Takao (ML). — The holotype is a ♀ from Pilam; the other specimens recorded above are paratypes.

Some females from other localities agree with the Formosan series in the shape of the gastral petiole, but there are certain differences in coloration which are worth mentioning.

China: 1 ♀ Prov. Fukien, Kuatun, April 1946, Tschung Len (ML, ex coll. Verhoeff); clypeus yellow with only a vague pale brownish area in the middle; frons with ill-defined yellowish spot in front of the anterior ocellus; spots on gastral tergite 2 rather large, narrowly connected with the basal mark; apical half of femora II and apical third of femora III yellow above; all tibiae with ill-defined yellowish mark on outer side at apex.

India: 1 ♀ United District of Mikir and North Kashgar Hills, Umbaso, 2300 ft., F. Schmid, 26 April 1960 (ML); very similar to the Formosan specimens, but the dark band at the posterior margin of the postscutellum narrower and not produced in the middle anteriorly.

Tenasserim: 3 ♀ Thagatà, March 1887, L. Fea (MCG; 1 ♀ ML); dark parts of thorax more extensive, postscutellum dark brown with only a narrow yellow band at anterior margin.

Thailand (?): 3 ♀ Central Thailand, Kwae Noi River Expedition, Niki, 23 April—6 May 1946, J. E. Jonkers (ML); these specimens present a problem which I am unable to solve at this moment; there is considerable variation in the shape of the first gastral segment (length: greatest height = 2.8, 3.0 and 3.2) but in general it is more similar to *nodosa* than to *varia*; in colour pattern, however, the specimens agree better with the latter species; the ground colour is darker than in normal *varia*, and the yellow markings are more sharply defined.

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EXPLANATION OF PLATES

Pl. 1

Nest of *Polybioides raphigastra* (Saussure), taken from rock cave at Sungei Pinang Hills, Penang, 8 July 1956, leg. H. T. Pagden. — Fig. a, front view, with the top of the nest on the left hand side; the lower end, on the right hand side, is damaged; b, view from under side, showing the spiral course of the single comb, which is directly attached to the rather thin envelope. Length of nest: 35 cm, long axis = 21 cm, short axis = 14 cm.

Phot. Keechun Studio, Penang; received from Mr. H. T. Pagden.

Pl. 2

Fig. a-b. *Polybioides raphigastra* (Saussure), the same nest as on pl. 1. — a, posterior side of the nest, showing where it was attached to the rock (the actual top of the nest is on left hand side); b, three quarters-view from top and rear of nest.

Fig. c. Branched nest of *Parapolybia varia* (Fabricius) on cacao, at Cherias, Malaya, 23 Dec. 1950.

a-b: phot. Keechun Studio, Penang; c: phot. H. T. Pagden.

Pl. 3

Parapolybia varia (Fabricius). — Fig. a, young nest, collected with one female; b, somewhat older nest, collected with two females, both from Padang, Sumatra, Sept. and Oct. 1953, leg. Wa. Vergeest; c-d, nest with wasps, Penang, Malaya, 22 Oct. 1950, leg. H. T. Pagden.

a-b: phot. H. Roman, Mus. Leiden; c-d: phot. H. T. Pagden.

