STUDIES IN ORIENTAL *MECOPTERA*.

I. The genus *Leptopanorpa* in Malaysia.

By

M. A. LIEFTINCK

(Zoölogisch Museum, Buitenzorg).

For some time I have been studying the *Mecoptera* of Malaysia and some of the neighbouring parts of the Oriental Region, partly to enable me to identify my own captures during the last five years in Java, and partly for the purpose of revising the Buitenzorg Museum collection in this group. The notes gathered while engaged on this task seem to be worth recording.

The present revision deals only with *Leptopanorpa*, a genus of which our knowledge was very unsatisfactory and more and carefully collected material was required in order to place the known species on a firmer and more modern taxonomic basis.

History.

The history of the genus in the existing literature is briefly characterized as follows:

Leptopanorpa was founded by R. McLachlan, on page 187 of the Transactions of the Entomological Society of London for the year 1875. The original diagnosis runs as follows:

> "Differs from *Panorpa* by the extreme slenderness of all its parts; the wings very narrow; the rostrum exceedingly long; the three terminal segments of the ♂ abdomen immensely long, and almost thread-like, the cheliferous segment being provided with a very long footstalk; the basal (unmodified) segments long (not transverse as in *Panorpa*) [1]).

The genotype, *L. ritsemae* McLachlan (loc. cit. p. 187 - 188) was described from one male and one female, collected by von Siebold in Japan. Both specimens are in the collection of the Leiden Museum. A second species, *L. sieboldi*, also from Japan, was described by the same author, but the male of this remained unknown.

In the "Mecoptera and Planipennia of Insulinde" (Notes Leyden Museum, 31, 1909) van der Weele quotes part of the original description and describes one new species from Java, viz. *L. longicauda* v. d. Weele. For the reception of the

[1]) See p. 273, footnote.

Malaysian species of the old genus *Panorpa,* that author proposes the new subgeneric name *Neopanorpa,* in which the following species would be placed:

N. angustipennis (WESTWOOD).

N. mülleri v.d. WEELE, and its subspecies *ungaranensis* v.d. WEELE.

N. javanica (WESTWOOD).

N. pi v.d. WEELE.

N. nematogaster (MCLACHLAN).

N. jacobsoni v.d. WEELE,

while *Panorpa charpentieri* BURM. is doubtfully placed.

The males of the species of *Neopanorpa* are here differentiated from *Panorpa* "by the curious process of the hindborder of the third tergit, which bears a very variable clubshaped prominency, that rests upon an elevation of the fourth tergit and which does not exist in the European species. I would propose for this group, that overleads to *Leptopanorpa,* the subgeneric name of *Neopanorpa*". (Loc. cit., p. 4). Other differences between *Panorpa* and *Neopanorpa,* and between *Neopanorpa* and *Leptopanorpa* are not given.

At the present time we know that all the species enumerated above, with the exception of *angustipennis* and its near ally *mülleri,* should be placed in the genus *Leptopanorpa* (*postea*).

ENDERLEIN, in the Zool. Anzeiger, 35, 1910, p. 392, has erected the generic name *Himanturella,* with *tubifera* ENDERLEIN as genotype, but since *tubifera* END. 1910 is the same species as *longicauda* WEELE 1909, which is a true *Leptopanorpa,* ENDERLEIN's unfortunate selection is invalidated. Moreover, ENDERLEIN created a second invalid name in making *Panorpa javanica* WESTWOOD the type of his new genus *Campodotecnum,* a species belonging undoubtedly to *Leptopanorpa.* In 1912, ENDERLEIN adds further to the confusion in placing his *Himanturella* as a synonym of *Neopanorpa,* while *nematogaster* is erroneously fixed as the type of *Himanturella* END. Thus, as has clearly been ascertained by ESBEN PETERSEN in his "Synonymic List of the order Mecoptera" (Entom. Meddelelser, 10, 1915), *Neopanorpa* WEELE 1909 (type: *P. angustipennis* WESTWOOD) is of earlier date than *Campodotecnum* ENDERLEIN 1910, and should be used as the name of that genus, while *Himanturella* becomes an absolute synonym of *Leptopanorpa* MCLACHLAN 1875, of which *ritsemae* is the type.

ENDERLEIN, on page 393 of his paper in the "Zoologischer Anzeiger" differentiates *Leptopanorpa* from his new genus *Himanturella* by the following characters:—

> "Diese Gattung unterscheidet sich von *Himanturella* ENDERL. durch das langgestreckte (nicht quergestellt und kurz) erste Abdominaltergit, das es zugleich von allen übrigen Gattungen der Unterfamilie *Panorpinae* auszeichnet. 6., 7. und 8. Segment sehr lang, fadenförmig. 9. Segment des Männchens gestielt. In diese Gattung gehört noch die *L. sieboldi* MACLACHL. 1875 gleichfalls aus Japan.
>
> MACLACHLAN schliesst ausdrücklich den *P. nematogaster* MACLACHL. aus Java von dieser Gattung aus".

Here ENDERLEIN is again wrong, as has been pointed out by ESBEN PETERSEN (Notes Leyden Mus. 35, 1913), who writes as follows:—

"When MACLACHLAN (Trans. Ent. Soc. Lond. Vol. II, 1875) states that the 1st abdominal segment in *Leptopanorpa* is very long, contrary to what takes place in all other genera of the *Panorpidae*, this statement is due to a misunderstanding. I saw the type specimen (♂) of *L. ritsemae* in the Museum of Leyden, July 1912, and later on Conservator R. VAN EECKE, Leyden, kindly has examined the type specimen and made a sketch of its abdomen for me, so I am sure that the genus does not differ from the other Panorpid-genera in this respect". (Loc. cit. p. 225, footnote) [1]).

On page 2 of ESBEN PETERSEN's monographic revision of the order *Mecoptera* (Cat. Coll. SELYS, fasc. V, 2nd part, 1921), the genera *Neopanorpa* and *Leptopanorpa* are distinguished thus:

"3. Abdomen in the male as long as the wings or shorter; 7th and 8th segments only a little prolongated ..... *Neopanorpa.*
Abdomen in the male much longer than the wings; 7th and 8th and sometimes also 9th segment much prolongated ..... *Leptopanorpa.*

Anticipating a thorough investigation of the generic and specific characters of *Neopanorpa*, it is sufficient for the present purpose to state that there are several reasons for thinking that the two genera, though closely related, are not differentiated on these characters alone, at least not in the male sex. Following ESBEN PETERSEN, the name *Leptopanorpa* is retained in this paper for a number of discontinuously distributed species, which are chiefly characterized by the slenderness of their body and wings. A discussion of the interrelationship of these two genera is better postponed until a study of the genital characters of Malaysian *Neopanorpa*, and of the extra-regional species of *Leptopanorpa*, is completed.

The unsettled condition of taxonomy within the genus *Leptopanorpa* is largely responsible for the uncertainty of nomenclature of several Malaysian species.

ESBEN PETERSEN (loc. cit. 1915, p. 230 - 231, and 1921, p. 85 ff.) enumerates 10 species of *Leptopanorpa*, viz.:

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[1]) Dr. H. C. BLÖTE, whom I asked to verify PETERSEN's statement, in a letter dated January 31th, 1936, writes me the following: — "*Leptopanorpa ritsemae* is represented in our collection by the unique male. Although still in fairly good condition, the specimen has been mouldy, the abdomen being rather shrivelled. The structure of the abdomen does not differ from that of the type of *L. longicauda* V. D. WEELE, with which I have compared it. The 9th segment is slightly longer, and the 7th and 8th segments are each a little shorter than in that species. The rudiment of the first abdominal segment is scarcely visible in the type ♂ of *ritsemae*, but in the ♀ it is more distinct (the body-pattern as well as the colours are rather different in the two sexes of this species, but I can not judge whether they might belong to two different species). The females of *L. sieboldi* are in very bad condition; the basal abdominal segment is unrecognizable". — From this renewed investigation it is evident that ENDERLEIN's generic name *Himanturella* should be withdrawn.

L. charpentieri (BURM.)	Bengal, Sumatra, Java.
L. effusa (NAVÀS)	Sikkim.
L. furcata (HARDWICKE)	Nepal.
L. jacobsoni (V.D. WEELE)	Java.
L. javanica (WESTWOOD)	Burma, Hainan, Sumatra, Java.
L. longicauda (V.D. WEELE)	Java.
L. pi (V.D. WEELE)	Java.
L. ritsemae MCLACHLAN	Japan (genotype).
L. sieboldi MCLACHLAN	Japan.
L. tubifera (ENDERLEIN)	Java.

Of these, I have not seen *L. ritsemae, sieboldi, furcata* and *effusa,* while Sumatran specimens of *charpentieri* (= *nematogaster* nob.) and *javanica* are also unknown to me.

In the present revision 6 new species and 1 new subspecies are described; *L. charpentieri* is traced specifically distinct from *nematogaster,* and a re-examination of most of the other species has resulted in the following revised list:

L. charpentieri (BURM.)	Bengal.
L. effusa (NAVÀS)	Sikkim.
L. erythrura, sp.n.	Java.
L. filicauda, sp.n. (= *longicauda* WEELE et PETERSEN, *partim*)	Java.
L. furcata (HARDWICKE)	Nepal.
L. inconspicua, sp.n.	Java.
L. jacobsoni (V.D. WEELE)	Java.
L. javanica (WESTWOOD)	Burma? Hainan? Sumatra? Java.
L. longicauda (V.D. WEELE) (= *tubifera* END. et auct., *partim*)	Java.
L. nematogaster (MCLACHLAN) (= *charpentieri* PETERSEN et auct., *partim, nec* BURMEISTER) (= *? linguata* NAVÀS)	Sumatra ? Java.
L. peterseni, sp.n. (= *pi* PETERSEN *partim, nec* V.D. WEELE)	Java.
L. pi pi (V.D. WEELE)	Java.
L. pi decorata, subsp.n.	Java.
L. ritsemae MCLACHLAN	Japan (genotype).
L. robusta, sp.n.	Java.
L. sarangana, sp.n.	Java.
L. sieboldi MCLACHLAN	Japan.

There are still two species of *Campodotecnum* described by ENDERLEIN (Notes Leyden Mus. 34, 1912, p. 236 - 237), which need elucidation. These are *C. lemniscatum* END. (Mt. Oengaran, Mid Java, ♀ only), and *C. cingulatum* END. (Mt. Panggerango, West Java, ♀ only). The former is almost certainly a *Neopanorpa,* and the latter may or may not be identical with my *L. erythrura,* but since of both species the males are unknown, the descriptions moreover

being quite insufficient, it is even impossible to ascertain the generic position of these two species. The types, to which I had no access, are in the Leiden Museum.

CHARACTERS.

The chief characteristics which have been used in the classification of Oriental *Panorpidae* are the wing-markings and the general aspect and size of the male abdominal segments.

As has been shown by CARPENTER [1]) for the nearctic species of *Panorpa*, and by MIYAKÉ and ISSIKI [2]) for the Japanese and East Asian *Panorpidae* (including some of the continental forms of *Neopanorpa*) these secondary characters are greatly variable and of but little value in safely discriminating the numerous species. After an examination of several hundreds of specimens of *Leptopanorpa* and *Neopanorpa* from Sumatra and Java, I soon became convinced that the systematic value of colours, wing-markings and external peculiarities of the body had been greatly exaggerated by previous and even recent writers. The normal range of variation in the wing-markings and the proportionate length of abdomen and wings is only determined by a careful survey of the amount and nature of variability in long series of each species. This amount of variability is different in almost every species. Colour and markings of the wing are convenient features for a general classification and sifting of the groups, and are sometimes even so constant that we can use them to assist in the determination of the species, provided that the doubtful cases are checked by the genitalia; taken alone they never furnish us with a means of accurate and final identification. The colour of the body is a notoriously bad guide to species in this family, although there appear to be certain well defined l i m i t s o f v a r i a t i o n. Some species, as e.g. *L. nematogaster*, have no definite pattern and show a great diversity of coloration, exhibiting nearly the whole gamut of colours from yellow through testaceous, ferruginous, brown and black, according to age and maturity. In others, such as *L. longicauda, filicauda, erythrura, sarangana*, the body-p a t t e r n is very distinct and quite stable, the apparent variation being caused by the change of colour-i n t e n s i t y. As was first stated by CARPENTER, the colour of the body of the dried *Panorpa* depends upon a number of external factors, viz., the extent of time since the insect emerged from the pupa, and the amount of grease in the body of the insect, which soon after death causes a complete change of colours. For the preservation of colours rapid drying is therefore essential.

Encouraged by the excellent studies of CRAMPTON, *and especially* ISSIKI, *on scorpion-flies of North America and Japan, a careful study of the genitalia*

[1]) See: p. 286, footnote.

[2]) T. MIYAKÉ: Studies on the Mecoptera of Japan. Journ. Coll. Agric. Tokyo, 4, 1913, p. 265 - 400, 10 pls.

S. ISSIKI: Morphological Studies on the Panorpidae of Japan and Adjoining Countries and Comparison with American and European Forms. Jap. Journ. Zool. Tokyo, 4, 1933, p. 315 - 416, 45 figs.

of *Leptopanorpa* was begun and it was soon evident that the genital structures of both sexes afford very important specific characters. In long series of one species it was found that even the minutest details of the male and female genitalia remain perfectly stable and easily comprehensible. The structure of these organs has been discussed by MIYAKÉ, CRAMPTON [1]), CARPENTER and others. Recently, a very detailed account of the genitalia throughout the entire family (except *Leptopanorpa*!) has been published by ISSIKI, who added excellent drawings of structural details. In this paper I have followed the terminology used by ISSIKI, so that it is only necessary to note the various parts most useful in taxonomy.

The wings. — The wings of *Leptopanorpa,* though generally narrower and more pointed than in *Neopanorpa,* are not venationally different from that genus. The anal veins are short and reduced, and in none of the Malaysian species a third anal vein is preserved in the hind wing. The venation is simple and the position and length of the various branches and cross-veinlets varies much in long series of each species. The shape of the wings is fairly constant, though unreliable as a specific means of distinction. In the majority of the species the wings are spotted and banded with brown; these wing-markings are very variable, better developed in the front wings than in the hinder pair, and more extensive in the female than in the male. Few species (i.e. *longicauda, filicauda, nematogaster*) have unspotted wings, the membrane in these species being often suffused with pale yellow or orange.

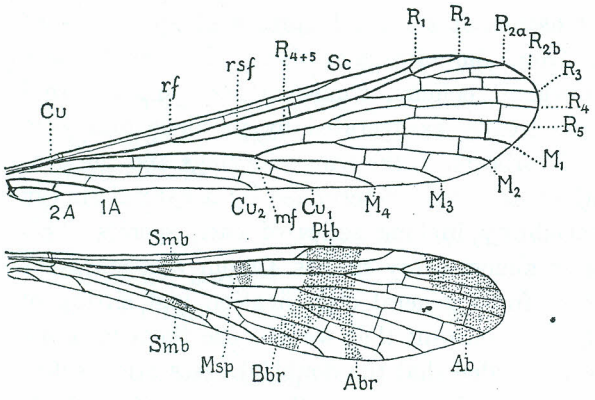


Fig. 1. — Fore and hind wing of *Leptopanorpa*, showing terminology of veins and markings. (Adapted from ESBEN PETERSEN, 1921). Lettering in the text.

In our sketch of the wings (fig. 1) we can distinguish the following veins and markings:

Veins: *1A* and *2A*, first and second anal veins; *Cu*, cubitus; Cu_1 and Cu_2, first and second branches of the cubitus; M_1, M_2, M_3 and M_4, the four branches of the media; *mf*, fork of the media; R_1, R_2, R_3, R_4 and R_5, the five branches of the radius; R_{2_a} and R_{2_b}, the two branches of R_2; R_{4+5}, the common stem of R_4 and R_5; *rf*, fork of the radius; *rsf*, fork of the radial sector; *Sc*, subcosta.

[1]) G. C. CRAMPTON: The genitalia and terminal abdominal structures of male *Neuroptera* and *Mecoptera*, with notes on the *Psocidae, Diptera*, and *Trichoptera*. Psyche (Boston), 25, 1918, p. 47 - 59.

Markings: *Ab,* apical band; *Abr,* apical branch of pterostigmal fascia; *Bbr,* basal branch of pterostigmal fascia; *Msp,* median (or marginal) spot; *Ptb,* pterostigmal band; *Smb,* rudiments of the submedian band. [Basal spots (*Bsp*) omitted in the figure].

The male abdomen. — In all Malaysian species examined the first segment is strongly modified, being fused to the metathorax. As in *Neopanorpa* the first tergum is divided into an anterior and a posterior plate. The former is narrow, transverse and usually distinctly upturned; anteriorly it is fused to the postnotum of the metathorax. The first sternite is extraordinarily small but remains as a pair of very narrow lateral plates. Each of the segments 2 - 5 has a chitinised undivided tergum and a somewhat less strongly chitinised sternum, between which a soft pleural membrane on either side is clearly discernible. In the anterior part of each segment, except the second, there is a minute sclerite, situated nearer the sternum than the tergum.

The middle part of the hind margin of the third tergite is distinctly produced apicad; this process reaches to about the middle of the fourth tergite. It is slightly different in shape in the various species of the genus and can be used as a specific character in mature specimens only. The fourth tergite in the majority of Malaysian species bears a distinct knob-like or conical production on its middle, the rounded apex of which being almost in contact with the subapical portion (or with the tip) of the process of the preceding segment. In *filicauda* this knob is low and indistinct; in *longicauda* it is unapparent and indicated only by a bunch of short, stiff hairs; lastly, in *robusta,* it is entirely absent.

ISSIKI (*loc. cit.*, p. 324) has observed in the male of *Neopanorpa ophthalmica,* that the costal margins of the left or right pair of wings of the female are held between the finger-like process of the third segment and the raised portion of the fourth segment, during copulation.

As in *Neopanorpa,* the segments 6 to 8 are without any sign of the pleural membrane, which has apparently become entirely chitinised, leaving the spiracles in their original positions. The segments 7 and 8 are much narrower than the preceding segments and, in most species, are enormously drawn out.

Male genitalia. — As in *Neopanorpa* the ninth abdominal segment is highly specialized. In the proximal area the fused tergite and sternite overlap the basal part of the gonopod or gonostylus, which consists of two segments. The basal or genital segment has been called basistylus (fig. 2 B and C, *bas*), the apical segment dististylus (fig. 2 B and C, *dist*). The basistylus is large, swollen and fused with the coxite; it forms the main portion of the so-called genital bulb. The dististyli — forceps or chelae — are more or less broad at the base, tapering towards the pointed apices, which are curved inwards. Each dististylus is dicondylic, articulated with the basistylus by dorsal and ventral points. It is provided basally with at least one somewhat triangular or finger-like process, which is directed inwardly; in most species on or near the base of the process there is a strongly chitinised, deeply coloured smooth

area with raised margin, which is sometimes provided with irregular knob-like protuberances and stiff bristles. The shape and armature of the dististylus is characteristic for each species. The tergite of the ninth segment is oblong, or squarish, and is designated as epiandrium (fig. 2 C, *ep*). This dorsal appendage, or preëpiproct, is differently shaped in all known species of *Leptopanorpa,* and covers the dorsum of the modified ninth segment, sometimes projecting beyond its extremity; the epiandrium in some species bends strongly downwards and laterally surrounds the rudimentary terminal segments, which are scarcely visible. The tenth segment, whose sternum is always preserved, is very small; it bears the so-called cerci, which are one-segmented and originate close to its margin, where they are well visible on each side of the epiandrium.

The sternite is considerably prolonged and free towards the apex. It lies on the ventral surface of the swollen bulb of the gonostylus and is always divided into two branches. This modified part of the sternum has been designated hypandrium. In all species of *Leptopanorpa* the hypandrium is sessile or shortly stalked; the two branches (fig. 2 B and C, *brhyp*) — hypovalvae, or ventral appendages — which exhibit a remarkable series of modifications in different species, are well developed and can be used with advantage as a specific character.

The aedeagus. — This organ is perhaps the most interesting and most complex structure of the whole genital apparatus of the *Panorpidae.* As in *Panorpodes, Panorpa* and *Neopanorpa,* the apical part of the vasa deferentia forms a large sac and occupies the space at the base of the fused basistylus, extending from within the bulb on the ventral side. Ventrally, this sac is completely hidden and well concealed under the leaf-like branches of the hypandrium, while, on its dorsal side, it is overlapped by the sub-cordate hypandrium. It is not clear where the apex of the sac opens, but probably it does so between the bases of two pairs of chitinous structures, which themselves form the apical part of the penis. The penis, or penile organ, is formed by the fusion of two pairs of complicated elements, which may here be designated ventral and dorsal valves (fig. 2 B and E, *vv* & *dv*). Both are very weakly chitinised structures, which are fused at their bases. It is very probable, though not certain, that the ventral and dorsal retractor muscles of the aedeagus are attached somewhere laterally, and in some species dorsally, of the fused basal portion of these two pairs of valves, since the prolongation and points of attachment of the dorsal valves in most species are clearly recognized on each side of the basal trunk, fitting on to the inner (dorsal) wall of the fused basistylus and disappearing sidewards under each of its free raised margins. The dorsal valves of the species of *Leptopanorpa* are not nearly of so complex a structure as they are in the less specialized genera *Neopanorpa* or *Panorpa;* they are always in the form of more or less approximate, parallel, finger-like rods, which, in only few species (*filicauda,* pl. 11) bear an indication of small apical

protuberances, which may be the remnants of dorsal titilators. In the other species examined, the dorsal valves bear only more or less acute longitudinal ridges or small transverse protuberances, mostly near their apices. Lateral processes of the dorsal valves are wanting.

The structure of that part of the aedeagus termed ventral valve in *Leptopanorpa* is again of a simple nature, and the different parts are not easily made out. They are very thin and weakly chitinised, beautifully developed and essentially different in the various species. The pair of filamentous ventral processes arising from the chitinous outgrowth at the extreme proximal end of the ventral valves, termed ventral titilators by systematists, is luxuriantly developed in the species of *Panorpa,* as are also the lateral titilators in this genus. In *Neopanorpa,* however, the ventral titilators are mostly broad and flat, or very short; lastly, in the known species of *Leptopanorpa* they appear to be absent altogether, and instead of them, each of the ventral valves is provided with one or two lateral processes (fig. 2 D, *lpvv*) of very variable shape (cf. *erythrura,* fig. 2 D, *lpvv; inconspicua, robusta*). In the most specialized species, *filicauda, longicauda,* and *nematogaster,* the whole complex is contracted and simplified, even the last mentioned processes having disappeared almost completely. As stated before, the different forms of the aedeagus afford excellent specific characters.

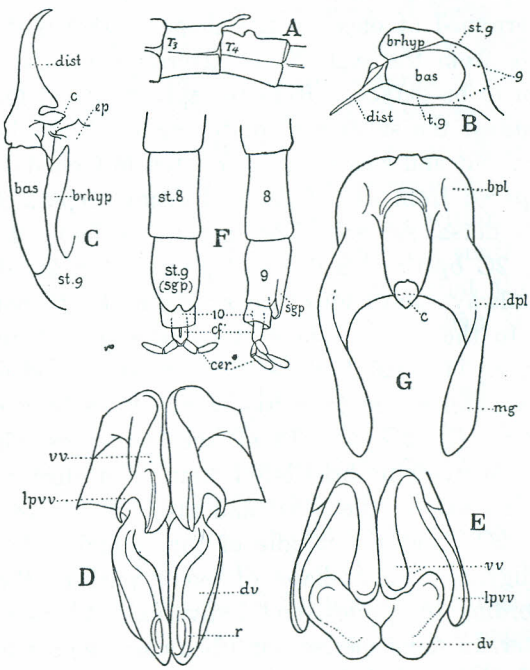


Fig. 2. — Male and female abdominal structures in various species of *Leptopanorpa.* Explanation in the text.

The female abdomen. The abdomen of the female of *Leptopanorpa* is very similar to that of the allied genus *Neopanorpa,* and the generic characters found in the length and shape of the terminal segments of the opposite sex do not hold good for the female. The body tapers gradually to the rear and the segments are not modified, nor are there any processes or chitinous outgrowths on the back of segm. 3 and 4. Usually, as in our fig. 2F of *erythrura,* the tenth segment is telescoped within the preceding one and therefore only partly visible. The eleventh segment, of which only a rudiment of the sternite is preserved, is not visible; from the dorsal surface of the membranous tergite arises a pair of two-jointed cerci (*cer*), the basal joint of which is articulated to a large piece, called the cercifer

(fig. 2F *cf*). — The following peculiarities of the terminal segments of the *Panorpidae* are taken from ISSIKI's account. Save for a few differences, these characteristics are also applicable to the species of *Leptopanorpa*.

The ninth segment in which the gonopores open, has undergone considerable modification. The sternum, or subgenital plate (fig. 2F, *sgp*) is large and its distal part is free and somewhat produced to behind. Between the plate and the main part of the segment a broad genital cavity is enclosed. To the dorsal wall of this cavity, at about the middle of the segment, a somewhat complicated chitinous structure is attached, which has been called the internal skeleton by MIYAKÉ (1913). Through this plate-shaped organ open the fused terminal ducts of the receptaculum seminis. As has been pointed out by CARPENTER (1931), the specific identity of a female in many cases can be determined at once by the shape of this plate. It is necessary to remove the plate from the segment to determine its nature. The end of the abdomen is then to be detached from the specimen and relaxed in boiling water for a few minutes; the subgenital plate can easily be bent back and the internal plate lifted out and cleared and mounted in Canada balsam. Our drawings have been prepared from such Canada balsam preparations in which the plates rest on their dorsal surfaces. The internal skeleton is composed af a basal plate (fig. 2G *bpl*) and a distal plate (fig. 2G *dpl*). The basal and distal plates are always continuous through the neck-like portion, the former usually extending to the dorsal side of the latter, and fusing with the dorsal wall of the cavity. The distal plate bears a pair of slender, usually somewhat twisted, lanceolate, apical processes, which have been called by CRAMPTON medigynium (fig. 2G *mg*). In all the species examined these processes are covered with microscopic bristle-like hairs. The duct passes through along the swollen median axis of the basal and distal plates, opening at the apex of the cone (fig. 2G *c*) at the middle of the caudal end of the latter plate, between the medigynium. The shape of every part of the plate is remarkably different according to species, and individual variation has not been observed by the writer. In some species, e.g. *filicauda, longicauda, javanica,* the proximal portion of the internal skeleton is very weakly chitinised, the outline of the basal side of the median axis, as well as that of the basal plate then being not clearly delimited; therefore, in our sketches of these organs, the supposed limits are indicated by a fine black line. In *L. nematogaster* the basal plate is very large and strongly chitinised, the basal plate being provided on each side with a leaf-like process of almost the same length as the medigynium. In other species (*L. inconspicua, erythrura, peterseni*) the much swollen median axis is strongly produced basally, bearing knob-like protuberances of various shape.

Unfortunately, I have not been able to learn the details of the genitalia of the types of all the confused species, but in the majority of them the classification could be placed on a firmer ground.

It is hoped that the solution here proposed for this geographical section of the genus will be found acceptable and the new classification therefore

prove to be a useful starting point for further investigation, which is very urgently needed.

DISTRIBUTION.

The geographical distribution of the genus exhibits certain peculiarities which are worthy of note.

As we have seen before, *Leptopanorpa* as now understood, consists of 16 species and 1 subspecies, two of which occur in Japan, three or four are from the southeastern part of continental Asia, and the remainder are from Sumatra and Java. The occurrence of two species in Japan is of great interest. It seems useful to notice that neither MIYAKÉ nor ISSIKI, two well-known Japanese authorities, have ever succeeded in collecting further specimens of these two species, *ritsemae* and *sieboldi*. The range of the genus is now known to extend considerably southeastwards. The great development of *Leptopanorpa* in Java, where no less than 11 species occur, together with the scarcity in Sumatra (only 2 species) and the total absence of the genus from Borneo, is very remarkable; and I am at a loss to give a satisfactory explanation of this phenomenon.

As has been pointed out by ISSIKI (1933) the various groups within the genera of the family (i.e. those of *Panorpodes* and *Panorpa*) are each confined to a very limited area of distribution. We may therefore assume that these groups have evolved independently in different countries, rather than that they have migrated from one country to another in recent times.

The large area of isolated mountain masses in Java, as compared with the extent of the lowlands, has resulted in the evolution of several species peculiar to the higher altitudes, and some of these are restricted to rather narrow vertical limits. The zonal limits for the species are still insufficiently known, but in the next chapter we will see that the zonal distribution is correlated with and dependent from the adaptability of each species to the conditions of the environment. In the Javan species of *Leptopanorpa* irregular overlapping areas is a common phenomenon, but we sometimes find one species extending over a considerable portion of the area occupied by the genus and including the entire *local* area of some of the other species. On Mt. Gedeh-Panggerango for instance, *L. longicauda, filicauda,* and *erythrura* are each restricted to different and very limited portions of the mountain slope [1]), whereas *nematogaster* — though sparingly — occurs in every suitable place from 1300 - 1600 meters above sea-level.

HABITS AND ENVIRONMENT.

With other inconspicuous and fragile insects, the scorpion-flies have not received much attention from entomologists generally and they are poorly represented in most collections. This is due chiefly to the fact that they occur

[1]) *L. longicauda*: northwestern slope (600 - 800 m), *filicauda*: eastern slope (1600 - 1800 m), *erythrura*: northern slope (1000 - 1300 m).

in inaccessible and unpleasant spots, out of the usual track of an insect-collector. For the scorpion-flies prefer shady places in very damp forest, where butterflies and other highly coloured objects are scarce, and where the persistency of the numerous leeches absorbs most of the collector's attention. The majority of the species inhabit primeval forest in mountainous districts, often at considerable altitudes above sea-level.

As I have pointed out elsewhere [1]), the Malaysian scorpion-flies are well adapted to a life in the damp atmosphere of a tropical rainy forest. Most species, if not all, on emerging from the earth that gives them birth, depart immediately from their hiding-places among the thick undergrowth of the wood, settling gregariously on the broad and nearly always wet leaves of forest-plants. Begonia's, arums (*Schismatoglottis*) and low ferns and palms, such as *Curculigo capitulata* and *Selaginellae,* are beloved resting-places for these hygrophilous insects. They naturally congregate at such spots, and it is evident that those insects requiring humid soil-conditions form natural societies which, in most cases, occupy only limited patches of the forest.

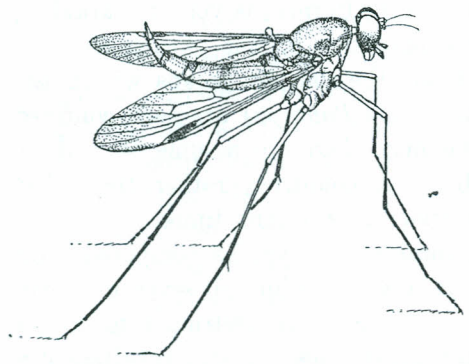


Fig. 3. — *Chrysopilus ferruginosus* WIED., in resting position (× 3).

In the rain-forests of West and Mid Java I have noticed several species of *Neopanorpa* and *Leptopanorpa* keeping company with other fragile insects, e.g. species of the cicindelid genus *Collyris,* dipterous insects of the family *Leptidae* (*Chrysopilus* spp.) (fig. 3), *Calobata* and *Nothybus biguttatus* VAN DER WULP among the *Calobatidae,* and numerous dolichopodid flies. Especially *Chrysopilus* and *Nothybus* (fig. 4 - 5) are regular companions of the scorpion-flies, and it is particularly interesting to note that some of them have similar habits, bearing a striking superficial resemblance to the pale-coloured *Leptopanorpae,* more especially to the females.

On being startled and dislodged, the scorpion-fly flies away, sometimes covering rather long distances; but their repellent instincts appear to prevent any wanderings, and sooner or later they always return to the original spot. This scrupulous flocking together of so many species of *Leptopanorpa* being doubtlessly correlated with a special degree of humidity of the atmosphere, we notice in consequence a strong tendency towards a softening of the tegument, and it is now easily understood that these delicate insects rapidly wither in a dry atmosphere, which fact obviously accounts for their limited powers of

[1]) M. A. LIEFTINCK: On Malaysian Scorpion-flies. Verslag 14de vergadering van de Afdeeling. Ned. Oost-Indië v/d Nederl. Entom. Vereeniging, dl. 1, no. 4, 1 Jan. 1933, p. CXVII - CXX (in Dutch); id.: Uit het leven der schorpioenvliegen (*Panorpidae*). De Tropische Natuur, 23, 1934, p. 64 - 70, figs (in Dutch).

distribution. The flight is weak and not sustained. In most places they fall an easy prey to the collector's net.

The sensitiveness of moisture is not, as was first thought, especially developed in those species in which the abdomen is most attenuated; *L. erythrura* for instance, which has not yet been found on the drier mountain-slopes, is a comparatively robust and solidly built insect, in which the body-segments are not noticeably elongated, whereas *nematogaster* and *longicauda,* two species apparently dwelling in quite similar places, are much slenderer and more delicate members of the genus. *L. javanica,* too, is a slender species, but, unlike the others, it inhabits plain forest and has adapted a life in relatively dry country.

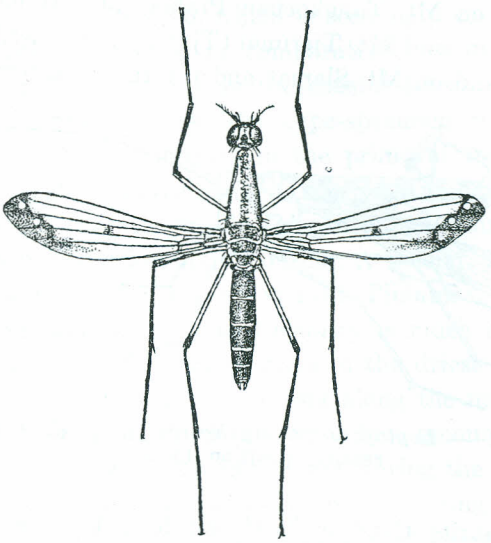


Fig. 4. — *Nothybus biguttatus* V. D. WULP (× 3).

Speaking generally, the ocurrence of a given species of scorpion-fly on a mountain slope is rather a matter of opportunity: given suitable conditions will be a guarantee for its subsistence as long as these conditions prevail.

W. VAN BEMMELEN [1]) and J. BOEREMA [2]) have constructed beautiful isohyetic maps showing the mean annual and monthly rainfall on Java as well as the average number of rainy days during the four consecutive and for every station driest months of the year on the same island. These maps are based on observations made at approximately 2500 stations up to the year 1928, and, as appears from these maps, the quantity of rain and number of rainy days depend largely on the situation of the mountains. It has also been pointed out by BOEREMA that in practically the whole of Java the driest four months of the year occur during the southeast monsoon. Where the southeast monsoon, after its free course over the Indian Ocean, is forced to rise, cloud- and rain-formation increase. The most intense drought occurs where the southeast monsoon crosses

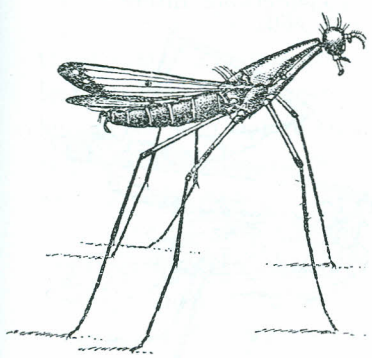


Fig. 5. — Typical resting position of *Nothybus biguttatus* V. D. WULP (× 3).

[1]) W. VAN BEMMELEN, Regenval in Nederlandsch-Indië. Verhand. Kon. Magnetisch en Meteorologisch Observatorium Batavia, 14, dl. 1 (vol. 1), 1925.

[2]) J. BOEREMA, Idem, dl. 2 (vol. 2), 1925 and: Gemiddeld aantal regendagen ... etc., Verhand. 23, 1931.

a mountain-ridge and descends into the plain where it causes fön-like winds in flat country. In West Java the highest number of rainy days has been observed among the extensive range of the Sanggaboeana, Gedeh-Panggerango and Salak mountains, while further maxima have been registered in the Djampangs, on Mt. Tangkoeban Prahoe, Mt. Malabar, various mountains of East Priangan, and Mt. Tjerimai (Tjaréme) in Cheribon. In Mid Java these maxima are found on Mt. Slamat and the range eastern to it, including Mt. Oengaran, the Merbaboe and Merapi volcanoes. In East Java the greatest rainfall is observed — among several unexplored mountains — on Mt. Lawoe, the Tengger Mts., the southern slopes of Mt. Raoeng and the adjoining Idjen Plateau. As is well shown on BOEREMA's map of the average number of rainy days during the four driest months of the year, the number of rain-days during this period decreases in Java generally from West to East, and because the southeastern slopes of the mountains force the monsoon to rise, there is also a decrease from South to North, because the northern coastal plains lay in the rain-shadow.

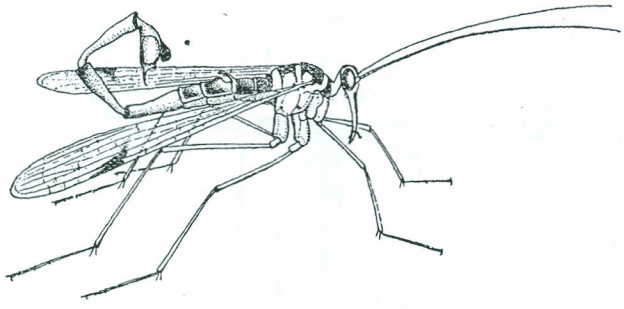


Fig. 6. — *Leptopanorpa erythrura*, sp. n. ♂. Typical resting position (× 3).

Although many mountain-slopes with a great fall of rain have remained practically unexplored, our knowledge on the distribution of Javan scorpion-flies being thus rather too fragmentary, yet it is of considerable interest to learn from the above observations that the known areas of distribution of Javan *Leptopanorpa* coincide with the areas of the greatest rainfall, — provided suitable climatic and soil-conditions; scorpion-flies of this genus being specifically as well as numerically most abundant on those localities where the mean annual rainfall amounts at least from 2500 - 3000 mm; or, taking into account BOEREMA's further climatic observations, that almost all species inhabit places where the mean number of rainy days during the four driest months of the year comes at a

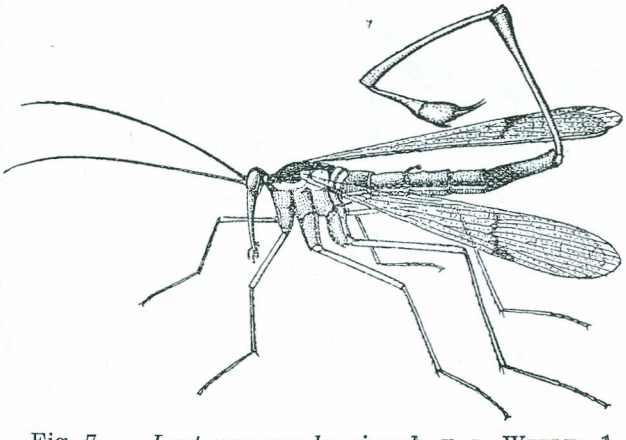


Fig. 7. — *Leptopanorpa longicauda* v. d. WEELE. ♂. Resting position (× 3).

minimum to 20 - 30, usually to more. In West Java, where more precise data are available with respect to the altitudinal range of each species, these figures are an average higher.

Having now seen that most species are restricted to the submontane and montane zone, there is one species, viz. *L. javanica,* which is seemingly capable to live under purely tropical conditions or even in comparatively very dry country; up to this time it has been observed only in the coastal forest zone. On Java it has a scattered distribution: besides the type-specimen whose locality is unknown, it was found by EDW. JACOBSON in the primeval forests on the island of Noesa Kambangan, slightly above sea-level. Noesa Kambangan has an exceptionally wet climate and is heavily wooded (mean annual rainfall 3825 mm, and about 46 rainy days in the driest four months). A second, more westward but not very remote locality of this species is near Tjidamar, also on the south-coast of Java; although well wooded, this country is much drier (rainfall 2500 - 3000 mm annually, but only 0 - 5 rainy days in the driest four months). Lastly, *javanica* has been taken in the teak-forests along the north-coast of Mid Java, near Semarang, where the annual rainfall is low, amounting to 2000 - 2500 mm, and where there are only 15 - 20 rainy days during the four driest months of the year. Thus, we see that *L. javanica,* besides being less selective as to its habitations, has a wider distribution than any of the other species. With *L. nematogaster* it is the only species found also in Sumatra (both doubtfully!), and it has been reported as far north as Burma and Hainan.

F o o d. — In the forest of Mt. Bèsèr, West Java, *L. erythrura* is a common species in certain restricted places and it was here that I once made an observation on the natural feeding-habits of this species which, though rather fragmentary, deserves our attention.

On Sept. 30, 1934, while collecting in this place, I noticed four specimens, three males and one female, of *L. erythrura* sitting on the flat surface of a leaf of *Phaeomeria solaris.* The insects attracted my special attention for I had never seen before such striking an assemblage of individuals settled on a single leaf. On getting nearer, the scorpion-flies became under close observation; yet they did not fly away nor even did they move, and I soon noticed that they were all seated round a little heap of an orange-coloured substance, with their rostrum stretched out and touching the bright patch of vegetable matter. The specimens then were captured and the food was examined. It consisted apparently of a mixture of *Ficus* (?)- seeds — which gave it the bright orangish tint — and the pappy remains of decaying vegetable matter, which I was unable to determine. My friend Dr. H. MULLER, who had taken some individuals of *erythrura* in the same locality a month in advance, told me afterwards that he had also observed a few scorpionflies feeding on this reddish substance, which is often seen on the leaves of forest-plants. Possibly it originates from fruit-eating bats, of which some species have the habit of ejecting part of their food, spitting out the indigested remains; or from fruit-pigeons which may have the same habit. So much is certain, that *Leptopanorpa,* like the other members

of the family, feeds upon dead animal or vegetable matter and they do not seem to touch a living uninjured animal of any kind. This is in full accordance with MIYAKÉ's observations on *Panorpa klugi* MCLACH., with SHIPEROVITSH's and STEINER's notes on the biology of *P. communis* L., and with CARPENTER's general account on the feeding-habits of *Panorpidae* [1]) (*postea*).

Behaviour in captivity. — On August 9, 1931, four males and six females of *L. nematogaster* were captured in the forest near Telagawarna, an old crater-lake on the Poentjak-pass, about 1450 meters above sea-level. These specimens were carried to the laboratory at Buitenzorg as soon as possible, and placed in a large round glass-vessel, 40 cm high and with a diameter of 36 cm; on top this vessel was covered with a movable piece of wire-screen and the bottom of the glass was filled with a thick layer of moist earth, rotten leaves and moss, in which various plants, such as *Commelina,* arums and a few begonia's were planted. This 'terrarium' was placed indoors and direct sunlight was admitted only during the early morning-hours. In such a way it was hoped that the insects could find suitable sheltered places.

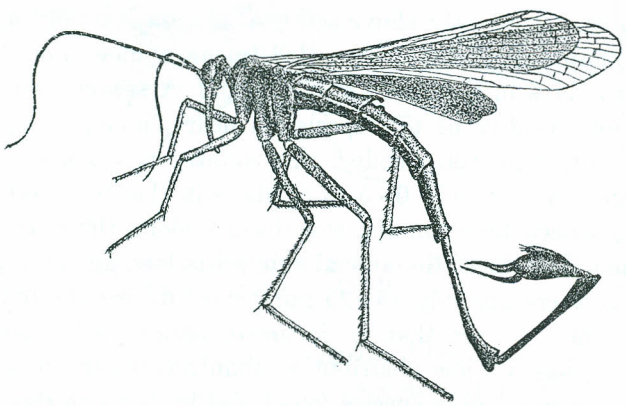


Fig. 8. — *Leptopanorpa nematogaster* (MCLACHLAN). (After KARNY 1923).

Evidently, the scorpion-flies were very thirsty, for as soon as drops of water were poured upon the upper wire-screen and on the surface of the leaves, they approached and sucked them dry very eagerly. It was always seen that the sucking of liquid takes up a long time and when drinking the scorpion-fly remains quite motionless. At times the liquid is discharged, and it was interesting to observe how the long curled abdomen of a male, at intervals of about 2 minutes, is gracefully curled back and completely stretched for that purpose, the forceps then being torn wide apart, on which a small crystalline drop of water is liberated from the tip of its abdomen.

Every morning the upper wire-screen and the leaves were moistened and

[1]) F. M. CARPENTER: Revision of the Nearctic Mecoptera. Bull. Mus. Comp. Zoöl. Harvard College, 72, 1931, p. 214 - 215.

T. MIYAKÉ: The Life-History of *Panorpa klugi* M'Lachlan. Journ. Coll. Agric. Tokyo, 4, 1912, p. 119 - 122.

V. J. SHIPEROVITSH: Biologie und Lebenszyklus von *Panorpa communis* L. Revue Russe d' Entom., 19, 1925, p. 27 - 40 (in Russian, with German summary on p. 37).

P. STEINER: Studien an *Panorpa communis* L. I. Zur Biologie. II. Zur Morphologie und Postembryonalen Entwicklung des Kopfskeletts. Zeitschr. Morph. Oekol. Tiere, 17, 1930, p. 1-67, figs.

always the insects seemed to relish it very much. The first four or five days the scorpion-flies were very active, walking restlessly about among the plants or upside down over the wire-screen. When excited in search of food, the wing-pairs are frequently elevated and depressed alternately; besides this slight and momentary raising ('shrugging') of the wings, these organs are but seldom used in captivity.

As for the food, I first gave small green caterpillars and wounded or freshly killed Tipulids, but the results were not satisfactory; although the caterpillars were also slightly injured and hence inactive, neither these nor the Tipulids were eaten or even touched. I then cut small earthworms into cylindrical pieces, put the fragments on a wet surface or in a drop of water, and then noticed that these pieces of worm were eagerly accepted. The latter were placed upright in order to enable the insects to put in their rostrum conveniently, and so they did, greedily nuzzling round with their mandibles and maxillae. Sometimes a specimen was observed with its rostrum half-way pierced into the fleshy substance. In this way each cylinder was masticated and sucked dry within three quarters of an hour. If the pieces of worm were old and dried up, they were left untouched but when again moistened the deliquescent remnants were sometimes also accepted.

Owing to the wet earth in the terrarium, the interior of my breeding-vessel always contained a high degree of moisture, but nevertheless the insects seemed to require a constant supply of fresh water. To comply with this demand, small quantities of water were at times poured out on the surface of one of the largest leaves. Although it was held already by MIYAKÉ, that too much water finally impedes the movements of these insects, the scorpion-flies enjoyed this sprinkling very much. If, for instance, the leaves, after having been dry for two consecutive days, were sprinkled with water, they would carefully enter the splash with projecting proboscis, then recurved the spirally bent abdominal segments so as to drag the tiny body along through the water, lifted their legs on one side of the body and finally fell down on the other, lying astray on their side and sprawling pleasantly all around in the water. These bathing-habits seemed to be peculiar to the males for the females appeared to be content with drinking.

After about three weeks most individuals became sluggish; they walked around staggeringly with drooping wings and, while drinking, could hardly keep up their bodies. Though they did not take any more food, their limpness could not prevent them from sucking up small quantities of water, but finally they dropped on their sides, being totally exhausted. Probably, the drowsy condition of my scorpion-flies was due to the surrounding temperature being too high in Buitenzorg, the excessive moisture in the breeding-vessel being perhaps also responsible for their untimely death. On September 13 and 14 the last two females died, so that these had remained in captivity for about 5 weeks. The copulation was not noticed, and I have never seen a male approaching his partner for this purpose.

During 1932 many living specimens of *L. erythrura* were brought home from Mt. Panggerango to the Buitenzorg laboratory for breeding-experiments, but these I could keep alive for about ten days only, whereafter all individuals died.

Thus, nothing is still known on the life-history of any of the Malaysian species of *Leptopanorpa,* and although two species were held in captivity for several weeks, the copulation and egg-laying habits were not observed.

SOURCES OF MATERIAL AND ACKNOWLEDGMENTS.

I wish in this place to tender my best thanks to all those, entomologists and collectors, not specially interested in the *Mecoptera,* who have contributed to the completion of this paper and whose names are gratefully mentioned throughout the text. Without the considerable number of specimens received from these collectors, it would have been impossible to deal with this group of insects in any detail. We are permitted to state that even now the Javan jungle remains still far from being fully explored, for nearly every mountain discloses new or interesting forms.

I am much indebted to Dr. H. C. BLÖTE, curator of the Leiden Museum, not only for the privilege of studying paratypes and other interesting specimens in the collection of that Institution, but also for his readiness in correspondence to answer numerous inquiries about specimens which could not be lent out.

Especial thanks are also due to Mr. P. ESBEN PETERSEN (Silkeborg), who has been most generous in the loan of material in his collection.

As to the illustrations joining this paper; all are highly magnified camera lucida drawings, reproduced on the same scale on every plate. The abdomina of the males are slightly modified plain outline-drawings. As to the complicated internal structure of the male genitalia, I had to relieve them from the monotony of dead flatness without departing too widely from the ideal of simplicity and clarity. The application of stipple proved most effective to indicate the relation of the various planes in one rather complex membranous object, while the use of lines — although sometimes perhaps too hard and harsh — was preferred to indicate the degree of pigmentation of the background. The extremely delicate and soft internal skeleton of the female could not be rendered by ordinary outline-drawings, and therefore the ink-sketches had to be worked up with a pencil to produce the half-tone designs on plate 14.

Some striking examples of Malaysian scorpion-flies and *Diptera* are well brought out habitually in the sketches of our native Museum-artist GOESTI ABDOELKADIR.

SYSTEMATIC.

Key to the males.

1. Body enormously drawn out and very slender; peduncle of segm. 9 of abdomen longer than the genital bulb. Segm. 7 and 8 of abdomen at least three times longer than segm. 5. Fourth abdominal tergite at most slightly

elevated before the middle, without knob-like tubercle on mid-dorsum. Abdomen largely pale in colour.

2. Body throughout orange-rufous. Wings unspotted, membrane strongly tinted with yellow, pterostigma amber-brown. *Brhyp.* but little projecting ventrad, narrow and lanceolate, tips reaching beyond hind margin of *bas. Ep.* narrow, gradually diminishing in width towards apex, which is rounded and but slightly downbent. *Dist.* evenly curved towards apices; basal portion with a roundish, hairy, inner tubercle at extreme base, followed by a strong, finger-like interior tooth; angular projection very low and obtuse. Penile organ narrow and slender; *dv.* elongate, sub-parallel, tips with irregular ventral protuberances; *vv.* one-third shorter than dorsal pair, sub-parallel, slightly dilated and hollowed out ventrally, mesal margin swollen and tips also somewhat concave ventrally. West Java ..... ***filicauda***

2'. Body with black markings on the thorax; head and basal portion of segm. 6 also black; rostrum reddish. Wings usually with traces of a *ptb.;* membrane slightly yellowish, pterostigma at least partly brown. *Brhyp.* not projecting ventrad, very narrow and lanceolate basally, their distal portion thread-like, reaching hind margin of *bas. Ep.* plate-shaped and almost rectangular, abruptly narrowed towards apex, which is in the form of a distinct downbent median tonguelet. *Dist.* very long and slender, at first rather straight, thence, after a slight constriction, inwardly bent; basal portion with two conspicuous, irregular, inner tubercles, followed by a very low inner convexity. Penile organ short, broadly cordate or sub-triangular in outline; *dv.* closely approximated, simple; *vv.* nearly equal in length to dorsal pair, strongly constricted before their middle, the divisions thus formed each with a smoothly rounded ventral tubercle. West Java ..... ***longicauda***

1'. Body, though sometimes very slender, generally not so drawn out; peduncle of segm. 9 of abdomen shorter than the genital bulb. Segm. 7 and 8 of abdomen at most three times longer than segm. 5, generally much less drawn out.

2. Segm. 7 and 8 of abdomen about three times longer than segm. 5. Abdomen black. Segm. 9 distinctly pedunculate.

3. Fourth abdominal tergite with a distinct knob-like median tubercle before the middle of segment. Wings very narrow and rather pointed; membrane strongly yellowish, otherwise unmarked, pterostigma very little darker. Body excessively slender. *Brhyp.* rather pointed; membrane strongly yellowish, otherwise unmarked, pterostigma very little darker. Body excessively slender. *Brhyp.* rather distal margin of *bas. Ep.* sub-cordate, apex broadly rounded with very slight median projection. *Dist.* very long and slender, at least equal in length to the genital bulb; basal portion with three approximated inner tubercles, but without submedian internal pro-

jection. Penile organ large; *dv.* straight, lanceolate and parallel to one another, their inner surfaces hollowed out; *vv.* unbranched, strongly outcurved and expanded distally in adult specimens, to form club-shaped processes which are but little shorter than *dv.* Java, Sumatra ..... ***nematogaster***

3'. Fourth abdominal tergite without knob-like tubercle nor elevation before the middle of segment. Wings broader and more rounded apicad; membrane strongly yellowish and at least with traces of a dark brown *ptb.* in front wing and with pterostigma partly brownish in hind wing. Body stouter. *Brhyp.* much longer than in the preceding species, widest in their basal third, then very thin and slender, parallel-sided and strongly diverging apicad, tips upcurved and much surpassing distal margin of genital bulb. *Ep.* elongate, apex rather suddenly narrowed and with a long downbent median projection. *Dist.* thick and strong, decidedly shorter than *bas.*, strongly incurvate and with a robust antemedian internal tooth. Copulatory organ with *dv.* and *vv.* subequal in length, straight, lanceolate and parallel; *vv.* with smoothly swollen ventral ridge, contiguous basally; each of them with two simple lateral processes, which are only half so long. Mid Java ..... ***robusta***

2'. Segm. 7 and 8 of abdomen less than three times longer than segm. 5, or, if so, abdomen for the greater part reddish. Segm. 9 shortly pedunculate.

3. Abdomen for the greater part orange. *Brhyp.* black. All segments comparatively short and compact. Segm. 7 and 8 thick, except at extreme base, barely three times longer than segm. 5, which is very short. Wings narrow and rather pointed; membrane strongly tinged with yellow. Markings reduced; pterostigma dark brown, or *ptb.* incomplete behind; no *smb.*, or at a maximum traces of it along costal margin. *Brhyp.* at first rather narrow, then much widening, hollowed out interiorly and strongly vaulted in profile view, a little diverging and much rounded apically; tips not surpassing distal margin of *bas. Ep.* with apex rather suddenly narrowed and with a distinct median projection. *Dist.* short and slender, much shorter than *bas.* Copulatory organ with *dv.* at least twice longer than *vv.*, pressed closely to one another, each with a well-marked median ridge below, which is divided near the apex so as to enclose an oval depression; apices obtusely pointed. *Vv.* sharply ridged below and with each of their lateral processes only little shorter, hook-like and sharply pointed. West Java ***erythrura***

3'. Abdomen almost entirely black. Segm. 7 and 8 less than three times longer than segm. 5.

4. Wings without any traces of *ab.;* membrane strongly tinged with yellow. An incomplete, dark brown *ptb.*, or only the pte-

rostigma dark brown. Thoracic sides pale in colour; dorsum with black markings. Segm. 7 and 8 similar in form to *erythrura,* though distinctly shorter, 7 longer than 8. *Brhyp.* shaped much as in that species, not surpassing distal margin of *bas. Ep.* also similar but apex more evenly narrowed and median projection decidedly shorter, slightly downbent. *Dist.* thicker, especially at base, equal in length to *bas.* Copulatory organ long and narrow; *dv.* twice longer than ventral ones, scarcely widened basally, strongly and intricately ridged ventrally, with apices rounded; *vv.* slightly incurvate, sharply ridged below and with lateral processes tooth-like and much shorter. West Java ..... ***inconspicua***

4'. Wings at least with traces of *ab.*, or smoky at tips.

5. Wings hyaline, heavily marked; a complete and very broad *ab.*, the inner margin of which is not indented; dark brown *ptb.* forked posteriorly so that a hyaline fenestra is enclosed between the fork and the wing-margin. *Ab* and *ptb.* confluent along costal margin. Elements of (incomplete) *mb.* conspicuous; basal spots present. Rostrum reddish; body otherwise entirely black. Segm. 7 and 8 of abdomen very slender, 7 about twice longer than 5, 8 slightly shorter than 7. *Brhyp.* elongate, almost parallel to one another and but little widened distally; each of them hollowed out interiorly, projecting well beyond distal margin of *bas;* tips rather abruptly rounded and a little upturned apically. *Ep.* plate-shaped and broadly rounded at tip; no median projection. *Dist.* long and slender, not longer than *bas.;* basal teeth robust, short and thick. Copulatory organ with *dv.* long and narrow, sub-parallel, each with a sharp ventral ridge. *Vv.* of intricate build, much shorter than dorsal ones; each of them consists of two widely distant parts, the ventral branch being much enlarged, at first transversely placed and extending basad to form wing-like structures, thence much expanded, outcurved and projecting downward; the mesial branches contiguous, twisted in a vertical plane to form oval lamellae, which are placed in the long axis of the body; *lpvv.* enormously enlarged, strongly incurved apically. West and Mid Java ***javanica***

5'. Wings with *ab.* narrower and incomplete; *ptb.*, if present, narrower, and usually not completely forked posteriorly, not confluent with *ab.* along anterior margin; median and basal spots, if present, usually very small.

6. Thorax almost entirely red, only the prothorax blackish

in front, and the anterior half of the mesonotum blackish or brown.

7. Wings comparatively broad, with apices less pointed. *Ptb.* present. Rostrum entirely reddish. Abdomen long and slender. *Brhyp.* sub-parallel, evenly widened and but little outcurved towards their middle; from that point they are considerably widened and strongly vaulted, the apices being obliquely truncated, reaching beyond distal margin of *bas.* *Ep.* plate-shaped and broadly rounded at tip; no median projection. *Dist.* long and slender, equal in length to *bas.* Copulatory organ cordiform; *dv.* broadly lamellar, apparently fused basally, not or only slightly ridged ventrally, each tapering gradually towards the end, with inner margins contiguous and straight; *vv.* swollen, much shorter than dorsal ones; ventral branches sub-parallel and a little convergent, each with a knob-like median tubercle which projects ventrad; *lpvv.* widely distant, curving at first outwards and then inwards, the swollen and tubercular tips not meeting. East Java ..... ***sarangana***

7'. Wings narrower, tips more pointed. *Ptb.* absent. Rostrum reddish, dark brown in front. Abdomen long and slender. *Brhyp.* sub-parallel, long and lanceolate, widest at middle, slightly convex interiorly, with tips rather pointed, reaching far beyond distal margin of *bas.* Shape of *ep.* undetermined. *Dist.* a little shorter than in *sarangana*, very slender, apices more incurved. Copulatory organs undetermined. Mid Java ..... ***jacobsoni***

6'. Thorax either entirely black, or at least with rich black markings on dorsum of meso- and metanotum. Wing-membrane hyaline, or faintly yellowish, with dark brown markings.

7. Thoracic sides pale in colour. *Brhyp.* almost filiform with much pointed tips. Dorsum of meso- and metathorax with roundish, pale spots. *Ep.* almost straight cut off behind, its apical margin slightly trilobate.

8. *Ptb.* broad, completely forked behind. *Ab.* abruptly and irregularly indented interiorly. Traces of median and basal dark spots present on both pairs of wings. Genitalia not different from the typical race. Mid Java... ***pi decorata***

8′. *Ptb.* broad, incompletely forked behind. *Ab.* reduced to a cloudy brownish spot at extreme apex. No traces of median and basal dark spots. *Brhyp.* very slenderly lanceolate, slightly outcurved at middle and placed rather in a vertical plane; tips projecting beyond distal margin of *bas.* *Dist.* slender, slightly shorter than *bas.*, with basal protuberance stalked and rather club-shaped, strongly hollowed out anteriorly. Copulatory organ compact and broadly cordate in outline; *dv.* fused in the median line, concave below and obliquely truncated apically; *vv.* much shorter than dorsal ones, shaped as on pl. 13; they are downwardly curved and pressed closely against each other in the median line; *lpvv.* slightly longer, lamellar. Mid Java ..... ***pi pi***

7′. Thoracic sides dark brown or black. Dorsum of meso- and metathorax with the sutures only yellowish. Wing-membrane hyaline or faintly tinged with greyish-yellow. Markings very variable. *Ab.* and *Ptb.* usually well developed, the latter irregularly forked posteriorly; *ab.* occasionally much reduced. Rostrum short, orangish, body otherwise almost wholly black. Abdomen slender but segm. 7 and 8 comparatively short. *Brhyp.* narrowly ovate, strongly hollowed out interiorly, tips rather pointed. *Ep.* broad and plate-shaped with rounded side-edges; median projection slightly prominent, rather rounded. *Dist.* slender, about equal in length to *bas.*; basal armature distinct, trituberculate, one of the projections long and finger-like. Copulatory organ of complex structure. East Java ..... ***peterseni***

Key to the females.

(The females of *L. jacobsoni* (V. D. WEELE) and of *pi decorata*, subsp. n., are unknown, while of *pi pi* (V. D. WEELE) I have not been able to examine the genital organs).

1. Wing-membrane hyaline or yellowish, or brownish, but never spotted. Pterostigma and wing-tips occasionally slightly darkened.
   2. Body without any black markings. Internal skeleton as on pl. 14. ***filicauda***

2′. Head and abdomen (in adulti also the thorax) for the greater part black, or bronzy-black. Internal skeleton as on pl. 14. ***nematogaster***

1'. Wing-membrane whether or not tinged with yellow, anterior pair of wings at least with an incomplete *Ptb*.
2. At least the tergites of abdominal segments 7 and 8 pale in colour.
3. Abdomen black, or bronzy-black above, segments 7 and 8 reddish; 9th tergite darkened, or black. Internal skeleton as on pl. 14. ***erythrura***
3'. Abdomen black, or bronzy-black; segments 7 - 9 reddish in colour, unmarked. Internal skeleton as on pl. 14 ..... ***longicauda***
2'. Tergites of all abdominal segments black, or bronzy-black.
3. Thorax entirely red, unmarked; occasionally a fine black line along posterior margin of metanotum. Internal skeleton as on pl. 14. ***sarangana***
3'. Dorsum of meso- and metathorax at least with sharply defined pale spots (including *L. pi*).
4. Internal skeleton as on pl. 14 ..... ***inconspicua***
4'. Internal skeleton as on pl. 14 ..... ***robusta***
3''. Dorsum of meso- and metathorax all black; the intersegmental membranes usually whitish. Wing-membrane hyaline, or very slightly tinged with yellow.
4. *Ptb* completely forked behind, the forks broad, enclosing a hyaline fenestra. *Ab* and *Ptb* fused along both margins, so that a clear, oval fenestra is enclosed. Inner margin of *Ab* usually straight. *Msp* and *Smb* very distinct. Internal skeleton as on pl. 14 ..... ***javanica*** [1])
4'. *Ptb* incompletely forked behind, or *Abr* very narrow. *Ab* and *Ptb* independent, widely apart, at least posteriorly. Inner margin of *Ab* indented, or otherwise irregular. Basal spots obsolete. Internal skeleton as on pl. 14 ..... ***peterseni***

Leptopanorpa filicauda, sp. n. (Pls. 4, 7, 9, 11 and 14).

1910. VAN DER WEELE, Notes Leyden Mus., 32, p. 200. — ♀ VAN DER WEELE, Mt. Malabar, W. Java (*longicauda*) [2]).

1913. PETERSEN, Notes Leyden Mus., 35, p. 228. — ♂ JACOBSON, Mt. Gedeh, W. Java (*longicauda*).

1921. PETERSEN, Cat. Coll. SELYS, Mecopt., p. 88 (*pars*!), pl. 2 fig. 16 (♂ insect). — ♂ JACOBSON, Goenseng (*errore*!), Mt. Gedeh, W. Java (*longicauda*).

Material examined: — 1 male, 4 females (1 ♀ juv.), W. Java, eastern slope of Mt. Gedeh, Tjibeureum (near Tjibodas), 16 - 1800 m, June 1932, L. J. TOXOPEUS, March 23, 1921, W. M. DOCTERS VAN LEEUWEN, March 28, 1932 and May 18, 1935, AUTHOR; 1 male (ad.), labelled: E. JACOBSON, Goenoeng Gedeh, Java, March 1911 (printed) *Leptopanorpa longicauda* WEELE (PETERSEN's handwriting) "Fig. Catal. SELYS" (printed), in coll. ESBEN PETERSEN; 1 male, 1 spe-

[1]) See the discussion of the ♀ of *javanica* under that species (*postea*).
[2]) VAN DER WEELE collected near Tjinjiroean, a cinchona-plantation situated about 1580 m above sea-level.

cimen (abd. wanting) labelled: Tjibodas, 1700 m, no. 24, 1923, KARNY"; 1 male (juv.), W. Java, northeastern slope of Mt. Kendang, 1650 m, Daradjat, July 12, 1934, AUTHOR. — Holotype: ♂ Mt. Gedeh, Tjibeureum, 1700 m, June 1932, L. J. TOXOPEUS; allotype: ♀ topotypical, 1800 m, March 23, 1921, W. M. DOCTERS VAN LEEUWEN.

Confined to West Java, 16 - 1800 m alt.

♂♀. Body throughout orange-rufous, without any trace of black colouring. Last joint of maxillary palpi brownish at tip. Rostrum relatively short, variable in length. Tarsal joints also slightly darkened apically.

Wings narrow and rather pointed; membrane deep chrome, unspotted [1]). Pterostigma long, deep xanthine orange.

♂. Abdomen at least twice longer than hind wing, usually longer. Segm. 2 a little broader than long; 3 and 4 increasingly longer, 3 hardly longer than broad, 4 more distinctly so, almost twice longer than broad and also a little longer than 3; 5 slightly longer than 4; 6 more than two times longer than 5; 7 and 8 extremely long and slender, each at least one and a half times longer than 6, 8 a little shorter than 7 (or equal in length); 9 longly pedunculate, the stalked portion longer than the genital bulb, which is narrow and small. Third abdominal tergite produced into a very narrow cylindrical process, which is slightly curved in profile view and of equal width throughout, reaching to the middle of segm. 4. The fourth tergite bears a very slight mid-dorsal elevation, just before the middle of the segment.

Appendages shaped as described in the key and as shown on the plates.

♀. Genitalia: internal skeleton small and ovate, widest before the middle, weakly chitinised. Basal and distal plates simple, the former without any processes, the latter rounded, but rather expanded laterally. Cone large, ovate, almost pointed apicad. Medigynium slender, lanceolate, compressed, sub-parallel, tips slightly twisted and a little outcurved.

Size very variable. ♂ abd. + app. 26.9 - < 40; fw. 13.4 - 15.2, hw. 12.2 - 14.5 mm. — ♂ Tjibeureum: segm. 1 - 6 9; 7 6.7; 8 6.2; 9 + dististyli 5 mm; fw. 13.7, hw. 12.8 mm. ♂ Tjibeureum: segm. 1 - 6 9; 7 8.5; 8 7.8; 9 + dististyli 6 mm; fw. 14, hw. 13 mm. ♂ Gedeh (JACOBSON): segm. 1 - 6 11; 7 9.5; 8 9.3; 9 + dististyli 7 mm; fw. 15.2, hw. 14.5 mm. ♂ Daradjat (juv.): segm. 1 - 5 7; 6 (absent); 7 11; 8 10.5; 9 + dististyli 9 mm; fw. 15, hw. 14.2 mm.

♀ abd. ± 9; fw. 13.4 - 14.5, hw. 12.2 - 13 mm.

Among other characters this fine species is readily distinguished from *longicauda* by the great length of the branches of the hypandrium, and by the finger-like projection at the base of the dististyli, which are not dilated nor abruptly incurved before their apices.

[1]) In one of the two females, captured by myself near Tjibeureum, on Mt. Gedeh, all four wings bear a sharply defined greyish-black apical band, whose inner margin is concave; anteriorly, this band extends almost to the orange pterostigma.

The history of this species is as follows. In December 1910, VAN DER WEELE captured a female on Mt. Malabar, along with *L. nematogaster*, and reports on it: "It differs from it [*nematogaster*] by the yellow-red colour of the body, the relatively longer rostrum and the darker legs, which are reddish brown with dark annulations on the tarsal joints". Since *filicauda* is the only species in which the entire body is "yellow-red", we may assume that VAN DER WEELE's specimen is correctly placed under this species. ESBEN PETERSEN also was wrong in determining JACOBSON's specimen from Mt. Gedeh as *longicauda* (loc. cit., 1913). In the monograph the same author gave a re-description of the male of *longicauda*, after the type specimen in the Leiden Museum, but he failed to recognize the Gedeh specimen as a distinct species. A drawing of this we find on pl. II fig. 16 of the monograph, which gives a very good impression of the unusual appearance of this immensely long-bodied insect. The unspotted thorax and the lack of any black markings on the abdominal segments is well brought out here, and a comparison with the insect itself has given definite proof of its specific distinctness. It may be noted, that the darkish shade of the sixth segment, as shown on PETERSEN's figure, is due to the effects of decomposition.

L. filicauda is one of the rarest and certainly the most grotesque of all known species. So far as my own experience goes, it is confined to the higher mountain-zone of West Java, where small and isolated colonies may be found in the most humid regions of the forest. Unlike other species of *Leptopanorpa*, such as *nematogaster*, it is remarkably restricted in its habitats. On the eastern slope of Mt. Gedeh *filicauda* has established itself for years and years in a few road-side spots near the Tjibeureum-falls, where it is almost certainly to be met with during most of the year, but always solitarily. The elusiveness of these remarkable insects is best understood from their habits of rambling about among wet vegetation in the shelter of palms and ferns, usually close to the ground. When disturbed they fly up from below, settling on the broad leaves of *Begonia* and *Araceae*, and then are an easy capture.

Leptopanorpa longicauda VAN DER WEELE (Textfig. 7, pls. 5, 7, 9, 11 and 14).

1909. VAN DER WEELE, Notes Leyden Mus., 31, p. 11-13, fig. 7-8 (♂ apps.), pl. 1, fig. 5 (♂ insect). — ♂ MÜLLER, Java.
1910. ENDERLEIN, Zool. Anzeiger, 35, p. 392-393. — ♂ Soekaboemi, W. Java (*Himanturella tubifera*).
1912. ENDERLEIN, Notes Leyden Mus., 34, p. 237-238. — Remarks (*Neopanorpa longicauda* + *tubifera*).
1915. PETERSEN, Entom. Meddel., 10, p. 231, cat. no. 6 and 7. — No description (*longicauda* + *tubifera*).
1921. PETERSEN, Cat. Coll. SELYS, Mecoptera, p. 88 (pars !). — ♂ MÜLLER, Java.
1921. PETERSEN, Ibid., p. 88-89. — Original description cited (*tubifera*).
1923. KARNY, Treubia, 3, p. 382. — Remarks (*tubifera*).
1934. LIEFTINCK, De Trop. Natuur, 23, p. 66 fig. 3 (♂ insect), 69 (*tubifera*).

Material examined: — 56 males, 42 females, W. Java, northwestern slope of Mt. Gedeh, 800 m, Tapos, 1932 - 1934, all the year round, L. G. E.

KALSHOVEN and native coll.; 2 females, W. Java, Mt. Salak, 600 m, May 28, 1926, L. G. E. KALSHOVEN; 6 males, W. Java, Djampang Tengah, Mt. Tjimerang, 600 m, March 1934, and Djampang Koelon, Mt. Malang, 600 m, May 1934, M. E. WALSH.

Confined to the lower mountain zone of West Java.

♂♀. Body-colouring largely pale, marked with brown and black. Head shiny black. Antennae dark brown, except torulus and first two joints which are flesh-coloured; base of third joint reddish. Rostrum long, wholly orange-rufous in front, growing paler aside and below; palpi of the same colour, the last joint of maxillaries darkened.

Ground-colour of pro- and synthorax orange-buff. Prothorax wholly black above, sutures also black. Dorsum of meso-metathorax black, each with a large oval pale spot placed on both sides after the middle, the median third of the nota thus remaining black. Sides pale with two pairs of minute black points.

Legs pale yellowish; outer sides of all tibiae and apices of tarsal joints a little darker.

Wings narrow and rather pointed, variable in width; membrane tinged with light ochraceous buff. Markings variable to some extent, russet, cinnamon-brown, or mummy-brown; different in both sexes.

♂. Front and hind wings at least with the proximal third of the pterostigmal space brown; front wing at a maximum with complete, irregular, pterostigmal band, with a small spot in the fork between R_1 and R_{2-5} in front wing, and with a dot in the distal edge of submedian space of both pairs of wings.

Abdomen at least almost twice longer than hind wing, usually much longer. Segm. 2 a little broader than long; 3 and 4 increasingly longer, 3 longer than broad, 4 more distinctly so, almost twice longer than broad and decidedly longer than 3; 5 subequal in length to 4; 6 hardly two times longer than 5, usually distinctly bent before its middle and with apex upcurved in profile view; 7 and 8 extremely long and slender, each at least one and a half times longer than 6, 8 a little shorter than 7; 9 longly pedunculate, the stalked portion longer than the genital bulb, which is narrow and still more evenly widened apically than in *filicauda*. Third abdominal tergite produced into a slender, cylindrical, curved process, which is distinctly clubbed apicad, not reaching beyond two-fifth of the length of segm. 4; apex with a bunch of stiff, backwardly directed, dark brown hairs. The fourth tergite bears a very low mid-dorsal elevation just before the middle of segment, which is also clothed with short, backwardly directed hair.

Coloration of abdomen for the greater part pale. In well preserved specimens segm. 1 is brown above, paler aside; the tergites of 2 - 5 are tawny, each with a rather diffuse brownish side-band and with postero-lateral edges deep black, hind margin of 4 and 5 usually also finely bordered with black. Sternites of 1 - 5 orange-buff, apical edges of 2 - 5 with a jet-black dot and with the hind margins also finely bordered with black. Basal half, three-fifth,

or two-third of segm. 6 glossy dark brown to black, this colour rather suddenly passing to bright orange behind, the apical margin of this segment bordered with black. Remainder of segments lighter than the basal ones: 7 - 9 and appendages throughout light orange-yellow to orange, only the lateral and ventral edges of the apical margin of 7 and 8 with a fine black border. Appendages shaped as described earlier and as shown on pls. 9 and 11.

♀. Head and thorax coloured as in the male. Wings more heavily marked; pterostigma at least with the proximal half and the distal edge filled in with brown and with the pterostigmal fascia broken up into a few spots of variable size (sometimes reduced so much as to be entirely absent in hind wing). Front wing at a maximum with complete, though narrow, pterostigmal band, a point between M_3 and M_4 close to the wing-margin, and three dots, two submarginal (median and submedian) and one submedian (between Cu_1 and Cu_2). Hind wing at a maximum with narrow pterostigmal band, and a small submedian spot, between Cu_1 and Cu_2.

Abdomen coloured quite differently from the male. Tergites of segm. 1 - 6 unicolorous shiny black, sometimes with low metallic-green reflex; intersegmental membrane and all sternites pale in colour (usually flesh-coloured, or pale orange-yellow). Segm. 7 - 10 light red; appendages black.

Genitalia: internal skeleton small and very slender, widest behind the middle, weakly chitinised. Basal and distal plates simple, the former without any processes, the latter narrow. Cone large, narrowly ovate, almost pointed apicad. Medigynium slender, lanceolate, depressed, slightly incurved towards the apex, tips not outbent.

Size very variable. ♂ abd. + app. 20.5; fw. 12, hw. 10.8 mm (smallest specimen, Tapos); abd. + app. 33; fw. 14.5, hw. 13 mm (largest specimen, Tapos). ♂ Tapos: segm. 1 - 6 8; 7 4.3; 8 4; 9 + dististyli 4.2 mm (smallest specimen); ♂ Tapos: segm. 1 - 6 11; 7 8.2; 8 7.1; 9 + dististyli 6.7 mm (largest specimen); ♂ Mt. Malang: segm. 1 - 6 9.5; 7 5.5; 8 4.5; 9 + dististyli 4.5 mm.

♀ abd. 9 - 10.5; fw. 11.6 - 14.5, hw. 10.2 - 13.3 mm.

Although I have not been able to re-examine the type of this species, VAN DER WEELE's description of *longicauda* is sufficiently clear to enable one to differentiate this species at once from all its congeners. As appears from our description, which was compiled after studying a great many specimens, the majority of *longicauda* males have a distinct, though mostly incomplete pterostigmal band and a number of small spots on the wings, whereas specimens with poorly developed markings, or those with almost spotless wings, are much less commonly found. Unfortunately, the wings of the type are just like those of *filicauda* LIEFT., as well as those of a couple of other species with unbanded wings, described later, so that the true *longicauda* was often wrongly identified and confused with other species.

L. longicauda is at once distinguished from *filicauda* by the black head, the two oval spots on the meso- and metathorax and the black colour of the

basal half of the sixth abdominal segment. These characters, as well as the strongly curved "forceps" of *longicauda,* have explicitly been mentioned in the original description. As we will soon notice, however, the proportionate lengths of the abdominal segments 6 - 8 are incorrectly given by VAN DER WEELE, while his sketches of the 9th segment are rather poor.

One year later, ENDERLEIN described *Himanturella tubifera,* from near Soekaboemi, in West Java. I believe it for certain that we are dealing here with *longicauda;* ENDERLEIN described *tubifera* in 1910 without knowing of VAN DER WEELE's description of *longicauda;* at least he makes no references in his paper to VAN DER WEELE's insect. In 1912 *L. tubifera* is placed in the genus *Neopanorpa,* along with *nematogaster, jacobsoni* and *longicauda.* On p. 238 the author remarks: "*Neopanorpa longicauda* (V. D. WEELE) ist der *N. tubifera* (ENDERL.) sehr ähnlich, die Flügel sind ebenfalls nicht gezeichnet, aber die Längenverhältnisse der Abdomensegmente sind ganz anders." [1]). E. PETERSEN, who has neither seen *tubifera* nor the true *longicauda,* quotes ENDERLEIN's description in his monograph (1921), comparing *tubifera* with *charpentieri* (= *nematogaster* nob.) and *jacobsoni.* His statement of the upper appendages "being strongly incurved laterally at the apex, the tips being narrow and cut off" (after a sketch of the type specimen of *tubifera* END.) applies perfectly to *longicauda,* a species with which we have seen PETERSEN had no acquaintance. This is evidently the reason why PETERSEN cautiously retained *tubifera,* although he does not give an explanation.

On comparing VAN DER WEELE's incorrect measurements of the abdominal segments of the type of *longicauda* ("....the sixth nearly three times longer than the fifth, the seventh and eighth three times longer than the sixth", *loc. cit.* p. 13) with the photograph of the same specimen on pl. 1 fig. 5, it is at once evident, that these statements are absolutely wrong. ENDERLEIN then not only overlooked this error, but perpetuated the confusion in creating a new species with exactly the same characters as *longicauda.*

This decorative and equally bizarre species is apparently confined to the lower mountain districts of West Java, where it has a scattered distribution. Its absence from the northern slope of Mt. Gedeh is noteworthy and obviously due to the complete devastation of all forest below altitudes varying between 1100 and 1500 metres above sea-level. At Tjisaroea, on the northern slope of this mountain (properly of the extinct twin-volcano Panggerango), virgin forest begins at about 1000 meters and, although the condition of the soil and humidity are not noticeably different, this locality is evidently too high for *longicauda,* for the only species living here are *erythrura* and *nematogaster,* the former being a moderately common insect. At Tapos, on the northwestern slope of the said volcano, primeval forest is likewise still in existence and it is in the dampest places of the dark ravines, from 7 - 800 m above sea-level, where *longicauda* has maintained itself, forming large colonies in a few favourable spots. In the mountainous Djampang country, south of Soekaboemi, there is

[1]) The spacings are mine.

much virgin forest still left upon the hills and here also the species has hitherto found a safe refuge, but, owing to the extensive cultivation, the recesses will not long exist, as the slopes of the main valleys and their branches are everywhere cut in terraces up to a considerable height, so that many patches of forest are gone for ever.

Leptopanorpa nematogaster MCLACHLAN. (Textfig. 8, pls. 4, 8, 9, 11 and 14).

1869. MCLACHLAN, Trans. Ent. Soc. London, p. 69, pl. 4 fig. 12. — ♀ WALLACE, Java (*Panorpa*).
1875. MCLACHLAN, Ibid., p. 188. — Same specimen (*Panorpa*).
1909? VAN DER WEELE, Notes Leyden Mus., 31, p. 5 (key), 9-10, fig. 4 (apps. ♂). — ♂ MÜLLER, Java and ♂ LUDEKING, Ambarawa ((*Neo*)*panorpa*).
1910. VAN DER WEELE, Ibid., 32, p. 200. — ♂♀ Mt. Malabar, notes (*Panorpa*).
1910. ENDERLEIN, Zool. Anzeiger, 35, p. 392. — Java (*Himanturella*).
1912. ENDERLEIN, Notes Leyden Mus., 34, p. 237. — Java, not seen (*Neopanorpa*).
1914. NAVÀS, Revue Russe d'Ent., 13, p. 430, fig. 8a-c (♂ abd.-structures). — ♂♀ PLASON, Sumatra (*Neopanorpa linguata*).
1915. PETERSEN, Entom. Meddel., 10, p. 231. — Cat., Java (*charpentieri*).
1921. PETERSEN, Cat. Coll. SELYS, Mecopt., p. 87-88 (pars !). — ♂♀ Java (*charpentieri*, partim).
1922. KARNY, Natur, 13, p. 203 fig. (♂ insect). — ♂ Mt. Gedeh.
1923. KARNY, Treubia, 3, p. 381-382, fig. (♂ insect). — Same specimen.
1933. LIEFTINCK, Verslag 14e Vergad. Afd. Ned. Oost Indië, 4, p. CXIX-CXX (biological notes). — Java (*charpentieri*).
1934. LIEFTINCK, De Trop. Natuur, 23, p. 69 - 70, notes on habits (*charpentieri*).

Material examined: — 2 males (both immature and in poor condition), labelled: LUDEKING, Ambarawa (Mid Java, Samarang res.), *cotype*, Cat. no. 3, *Panorpa nematogaster* MCLACHLAN, det. R. MCLACHLAN; and MÜLLER, Java, *cotype*, Cat. no. 2, *Panorpa nematogaster* MC LACHLAN, det. R. MCLACHLAN; both specimens in Museum Leiden. — 5 males, 2 females, W. Java, Poentjak pass, forest near Telagawarna, 1450 m, March 30, 1930 and Aug. 9, 1931, AUTHOR; 13 males, 13 females, W. Java, eastern slope of Mt. Gedeh, Tjibodas, 14 - 1500 m, Aug. 1921, 1923, H. H. KARNY, July 28 and Dec. 25, 1930, Aug. 9, 1931, and Jan. 2, 1936 AUTHOR, Sept. 8, 1931, T. VAN BENTHEM JUTTING, June 26, Dec. 28, 1933, L. J. TOXOPEUS, and May 22 - 23, 1935, J. VAN DER VECHT; 1 female, W. Java, northern slope of Mt. Panggerango, Tjisaroea Est., 1300 m, Dec. 2, 1934 AUTHOR; 9 males, 8 females, W. Java, western slope of Mt. Goentoer, Kamodjang, 1450 m, April 21, 1930, AUTHOR and May 1935, H. OVERBECK; 3 males, 5 females, W. Java, southern slope of Mt. Tangkoeban Prahoe, 1500 m, Sept. 10, 1929, Dec. 7, 1933, Jan. 4, 1934, F. C. DRESCHER; 6 males, 7 females, W. Java, western slope of Mt. Papandajan, 1600 m, Oct. 1934, EDW. JACOBSON; 1 male, W. Java, Mt. Malabar, 1500 m, Jan. 1936, EDW. JACOBSON.

West and Mid Java, 13 - 1600 m alt., and Sumatra.

♂♀ (adult). Body, with the exception of the rostrum, antennae, legs and intersegmental membranes of thoracic and proximal abdominal segments, wholly black, the abdomen usually with low metallic-green or blue shine.

Rostrum orange to orange-rufous, with a longitudinal amber-brown stripe over the entire length in front; this stripe sometimes effaced, but usually rather well delimited, occasionally very dark brown. Palpi orangish, last joint of maxillaries blackish at tip. Antennae dark brown, second and base of third joint a little paler. Head shiny black. Prothorax black.

♂♀ (juv.-ad.). Colouring of meso- and metathorax variable, according to age and maturity. In very old specimens the thorax is entirely black, while only the anterior surfaces of the first pair of coxae are pale in colour. Individuals of slightly younger age have the thoracic sides, including most of the coxae chestnut-brown, and indistinct cinnamon-rufous spots upon the back. Lastly, in juvenile specimens, the whole of the thorax is ochraceous-buff or flesh-coloured, only the mesonotum being darkened in front, fading to cinnamon-rufous behind, and the hind border of metanotum black. Legs pale, ochraceous-orange to light ochraceous-buff. Outer sides of tibiae and tarsi slightly darker in old specimens, the last two joints of tarsi usually brownish.

Wings long and very narrow, evenly and but slightly widened after the middle, with apices narrower and more pointed than in *filicauda* or *longicauda;* membrane pale orange-yellow, much less intensively coloured than in *filicauda,* but darker than in *longicauda*. Pterostigma not well marked off, almost of the same tint. Wing-tips rarely somewhat smoky.

♂. Abdomen excessively slender, though scarcely twice longer than hind wings, segments very thin. Segm. 2 about as long as broad; 3 and 4 longer, 3 ca one and a half times longer than broad and scarcely shorter than 4; 4 twice longer than broad and of the same length as 5; 5 still narrower, about two and a half times longer than broad; 6 one and a half times longer than 5; 7 and 8 extremely slender, each ca one and a half times longer than 6, sometimes longer, 8 a little shorter than 7 or nearly of the same length; 9 shortly pedunculate, the stalked portion very narrow, a little variable in length but always shorter than the genital bulb, which is comparatively small. Dististyli long and very slender. Third abdominal tergite produced into a slender, cylindrical and curved process which, in side view, is distinctly hollowed out ventrally; in dorsal view it is widest at base, then slightly constricted, the apical half slender, club-shaped, slightly pilose; it reaches not beyond one-third of the length of segm. 4. The fourth tergite bears a quite distinct, rounded median tubercle, placed much before the middle of segment, which is clothed with short silvery hair.

Coloration of abdomen throughout steely black; apex of dorsal process of segm. 3, and segm. 7 - 8 sometimes with slight dark brown intermingling, distal half of distisyli also reddish-brown.

Outline of the branches of the hypandrium variable; usually the two lobes are rather roof-shaped and hence much projecting in side view, but sometimes they are rather more turned in a horizontal position, so as to appear narrow and lanceolate, less convex and less projecting in profile view; in fact each of

the lobes is rather broad after the middle and obliquely truncated apically. Appendages otherwise as described in the key and as shown in the figures.

♀. Similar to the male. Wings occasionally with smoky apices (in one specimen from Mt. Gedeh the proximal half of the pterostigmal region is darkly enfumed and the tips are also much darkened).

Abdomen throughout steely bluish black; intersegmental membranes whitish.

Genitalia: internal skeleton entirely different from any of the known species. Main portion of the chitinous body considerably enlarged, the median axis projecting far basad; laterally, the basal plates are strongly chitinised and also much larger than usual, almost as long as the medigynium. Distal plate situated nearer to the middle, decidedly expanded in a horizontal plane.

Size very variable. ♂ abd. + app. 19.5 - 26.2; fw. 12.5 - 15, hw. 11.3 - 13.6 mm. — ♂ Tjibodas and Kamodjang: segm. 1 - 6 7.5; 7 4.3; 8 4.1; 9 + dististyli 3.6 mm; fw. 12.5, hw. 11.3 mm (smallest specimens). ♂ Tjibodas and Mt. Tangkoeban Prahoe: segm. 1 - 6 10.2; 7 5.8; 8 5.5; 9 + dististyli 4.7 mm; fw. 14.5 - 15, hw. 13.6 mm (largest specimens).

♀ abd. 9 - 10.6; fw. 12 - 14.4, hw. 11 - 13 mm.

Unfortunately, there is apparently much confusion about this species in literature. *L. nematogaster* was first described by MCLACHLAN after a ♀ captured by WALLACE somewhere in Java. In 1915, E. PETERSEN placed the species as a synonym of *Panorpa charpentieri* and in his monograph reports on it: "BURMEISTER on page 957 in his "Handbuch" says that he will describe a new species from Bengal; but in his description he only gives the vague locality "Ostindien". The only true localities known to me is Java and Sumatra, so I think the occurence of the species in Bengal to be rather doubtful" (loc. cit. p. 88).

In fact, BURMEISTER, on page 957 tells us that: "die Hallenser Sammlung besitzt davon [of the genus *Panorpa s. lat.*] 3 [species], und eine neue aus Bengalen; diese 4 werde ich aufführen". Then follow the diagnoses of the 3 known species, viz., *P. scorpio* FABR. (Süd-Karolina), *P. japonica* THUNB. (Japan) and *P. communis* L. (Europe), while on p. 958 the fourth member, *P. charpentieri* [new species!] is described by that author (from: "Ostindien; beide Geschlechter vom Herrn v. CHARPENTIER mitgetheilt").

We may therefore assume that BURMEISTER's *Panorpa Charpentieri* was from Bengal, for no other species was mentioned by him from continental Asia, "Ostindien" being clearly the general indication of a habitat referred to on the previous page of BURMEISTER's account.

PETERSEN's description in the monograph is very probably based on specimens of the true *nematogaster,* although no description of the ♂ appendages is given. Of BURMEISTER's types of *charpentieri* this author remarks: "the type-specimens of BURMEISTER are somewhat immature and smaller of size than the female from Brit. Mus.". The wings of the type ♂ of *charpentieri,* reproduced on p. 87, are very similar to those of *nematogaster,* but the sketches of the ♂ abdomen

and genital bulb (figs. 98 and 99, see fig. 9) differ considerably from our drawings of Javan *nematogaster* (cf. pls. 8 and 9). Although only a comparative examination of the internal genital structures of both sexes of *charpentieri* would give a decisive answer as to the status of that species, I am inclined to regard *charpentieri* specifically distinct from *nematogaster*, thus following VAN DER WEELE, ENDERLEIN and KARNY.

Dr. BLÖTE has kindly sent me two paratype males of *L. nematogaster* from Java, both identified as such by MC LACHLAN. Unfortunately these two males are in a very dilapidated state of preservation. The ♂ collected by S. MÜLLER is a juvenile specimen with its terminal segments lost. The specimen from Ambarawa is also very immature, the abdomen being shrivelled and the genitalia distorted; this may possibly explain the greatly dissimilar structure of the internal genital apparatus, which in this specimen is shown in an unnatural position, the ventral valves of the aedeagus being twisted so much that the lateral surfaces are turned ventrad, being in the form of horizontally expanded blades, thus differing widely from those of a fully mature specimen from West Java (cf. pl. 11, figs.).

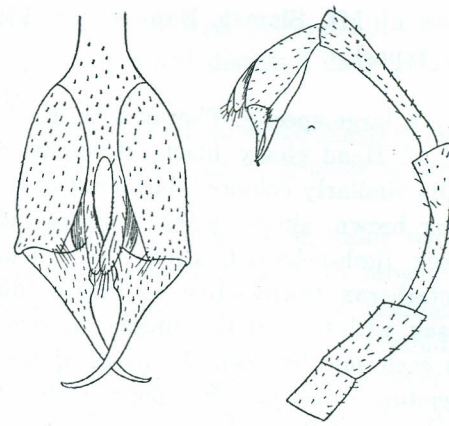


Fig. 9. — *Leptopanorpa charpentieri* (BURM.) T y p e. Ventral view of ♂ genital bulb and distal portion of abdomen. (After ESB. PETERSEN, 1921).

In the shape of their wings, and in the body-markings, these teneral individuals are exactly alike specimens from West Java, but since Ambarawa — only at 524 meters above sea-level! — is situated in cultivated country at the foot of Mt. Oengaran, it is very likely that LUDEKING's specimen came from that mountain. More material of Mt. Oengaran is urgently needed to answer the question as to whether MCLACHLAN's insect represents a distinct species or not.

ESBEN PETERSEN has examined NAVÀS's types of *Neopanorpa linguata* of Sumatra, which he found to be conspecific with *L. nematogaster*. This is the only record of it for Sumatra.

As has been pointed out by VAN DER WEELE (loc. cit., 1910, p. 200), *L. nematogaster* is a very variable species. The coloration of the thoracic segments is entirely dependent on the degree of maturity of the imago, though differences in the length of the last abdominal segments in specimens of similar size, seem to depend largely on soil- and food-conditions, in both sexes. The species is easily distinguished from its congeners by the excessive slenderness of the shiny black body, and by the genital organs and wings. *L. nematogaster* is one of the least rare members of the genus, occurring sometimes in large numbers in suitable places. Some remarks on the habits and food are to be found in the author's previous paper (1934), and on pp. 286 - 287. KARNY's drawing of the

♂ of this graceful insect (after a pinned specimen) gives a good general impression of this species.

Leptopanorpa robusta, sp. n. (Pls. 5, 8, 9, 12 and 14).

Material examined: — 9 males, 3 females, Central Java, southern slope of Mt. Slamat, Batoerraden, 950 m, Oct. 21, 1933, AUTHOR (including the types).

A large species. Thorax with much pale colouring, abdomen entirely black.

♂. Head glossy black. Rostrum ferruginous, paler aside and underneath; palpi similarly coloured, last joint of maxillary palpi darkened at tip. Antennae dark brown, almost black; torulus and first two joints pale brownish yellow. Neck flesh-coloured. Prothorax blackish brown, or black, lustreless. Meso-metathorax tawny-olive to tawny (discoloured), dorsum clearer. Mesonotum black, with the anterior suture and two large and sharply defined roundish spots on each side between the bases of front wings, cinnamon-buff; intersegmental membrane also pale in colour; metanotum with two similar, roundish spots on each side of the middle, which remains narrowly black, and with the projecting hind margin likewise pale at base, bordered with black behind. Sides cinnamon-buff, or tawny, metapleurae and coxae of posterior pair of legs very dark brown or black.

Legs including the coxae of first two pairs, ochraceous-buff; outer sides of tibiae and last three jounts of tarsi a little darkened.

Wings comparatively broad, with well rounded apices; membrane strongly tinged with pale orange-yellow, this tint slightly deeper than in *nematogaster*. Markings reduced, variable in extent, cinnamon- to mummy-brown. Front wing at least with very narrow, slightly oblique, diffuse brownish pterostigmal band; this fascia effaced posteriorly. Hind wing unmarked, pterostigma not or hardly deeper in colour than the membrane. Front wing at a maximum with complete, irregular, pterostigmal band and with two small, isolated, dark spots between M_2-M_3, and M_3-M_4 close to the wing margin (the remains of a posterior fork); hind wing at a maximum with similar, though narrow, pterostigmal fascia, which is curved somewhat basad, effaced posteriorly, terminating at M_4.

Abdomen rather robust, slightly less than twice the length of hind wing; segm. 1 - 6 gradually narrowed to behind, 7 and 8 long and very slender. Segm. 2 a little broader than long; 3 to 5 equal in length, 3 longer than broad and almost one and a half times longer than 2; 4 narrower, nearly one and a half times longer than broad; 5 short and narrow, one and a half times longer than broad; 6 tubular, more than one and a half times longer than 5; 7 and 8 subequal in length, each about twice longer than 6; 9 shortly pedunculate, the stalked portion thick and evenly widened distally, much shorter than the genital bulb, which is considerably widened apically and of robust building. Forceps short and thick, tips strongly incurved. Third abdominal tergite produced into a slender, almost straight, cylindrical process, which in side view is but

little concave ventrally, apex furnished with backwardly directed blackish hair; in dorsal view it is scarcely widened towards apex, which is rounded and slightly clubbed; this process is somewhat shorter than half the length of segm. 4. The fourth tergite is of simple structure and devoid of any dorsal protuberances.

Coloration of abdomen deep black; segm. 1 - 6 with low metallic-green shine. Tips of dorsal process of segm. 3, appendages and dististyli dark reddish brown. Genitalia as described and figured.

♀. Head as in the opposite sex. Rostrum in two out of three specimens darker in front than in male, basal third dark reddish-brown, growing paler towards apex.

Wings similar in principle; pterostigmal fascia complete in front wings of all specimens and distal edge of pterostigma also filled in with brown in two females. Front wing in all specimens with two more or less confluent brown spots between M_{2-3} and M_{3-4}, close to the wing margin and a trapezoidal (submedian) spot of variable shape along Cu_1; one female has moreover a minute spot placed upon the middle of the stalk of R_{2-5} and two others have a similar spot upon $R_{4\ 5}$, just beyond the radial fork. In the distal portion of the front wing further spots are absent (one specimen), or there is a maximum of two confluent transverse spots between R_3 and M_1 (2 specimens).

Abdomen throughout steely bluish-black; intersegmental membranes pale.

Genitalia: internal skeleton with the median tube long and inflated basally; basal plate well developed, strongly chitinised, forming two rounded tubercle-like projections which are separated anteriorly by a shallow depression. Distal plate expanded horizontally, evenly widened to behind; medigynium long and broadly lanceolate, directed almost straight backwards and lying in a horizontal plane.

Size variable. ♂ abd. + app. 20.3 - 24.2; fw. 13.7 - 14.9, hw. 12.3 - 13.3 mm. — Segm. 1 - 6 8.2 - 9.5; 7 4.1 - 5; 8 4.1 - 5; 9 + dististyli 3.9 - 4.7 mm. ♀ abd. 7.9 (shrivelled), 9.9 or 10.1; fw. 11.8, 14.3, 14.8; hw. 10.3, 12.7, 13.5 mm.

By its spotted wings, absence of a dorsal tubercle on the middle of the fourth abdominal tergite, and by the very robust pear-shaped genital bulb, this large and handsome species is easily distinguished from other black-bodied members of the genus.

Few specimens only were found in damp places of the forest, keeping company with *L. pi decorata* m.

Leptopanorpa erythrura, sp. n. (Textfig. 6, pls. 4, 7, 9, 12 and 14).

1933. LIEFTINCK, Verslag 14e Vergad. Afd. Ned. Oost Indië, 4, p. CXIX-CXX (biological notes). — Java (*nom. nud.*).

1934. LIEFTINCK, De Trop. Natuur, 23, p. 65 fig. 2 (♂ insect). — W. Java (*nom. nud.*).

1935. HANDSCHIN, Revue Suisse Zool., 42, p. 708. — W. Java (LIEFT. *in litt.*).

Material examined: — 15 males, 12 females, W. Java, northern slope of Mt. Panggerango-Gedeh, Tjisaroea Est., 1000 - 13000 m, Aug. 10 and

Dec. 14, 1930, Jan. 11 (ED. HANDSCHIN and AUTHOR), July 19, Oct. 11 and Nov. 1, 1931; Sept. 15, 1933; Febr. 28 and Dec. 2, 1934; all AUTHOR coll. 1 male, W. Java, southern slope of Mt. Megamendoeng, 1000 m, Nov. 1, 1931, AUTHOR. 22 males, 20 females, W. Java, Mt. Bèsèr, near Tjiandjoer, 1250 m, Aug. 30, Sept. 30, 1934 and March 16, 1936, H. R. A. MULLER and AUTHOR. — Holotype ♂ and allotype ♀: Mt. Panggerango, Tjisaroea, 1100 m, Jan. 11, 1931, AUTHOR.

West Java, 10 - 1300 m.

A very distinct species, characterized by its short and thick-set abdomen, by its pale colours, and by its narrow wings.

♂. Head shiny black. Rostrum flesh-ocher to rufous, usually rather darkened in front, especially over the basal half, chestnut-brown, limits indistinct. Palpi similar in colour, maxillaries with the last joint darkened at tip. Antennae very dark brown, torulus and first joint pale yellow, second and base of third joints rather reddish. Thorax light ochraceous-buff to flesh-ocher. Anterior lobe of prothorax broadly margined with black and mesonotum also dark brown or black, adorned with two large, roundish pale spots, placed on each side between the bases of front wings. Metanotum with the middle portion and the carinae only black, so that two similar pale side-spots, placed between the bases of hind wings, are surrounded by black. Metascutum cinnamon-rufous, darkened posteriorly.

Legs, including the coxae, light ochraceous-salmon or light buff, outer sides of tibiae and apical joints of tarsi a little darker.

Wings narrow, evenly widened distally, apices rather pointed; membrane, though strongly tinged with pale yellow-orange, less intensively coloured than in *robusta*. Markings reduced, dark and opaque, mummy-brown in colour, restricted to the pterostigmal area. Front wing at least with the proximal two-thirds of the pterostigma filled in with brown; this wing at a maximum with the distal edge of the pterostigma also filled in with brown and with a narrow, irregularly triangular, postero-basal prolongation, which ceases at the common stalk of M_{1-2} or enters the first cell between M_{2-3} (in most specimens this basal off-shoot is poorly developed and very often altogether wanting). In a few specimens there are, in addition, two very small submedian spots, one in the fork between R_1 and R_{2-5} and one between Cu_1 and Cu_2. Hind wing at least with the proximal two-thirds of pterostigma brown, this spot often slightly projecting inward but never surpassing R_5.

Abdomen stout and of compact build, from 3.3 to only 1 mm longer than hind wing and sometimes of the same length as front wing (specimens from Mt. Bèsèr). Segm. 2 about 1½ times broader than long, 3 a little longer and likewise broader than long; 4 and 5 short, subequal in length, each less than 1½ times longer than broad (about twice longer than segm. 2); 6 about twice longer than 5, and only three times longer than broad; 7 and 8 short and comparatively thick, each but little longer than 6, their narrowest point lying

at extreme base; 9 sessile, or with a very short stalk, genital bulb large and very thick, widest at middle. Dististyli rather short, though slenderly built, incurved at apices. Third abdominal tergite produced into a slender, slightly curved, cylindrical process, which in side view is widest at middle, then rather concave ventrally, the apex furnished with a bunch of backwardly directed, ferruginous hairs; in dorsal view it is very slender, not or scarcely widened towards apex, which is rounded; this process is ca. half so long as segm. 4, or a trace longer, but does not extend beyond the middle of that segment. The fourth tergite bears a strong knob-like protuberance upon mid-dorsum, placed just before the middle of segment.

Coloration of abdomen pale. In well preserved specimens the tergites of segm. 1 - 5 are progressively lighter, amber brown or hazel on segm. 2 and 3, turning to cinnamon-rufous on 4 and 5; the sternites of these segments are apricot-buff or flesh-ocher. There is a well marked deep black streak on each side along hind margin of segm. 3, and the dorsal tubercle of 4 is slightly brownish above. The segments 6 to 9 are lighter and more vividly coloured than the preceding ones: throughout apricot-orange, or rufous, with no dark markings other than a deep black streak, one on each side, bordering the posterior margin of 6, 7 and 8, and the whole of the hypandrium of segm. 9, which, accordingly, is quite conspicuous. The branches of the hypandrium are in the form of much projecting, and strongly vaulted, golfstick -shaped processes. Epiandrium and dististyli rufous. Genitalia otherwise as described earlier and as appears from the figures.

♀. Head and thorax coloured as in the opposite sex. Rostrum usually darker in front than in the male, chestnut-brown above and pale yellow below in the majority of specimens.

Wings similar, but markings generally more extensive; these at least similarly developed as in heavily marked males, and always with a small brown spot in the fork between R_1 and R_{2-5} of front wing; the maximum development of wing-markings is shown on pl. 4.

Abdomen with the tergites of segm. 2 - 6 throughout steely greenish-black and with the sternites of these segments light buff to flesh-ocher. Segm. 7 - 10, with the exception of the ninth tergite, which is *black,* throughout apricot-orange or rufous. Appendages black, slightly darkened at base.

Genitalia: internal skeleton with the median tube strongly developed, subcylindrical in form; proximal portion with a robust subtriangular lateral cone which is directed slightly ventrad. Basal and distal plates weakly chitinized, merging into one another and evenly curved in a horizontal plane; medigynium broadly lanceolate, twisted on itself and extending backwards in a vertical plane, with slightly outcurved tips.

Size variable. ♂ abd. + app. 11.5 - 15.8; fw. 11.6 - 14, hw. 10.5 - 12.4 mm. — Segm. 1 - 6 5 - 6.2; 7 2.1 - 3.1; 8 2 - 3; 9 + dististyli 2.4 - 3.5 mm.

♀ abd. 7 - 9.2; fw. 11.3 - 14; hw. 10.2 - 13 mm.

Locally abundant in dense jungle, forming large colonies in the dampest places of the forest. An easily recognized species, distinguished from all others by the thick-set and rather short abdomen, and by its conspicuous, delicate colours. The male is at a glance distinguished from its congeners by the deep black genital valves which contrast so strikingly with the reddish tint of the bulb.

Leptopanorpa inconspicua, sp. n. (Pls. 4, 8, 9, 12 and 14).

Material examined: — 2 males (ad.), 1 female (slightly juv.), W. Java, Djampang distr., Soekanegara, ca. 1100 m, Dec. 26, 1931, in damp forest, AUTHOR (including the types).

A small, darkly coloured species, with short abdomen and narrow wings.

♂. Head shiny black. Rostrum dark in front, mars-brown, fading to cinnamon-rufous aside and underneath, base light ochraceous-buff below. Palpi cinnamon-rufous, last joint of maxillary palpi darkened at tip. Antennae blackish-brown, torulus and first joint light buff. Neck also pale in colour.

Prothorax black, side-margins paler. Ground-colour of meso-metathorax russet to cinnamon-brown (colours faded); sides unmarked, except two pairs of blackish points on meso- and metapleurae, and the posterior half of third pair of coxae, which are dark brown. Meso- and metanotum with the sutures and two pairs of large roundish spots (placed on either side between the bases of the wings, and very similar to *erythrura*), cinnamon-brown; metascutum black.

Legs, including first two pairs of coxae and most of the posterior pair, dirty ochraceous-tawny. Last three tarsal joints slightly darkened apically.

Wings narrow, evenly widened, tips rather pointed, similar in outline to *erythrura;* membrane strongly tinged with pale yellow-orange (also much as in *erythrura*). Markings reduced, cinnamon- to chestnut-brown, restricted to the pterostigmal area and continued obliquely inward to the middle of the wing (pl. 4), or only the proximal ¾ of the pterostigma filled in with brown (paratype). In the front wings of both males a minute brownish spot is present in the space between the fork of R_1 and R_{2-5}; for the rest the wings are unmarked in the paratype specimen.

Abdomen short and compact, similar in shape to *erythrura,* but segments 6 - 8 comparatively shorter. Segm. 2 and 3 subequal in length, about as long as broad; 4 and 5 a little longer than broad, both of the same length and longer than 2 and 3; 6 short, about 1½ times or slightly more longer than 5 and about twice longer than broad; 7 and 8 short but rather slender, less abruptly widened after the base than in *erythrura,* 8 a little shorter than 7; 9 almost sessile or very shortly stalked, genital bulb greatly developed, broadly ovate in outline and much swollen. Dististyli rather short, broad at base, distal halves slender and evenly curved inwards. Third abdominal tergite produced into a slender, hardly curved, cylindrical process, which in side view is a little concave ventrally, the concavity lying much beyond the middle of

its length; apex rounded, furnished with a bunch of backwardly directed blackish hairs; in dorsal view the process is narrow and not widened distally, reaching to slightly over the middle of segm. 4. The fourth tergite bears a strong knob-like mid-dorsal protuberance, situated immediately before the middle of the segment.

Coloration of abdomen steely black, with slight greenish lustre. The visible part of segm. 1 pale in colour, and distal half of dististyli ferruginous. Genitalia as described earlier and shaped as in the figures.

♀ (juv.). Very similar to the male. All colours a little paler. Wing-membrane slightly yellowish. Markings better developed. Front wing with complete, though narrow, irregular pterostigmal fascia, two distinct brown submedian spots (one in the spaces between Sc-R_1, R_2-R_5 and R_{2-5}-M, and an elongate spot between Cu_1 and Cu_2), a confluent spot between M_2 and M_4 close to the wing-margin, and a point between R_3 and R_4 at level of the end of R_1. Hind wing with complete pterostigmal fascia almost identical in shape, and with a vestige of a spot between Cu_1 and Cu_2.

Abdomen with the tergites of all segments steely greenish-black; sternites of segm. 2 - 5 dark brown, with greenish lustre; remainder discoloured.

Genitalia: internal skeleton very similar to that of the preceding species but of heavier build and with the fused basal and distal plates more strongly chitinized. Proximal end of the median tube with three indistinct knob-like tubercles, but without any indication of lateral processes. Medigynium evenly twisted, very slender apically.

♂ abd. + app. 13.2 - 13.5; fw. 12, hw. 11 mm. — Segm. 1 - 6 5.6 - 5.8; 7 2.6 - 2.7; 8 2.3 - 2.4; 9 + dististyli 2.6 - 2.7 mm.

♀ abd. 6.3 (shrivelled); fw. 12.2; hw. 11.3 mm.

Leptopanorpa jacobsoni (VAN DER WEELE) (Pl. 4).

1909. VAN DER WEELE, Notes Leyden Mus., 31, p. 10-11 fig. 5-6 (♂ genital bulb and apps.), pl. 1 fig. 4 (♂ insect). — ♂ JACOBSON, Mt. Oengaran (*Panorpa*).
1913. PETERSEN, Ibid., 35, p. 228. — No description; ♂ JACOBSON, Mt. Oengaran.
1915. PETERSEN, Entom. Meddel., 10, p. 231, cat. no. 8.
1921. PETERSEN, Cat. Coll. SELYS, *Mecoptera*, p. 89. — ♂ described (no locality given).

Material examined: — 1 ♂ (sub-adult, abd.-segm. 7 - 10 missing, labelled: "E. JACOBSON, Goenoeng Oengaran, Java, Sept. 1910" (printed), "*Leptopanorpa jacobsoni* WEELE ♂, det. ESB. PETERSEN", in Mus. Leiden.

Of this fine and very distinct species only three males are known. The type was discovered by JACOBSON on Mt. Oengaran as early as in October, 1905, and is still in the Leiden Museum collection. Of the two other specimens, both topotypical and captured five years later by the same collector, one is in PETERSEN's collection and the second one in the Leiden Museum. It has been my privilege to examine one of these, which, unfortunately, lacks part of the abdomen so that no discussion and figures of the genital organs can be added to my description. The terminal segments, however, are well figured by VAN

DER WEELE and the sketches published by him agree very well with an outline drawing of the genital bulb of the type, made for me by Dr. H. C. BLÖTE, so that only the internal genitalia remain to be studied.

L. jacobsoni differs from all other known species by the yellow thorax and the black abdomen, which, together with the presence of a well defined apical band of the wings, are sufficient characters in discriminating the species from its allies.

The incomplete specimen, now before me, may be described as follows.

♂ (not fully ad., plesiotype). Head shiny reddish-black, with an indistinct reddish spot on each side along the eye-margin. Rostrum long and slim, with a longitudinal, glossy amber-brown stripe in front, shading to ferruginous and ochraceous-buff aside; below also pale in colour. Palpi orangish, distal half of last maxillary joint brown. Antennae dark brown; first two joints cinnamon-coloured, each with a blackish spot in front.

Prothorax brownish black, the posterior lobe orange-yellow and an indistinct median spot brownish. Thorax throughout deep chrome, anterior coxae and a small area below mesonotum pale orange-yellow. Anterior half of mesonotum Sanford's brown, turning paler behind.

Legs pale orange-yellow, apices of first tarsal joints and last two joints entirely, brownish.

Wings long, evenly and strongly widened after the middle (widest at the end of pterostigma), apices rather suddenly narrowed and finally somewhat pointed; membrane pale orange-yellow, this tint deepened at base and in the pterostigmal area; unmarked, except a well defined cinnamon-brown apical band whose inner margin is straight.

Abdomen slender, evenly narrowed to behind; shape of the existing segments unimpaired: 2 as long as broad; 3 almost 1½ times longer than 2 and as much longer than broad; 4 and 5 subequal in length, slightly longer than 3 and each about twice longer than broad; 6 long and tubular, amply 1½ times longer than 5. Remainder of segments missing. The process of the third abdominal tergite very similar in shape to *nematogaster*, though less curved as seen from aside and still broader at base in dorsal aspect; the apex is distinctly clubbed and provided below with short blackish hairs. Dorsal protuberance of segm. 4 small but quite distinct, situated much before the middle of segment.

Coloration of abdomen throughout steely greenish-black.

In the type the 7th and 8th abdominal segments are said to be relatively shorter than in *nematogaster*, the 9th segment being somewhat shorter pedunculate and narrower, with the tips of the dististyli more strongly crossed. The genital valves (*brhyp*) are narrower and "acutely angulate" in side view. From VAN DER WEELE's photograph of the whole insect segm. 7 and 8 appear subequal in length and about 1½ times longer than 6. The genital bulb is narrow basally, then much widened, the greatest width lying at extreme end.

Our specimen differs from the type by its larger size and slightly paler colours, the dark colouring on the anterior half of mesonotum being still very indistinct.

Size apparently variable. ♂ (type) abdomen 20, fw. 11.5, hw. 11 mm (*sec* VAN DER WEELE). ♂ (plesiotype) abd.-segm. 1 - 6 10, fw. 14.5, hw. 13.5 mm. ♂ (PETERSEN's specimen) abdomen 25, fw. 15, hw. 13 mm (*sec* PETERSEN).

This species has much in common with *L. sarangana,* with which it is closely allied. The chief differences are given in the key to the species; the outline of the wings as well as their markings are very distinctive. From *L. nematogaster* our species differs by its robustness and pale thorax; it is at once distinguished from that species by the genital organs and by the shape and markings of the wings. The ♀ is unknown.

Leptopanorpa sarangana, sp. n. (Pls. 5, 8, 10, 13 and 14).

Material examined: — 2 males (one in poor condition), 4 females (ad.) East Java, Mt. Lawoe, Sarangan, 1350 m, Jan. 10, 1930, W. M. DOCTERS VAN LEEUWEN, and June, 1932, J. G. BETREM. — Holotype: ♂ Mt. Lawoe, Sarangan, 1350 m, June 1932, J. G. BETREM; allotype: ♀ topotypical, Jan. 10, 1930, W. M. DOCTERS VAN LEEUWEN.

Allied to *L. jacobsoni.*

♂ (ad., type, June 1932). Head glossy black. Rostrum orange in front, fading to ochraceous-orange or ochraceous-buff below; palpi tawny, tips of last joint brownish. First two antennal joints and base of third joint ochraceous-orange, slightly darkened at end; next joints very dark brown, apical joints again a little lighter.

Prothorax mummy-brown, almost black, posterior lobe rather russet.

Meso- and metathorax, inclusive of the legs, throughout ochraceous-orange; anterior border of mesonotum indistinctly russet, this tint soon fading away posteriorly; metascutum also darkened behind. Outer side of hind tibiae and last tarsal joints slightly brownish.

Wings broader and more widened at middle than in *jacobsoni,* apices rather rounded; membrane pale orange-yellow, basal third of the wings more intensively coloured so. Front and hind wings with a sharply delimited, wedge-shaped, mummy-brown pterostigmal band; this is widest anteriorly, filling up the entire pterostigmal area, then tapers rapidly toward the opposite side of the wing, terminating at M_4 in front wing and at the fork of M_{1-2} in hind wing. The inner and outer limits of this spot are regularly convex, so that they are rather triangularly pointed to behind. Apices of both front and hind wings with a sharply defined, very oblique, mummy-brown spot, the inner margin of which is nearly straight, forming almost a straight angle with the outer margin of the pterostigmal fascia, from which it is separated along margin by a narrow space.

Abdomen slender, shaped much as in *jacobsoni,* 1½ times longer than hind wing; basal segments somewhat slenderer, progressively longer to behind: 2 a little broader than long; 3 somewhat longer than broad; 4 very little longer than 3 but 1½ times longer than broad; 5 distinctly longer than 4 and about

2½ times longer than broad; 6 tubular, almost 1½ times longer than 5; 7 and 8 very slender, 7 less than 1½ times longer than 6 and a little longer than 8; 9 shortly but distinctly pedunculate, the stalk much shorter than genital bulb, which is rather broad and evenly widened to behind. Branches of ventral appendages projecting and strongly hollowed out in their distal part, longer than genital bulb. Genitalia otherwise as described earlier. Dorsal process of third abdominal tergite long, very slender, cylindrical; in side view it is almost straight above, but beneath a little excavated after the middle, with rounded tip bearing short reddish hairs; in dorsal view it is finger-like and very slender, lacking the basal widening as is seen in *jacobsoni*. This process reaches about half the length of segm. 4, which is provided with a stout, knob-like median tubercle, placed just before the middle of the segment.

Coloration throughout shiny black with slight steely green reflections. Tip of dorsal process of segm. 3, extreme base of segm. 9 and distal half of dististyli reddish.

♂ (paratype). This is a larger specimen, differing from the type only by the wing-markings, which are slightly more extensive: in the front wing the pterostigmal fascia is continued on to the posterior margin in a very irregular manner, and the apical spot touches the pterostigmal one along anterior margin of hind wing (pl. 5). Most of the abdomen is wanting.

♀. This sex differs from the male in that the rostrum is entirely orange; in one (alcoholic) specimen (allotype, Jan. 10, 1930) the thorax and legs also are bright orange, and the first antennal joint is not spotted with brown anteriorly.

Wings shaped and tinged as in the male; arrangement of dark markings quite similar in principle. In all specimens the pterostigmal band is c o m p l e t e and but slightly indented or constricted on middle; its posterior portion narrower and with parallel sides. The apical spot is not different in shape from the male in the hind wings, but in the front wings of two specimens, including the allotype, this band is at first rectangulate and then curves outwards, ceasing at the point where R_5 reaches the wing-margin.

Abdomen unicolorous black, all segments with metallic-green shine.

Genitalia: internal skeleton with the median tube reduced and somewhat similar in shape to that of *filicauda* and *longicauda*. Basal plate greatly developed and strongly chitinised, extending proximad well beyond the base of the median tube. Distal plate rather expanded laterally; medigynium slightly incurved and extending to behind in a horizontal plane.

Length variable. ♂ (type) abd. + app. 17.4, fw. 12.8, hw. 11.6 mm. Segm. 1 - 6 8; 7 3.3; 8 3; 9 + dististyli 3.1 mm. — ♂ (paratype) fw. 13, hw. 12 mm.

♀ abd. (shrivelled) 7, fw. 13, hw. 12 mm (allotype); fw. 11.5 - 12, hw. 10.3 - 11.3 mm (paratypes).

A handsome and very distinct species, peculiar by the rich red colour of the thorax, and by the sharply pronounced pattern of the wings.

Leptopanorpa pi pi (VAN DER WEELE) (Pls. 6, 8, 10 and 13).

1909. VAN DER WEELE, Notes Leyden Mus., 31, p. 8-9 fig. 3 (♂ apps.), pl. 1 fig. 3 (♀ insect). — ♂♀ JACOBSON, Mt. Oengaran (*Panorpa pi*).
1912. ENDERLEIN, Ibid., 34, p. 238 (key). — Java, not seen (*Campodotecnum pi*).
1913. PETERSEN, Ibid., 35, p. 229 (pars !). — No description; ♂ JACOBSON, Mt. Oengaran (*pi*).
1915. PETERSEN, Entom. Meddel., 10, p. 231, cat. no 10. — No description (*pi*).

Material examined: — 1 male (adult), labelled: "E. JACOBSON, Goenoeng Oengaran, Java, Sept. 1910 (printed), *Leptopanorpa pi* WEELE ♂" (in PETERSEN's handwriting), in Mus. Leiden.

The only specimens of the typical *pi*, described by VAN DER WEELE, are a pair in the Leiden Museum, captured by E. JACOBSON on Mt. Oengaran, in October 1905, and a topotypical male, likewise collected by JACOBSON, recorded by PETERSEN in 1913. The type is an immature specimen in poor condition, while PETERSEN's male, on which the following description is based, is fully adult, allowing a closer examination of structural details.

In the Selysian monograph of the *Mecoptera*, PETERSEN described a male from Nongkodjadjar, collected by JACOBSON, which is wrongly placed under this species; the specimen described there belongs to *L. peterseni* (see under that species).

♂ (adult, plesiotype, Mt. Oengaran): Head shiny black. Rostrum very dark in front, basal side-edges and under-surfaces ochraceous. Palpi ochraceous, last maxillary joint darkened. Basal half of antennae, including the first joints, almost black, distal half gradually a little lighter, auburn. Prothorax, except the lower anterior ridge and two indistinct pale spots along posterior margin, black. Ground-colour of meso-metathorax orange-buff, dorsum marked with black. Mesonotum dull black, with the sutures and two large roundish posterior spots, one on each side between the bases of front wings, orange-buff; metanotum likewise black, with two similar spots on each side and with the metascutum also lightly coloured along base. Sides, including the coxae, pale in colour with no other markings than two pairs of conspicuous black points on meso- and metepimerum.

Legs throughout pale orange-yellow; last tarsal joints slightly obscured.

Wings long and rather broad, evenly widened after the middle, apices rather rounded. Membrane almost clear; front and hind wings with sharply defined, strongly angulate, cinnamon-brown pterostigmal fascia, shaped as is shown on pl. 6, and with the apices of front wings distinctly smoky (tips of hind wings slightly so).

Abdomen almost 1½ times longer than hind wings. Segm. 2 - 6 progressively longer; 2 a little broader than long and slightly shorter than 3; 3 equally long and broad and slightly shorter than 4; 4 a little longer than broad and slightly shorter than 5; 5 about 1½ times longer than broad; 6 tubular, almost twice longer than 5 and three times longer than its greatest width; 7 and 8 very

slender, both less than 1½ times longer than segm. 6, 8 a little shorter than 7; 9 shortly pedunculate, genital bulb large, narrow at base, strongly widened distally. Third abdominal tergite produced into a slender, very little curved, cylindrical process, which in side view is a little shorter than half the length of segm. 4 and but slightly pilose; in dorsal view it is thin and not clubbed apically. The fourth tergite bears a distinct knob-like mid-dorsal protuberance, placed just before the middle of segment.

Abdomen dark in colour; segm. 2 - 6 steely black, remainder of segments very dark brownish black, extreme base of segm. 9 and distal halves of dististyli ferruginous. Genitalia as described in the key and as shown in the figures.

♀. A description of this sex has never been published, although VAN DER WEELE gave a photograph of it, and in this the wing-markings are well brought out. In the front wing the posterior branch of the π-shaped pterostigmal band is narrow and reaches the wing-margin; in the hind wings the posterior off-shoot is incomplete and pointed.

Only a single female has been made known, and I have been unable to examine the genital organs.

Type measurements: ♂ abdomen 15, fw. 12.5, hw. 11.5; ♀ abdomen 10, greatest width of front wing 3, idem of hind wing 2.75 mm (*sec* v. D. WEELE). Plesiotype ♂: abd. + app. 17.3; fw. 13.5, hw. 12 mm. — Segm. 1 - 6 7.4; 7 3.5; 8 3.1; 9 + dististyli 3.3 mm.

Leptopanorpa pi decorata, subsp. n. (Pls. 6, 8 and 10).

1934. LIEFTINCK, De Trop. Natuur, 23, p. 65 fig. 1 (♂ insect). — Mt. Slamat (*L. brachyura, nom. nud.*).

Material examined: — One male (ad.), Central Java, southern slope of Mt. Slamat, ca. 1000 m, Oct. 21, 1933, AUTHOR; taken in company with *L. robusta* m. — The specimen is the holotype.

The single specimen of this richly coloured insect looks quite different at first sight from typical *pi*, but a closer examination of the genital organs afforded no differences of sufficient importance to give it specific rank. Although of slightly smaller size and more compact build, the proportionate length of the separate abdominal segments were found to be approximately the same in the two insects compared; and as no differences in the colour-pattern of the body exist, the two forms are here regarded as races of but a single species.

Besides being smaller, *L. pi decorata* differs from the typical race by the ground-colour of the thorax being more obscured, and by the wing-markings, which are much more extensive. The following is a comparative description of the insect.

♂ (ad.). Rostrum shiny black, basal side-edges and beneath auburn. Basal half of antennae black, distal half gradually somewhat lighter. Ground-colour of meso- and metathorax obscurely tawny, coloured much as in *robusta;* black

pattern of meso- and metanotum not different from typical *pi*, the pale roundish spots rather obscured. Legs similar.

Wings not different in outline; membrane hyaline, markings as on pl. 6.

Abdomen less than 1½ times longer than hind wing. Ratio of segments similar to *pi*. Process of third abdominal tergite almost straight and slightly more thickened apically. Fourth tergite as in the typical race.

Coloration, except the middle of first segment (which is pale), throughout steely black. Apices of dististyli ferruginous. Genital bulb and appendages not appreciably different in structure. Internal genital organs identical.

Abd. + app. 14.5, fw. 12, hw. 10.2 mm. — Segm. 1 - 6 6.2; 7 2.8; 8 2.5; 9 + dististyli 3 mm.

♀. Unknown.

Leptopanorpa javanica (WESTWOOD) (Pls. 6, 7, 10, 12 and 14).

1846. WESTWOOD, Trans. Ent. Soc. London, 4, p. 186. — ♂♀ Java (*Panorpa*).
1852. WESTWOOD, Ibid, 1 (ser. 2), p. 5. — ♂♀ Java (*Panorpa*).
1853. WALKER, Cat. Neur. Brit. Mus., p. 460. — Java (*Panorpa*).
1909. VAN DER WEELE, Notes Leyden Mus., 31, p. 6. — Short notes on ♂ Java & Sumatra in Brit. Mus. (*Panorpa*).
1910? ENDERLEIN, Zool. Anzeiger, 35, p. 391. — ♂♀ N. E. Sumatra (*C. javanicum*, type of genus *Campodotecnum*).
1912. ENDERLEIN, Notes Leyden Mus., 34, p. 236-237 (notes), 239 (key). — (*Campodotecnum javanicum*).
1913. PETERSEN, Notes Leyden Mus., 35, p. 229. — No description; ♂♀ JACOBSON, Noesa Kambangan, Java.
1915. PETERSEN, Entom. Meddel., 10, p. 231, cat.-no. 9. — Java.
1921. PETERSEN, Cat. Coll. SELYS, Mecoptera, p. 89-90 (*pars* ?), fig. 100 (wings ♂ Noesa Kambangan, Java). — ♀ ?Burma, ♀ ?Hainan, ♀ ?Sumatra; ♀ HORSFIELD, Java; ♂♀ JACOBSON, Java).

Material examined: — 1 male, M. Java, Banjoemas, isle Noesa Kambangan, March 1911, E. JACOBSON, labelled: *Leptopanorpa javanica* WESTW. (in PETERSEN's hand); 2 females, M. Java, Semarang, no. 10, 1924 - 1928, "teak-forest", L. G. E. KALSHOVEN; 1 male, SW. Java, coastal forest around Sempoertjondong (Tjidaoen), 100 m, Sept. 5, 1935, MAX BARTELS JR.

So far known restricted to the wooded lowlands of Southwest and Mid Java, and ? Sumatra.

♂♀. Body, with the exception of the rostrum, entirely black. Wings heavily marked.

♂. Head shiny black; rostrum comparatively long, ochraceous-orange, not darkened in front. Palpi also orangish, maxillaries with the distal half of the last joint brown. Antennae very dark brown, torulus and first joint pale yellow, second joint reddish at base. Pro- and synthorax unicolorous dull black; meso- and metapleurae with faint reddish-brown hue. Intersegmental membranes colourless.

Coxae dark reddish-black. Legs otherwise entirely ochraceous-buff, outer sides of tibiae and last tarsal joints slightly darker.

Wings broad, apices much rounded; membrane h y a l i n e. Markings well-developed, very extensive, cinnamon-brown in colour. Front and hind wings very similar to the figure on pl. 6 (♀), but with the pterostigmal and apical bands only narrowly confluent along costal margin; the hyaline marginal fenestra between the fork of the pterostigmal band in hind wing is equal in width to the basal off-shoot of this band, and o p e n (not bordered with brown) behind. In both pairs of wings the two hyaline spaces in the outer half of the wings, though transparent, are milky-white.

Abdomen stout but rather long, over one and a half times longer than wing. Segm. 2 a little broader than long; 3 somewhat longer than 2 and squarish; 4 hardly longer than 3 but a little longer than broad; 5 a little longer than 4 and fully 1½ times longer than broad; 6 tubular, about 1½ times longer than 5 and about three times longer than its width at base; 7 and 8 very slender, each a little less than 1½ times longer than 6, 8 somewhat shorter than 7; 9 shortly pedunculate, almost sessile, genital bulb large and rubust, widest apically. Dististyli very long, of slender build, slightly incurved at apices.

Third abdominal tergite produced into a slender, almost straight, cylindrical process, which is of equal width throughout, its swollen apex furnished with a bunch of very short, backwardly directed black hairs. In the specimen from Noesa Kambangan this process is a little shorter than half the length of segm. 4, but in our second male it is longer, reaching beyond the tubercle of segm. 4. The fourth tergite bears a distinct, knob-like protuberance, placed upon the middle of the segment.

Coloration of abdomen throughout shiny black with faint metallic-blue shine; intersegmental membranes between basal segments dirty ochreous. Dorsal appendage and dististyli dark reddish-brown. Epiandrium escutcheon-shaped with the apex slightly projecting at middle, but with rounded margin. Branches of the hypandrium convex, long and straight, sub-parallel, tips broadly rounded is ventral view. Genitalia otherwise as described earlier and as appears from the sketches.

♀. Head and thorax coloured as in the male. Rostrum of the same striking orangish tint. In one specimen the legs are a little darker.

Wing-markings much as in the male, though slightly more extensive, and not different in the two specimens. No milky-white fenestrae.

Genitalia: internal skeleton very short and comparatively broad. Basal plate in the form of two wing-like structures, which are rather twisted and turned dorsad; mesially the two portions converge and are connected with each other by a thin membrane. Distal plate well demarcated; medigynium closely apposed to the body-wall and not clearly delimited dorsally (pl. 14).

Length: ♂ abd. + app. 20.6; fw. 13.3, hw. 12 mm. — Segm. 1 - 6 9; 7 3.9; 8 3.7; 9 + dististyli 4 mm.

♀ abd. ca. 8.5; fw. 11.5 - 12.3; hw. 10.2 - 10.8 mm.

This interesting scorpion-fly is apparently the only one having essentially coastal habitations, avoiding the highlands. Although very local and obviously a rare species, *javanica* may turn up in various other districts of the southern and northern residencies of the island.

The two males agree closely with one another, but I am not quite certain about the females from Semarang, which may belong to a distinct species. The wings, of course, are like those of the males, but it is a common phenomenon among Panorpidae that those species inhabiting low country have the wings more strongly pigmented and more heavily marked than those of higher altitudes, and so we may expect two different species in low country with approximately the same wing-pattern.

From South Java — typical *javanica!* — I have only seen the male, whereas from the djati-forests along the northcoast only females are at present available; hence, it remains an open question whether or not the northern individuals belong to a different species. The wing-markings are indeed a little different in both sexes and therefore topotypical females of *javanica* are very needed in view of an examination of the genital organs and the internal skeleton, which alone can give a conclusive answer as to the stability of secondary characters, such as the pattern of the wings.

In our females *Smb* is complete and runs obliquely from R_1 to the end of Cu_2, while in the males *Smb* coalesces with a basal spot so as to form an extensive, longitudinal, brown streak in the cubital space of the wing, which appears to be a distinctive character of this species.

Leptopanorpa peterseni, sp. n. (Pls. 6, 7, 10, 13 and 14).

1921. PETERSEN, Cat. Coll. SELYS, Mecoptera, p. 91 (*pars* ?). — ♂♀ Nongkodjadjar, Java described (*pi*).

Material examined: — 1 male (juv.), labelled: E. JACOBSON, Java, Nongkodjadjar, Jan. 1911 (printed), *Leptopanorpa pi* WEELE (in PETERSEN's hand), in Mus. Leiden. — 2 males, 1 female, E. Java, southern slope of Kendeng Mts. (Idjen Plateau), Blawan, 950 m and Kendeng III, 1400 m, June 1924, K. W. DAMMERMAN. 6 males, 6 females, Idem, Blawan, 950 m, Nov. 19, 1933; Jan. 14 and Dec. 2, 1934; Jan. 27, Febr. 19 - March 16 and Dec., 1935, H. LUCHT & L. J. TOXOPEUS. 4 males, 2 females, Idem, Sempol, 1200 m, Febr. 1934, E. HANDSCHIN. 18 males, 12 females, E. Java, southern slope of Idjen Mts. (Idjen Plateau), Mt. Raoeng, Bajoekidoel Est., ca. 5 - 700 m, May, Sept. 25 and Dec., 1932; April 29 and Dec. 8, 1933; Febr. 12 and March 9, 1934; H. LUCHT. — Holotype ♂ and allotype ♀: Mt. Raoeng, Bajoekidoel, 5 - 700 m, Sept. 1932, H. LUCHT. Paratypes (from Sempol) are in the collection of the Basle Museum, and topotypes (from Mt. Raoeng) are in ESB. PETERSEN's collection.

Confined to the submontane and montane tracts of East Java: north-western slope of Mt. Tengger (Nongkodjadjar, 1200 m), Mt. Idjen, Mt. Raoeng, 800 - 2000 m alt.

A very variable species, especially in its wing-markings.

♂♀. Body, with the exception of the rostrum, entirely black, or dark reddish-black. Wings at least with a brown pterostigmal fascia and smoky apices.

♂. Head glossy black; rostrum zinc-orange, ochraceous-orange, or ochraceous-tawny, not darkened in front. Palpi also pale, last joint of maxillary palpi brownish distally. Antennae blackish brown; torulus and first joint yellow, second joint also pale at base. Pro- and synthorax unicolorous dull black; meso- and metapleurae sometimes intermingled with reddish- or purplish-black. Intersegmental membranes usually clear yellowish (flesh-coloured in faded specimens).

Coxae black, or reddish black, only the distal extremity of them yellow. Legs otherwise pale in colour, light ochraceous-buff; tarsi gradually darkened towards the end, the last two joints rather more brownish (sometimes dark brown).

Wings rather broad with rounded apices, but narrower than in *javanica*, especially in their basal part; membrane sub-hyaline, but occasionally with greyish yellow suffusion all over it. Markings cinnamon-brown, extremely variable, as is demonstrated by our figures 4 - 6 on pl. 6. In most specimens (including the type), there is a broad pterostigmal band, which, usually, is more distinctly forked posteriorly in front wing than in the hind one, but in all heavily marked specimens this posterior off-shoot, if complete at all, is only very narrow. The apical band is variable to a similar extent and in none of the males the two spots are confluent along costal margin.

In the specimens from Nongkodjadjar (Mt. Tengger) and in four males from Mt. Raoeng the posterior fork of the pterostigmal band is absent altogether and the apical band is reduced to a tiny pale brown marginal whisk (pl. 6).

Abdomen rather robust and comparatively very short, extremely variable in length, from 1.3 to 1.8 times longer than hind wing, segm. 1 - 6 of the usual shape, gradually narrowed to behind, 7 and 8 slender, but comparatively much shorter than in most of the other species. Segm. 2 a little broader than long; 3 slightly longer than 2, squarish in dorsal view; 4 equal in length to 3 but slightly longer than broad; 5 rather short, longer than 4 and almost one and a half times longer than broad; 6 short and tubular, scarcely one-third longer than 5; 7 and 8 subequal in length, each about one-third longer than 6; 9 shortly pedunculate, the stalked portion thick and evenly widened distally, much shorter than the genital bulb, which is of slender build and only little widened apically. Dististyli long and slender, tips somewhat incurved. Third abdominal tergite produced into a slender, basally slightly downbent, cylindrical process, which in side view, after a slight thickening, is distinctly excavated ventrally; apex furnished with short, backwardly directed, blackish hair. The fourth tergite bears a strong, semicircular, mid-dorsal tubercle which, in side view, is placed slightly before to almost at middle of the segment.

Coloration of abdomen throughout shiny black, with the first six segments usually faintly bronzy or with slight bluish bloom; intersegmental membranes pale ochreous.

Epiandrium black, apical portion parallel-sided, almost rectangular, with rounded side-edges and very slightly produced, rounded apex. Branches of the hypandrium black, prominent. Dististyli dark blackish brown, apices chestnut-coloured. Genitalia otherwise as described earlier.

♀. Coloration of the body identical to the male. Thoracic sides in adult specimens always deep black. Wing-markings similar in principle to the opposite sex and equally variable. Front wings at least with a narrow, complete pterostigmal band, a brown streak between Cu_1 and Cu_2, and with the apex of the wing narrowly bordered with brown; hind wing at least as before but without a streak between the said veins. The markings of the darkest specimens are similar to those of the darkly coloured males, except that the distal branch of the pterostigmal band, though narrow, is complete in all wings, the apices then being entirely filled in with brown. All intergradations are represented in our material.

Genitalia: internal skeleton of very complex structure, the median tube reminding somewhat a skittle in general aspect and as seen from below. Proximal portion much thickened, the lateral tubercles well visible in ventral view. Basal plate not developed; distal plate expanded, separated from the medigynium by a well-marked constriction. Basal knob of the median tube connected with the distal plate by a thin membrane. Medigynium slenderly lanceolate, each a little incurved, not twisted. An outline drawing of the internal skeleton, as seen from the side, is given on pl. 14.

Length: ♂ abd. + app. 12.8 - 18; fw. 11 - 13.2, hw. 10 - 12.5 mm. — Segm. 1 - 6 5.9 - 8.1; 7 2.3 - 3.4; 8 2.1 - 3.2; 9 + dististyli 2.5 - 3.3 mm. The type measures: abd. + app. 17.3; segm. 1 - 6 8; 7 3.1; 8 2.9; 9 + dististyli 3.3 mm.

♀ abd. 9 - 10; fw. 11 - 13.5, hw. 10.5 - 12.2 mm.

This species is by no means rare but apparently restricted to a small area in the eastern part of the island. It inhabits thick forest in hilly country as well as the higher levelled mountain-slopes. The individuals from Sempol are among the smallest and in these the rod-like process on the dorsum of segm. 3 is most distinctly constricted before the apex, while the branches of the hypandrium are slightly longer and more elongate than in a number of equally small specimens from Bajoekidoel Estate, which is situated about 600 meters lower. In our series from Blawan however, all types are represented and all characters, except perhaps the internal genital organs appear to be unstable in this species. As stated before, the branches of the hypandrium may be different in shape and length: in some specimens they are rather blunt and do not project beyond the end of the genital bulb, while in others, besides being longer and more

slender, they are more or less pointed apically. Since the male genitalia of all the forms are identical, I am almost convinced that we are dealing with a single species.

All agree in having the rostrum comparatively very short; and the peculiar finger- or rod-like branch and tufts of barbs on the base of the *dististyli* are very constant and enable easy recognition of the species.

The wings of *peterseni* are subject to considerable variation and especially in our large series from the foot of Mt. Raoeng there are examples with heavily banded wings as well as some in which the wings are clearer and almost devoid of the original pattern.

I have named this fine species in honour of P. ESBEN PETERSEN, who has contributed so much to our knowledge of Oriental scorpion-flies.

EXPLANATION OF PLATE 4.

Fore and hind wings of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. filicauda, sp.n. ♂ (paratype), Mt. Kendang.

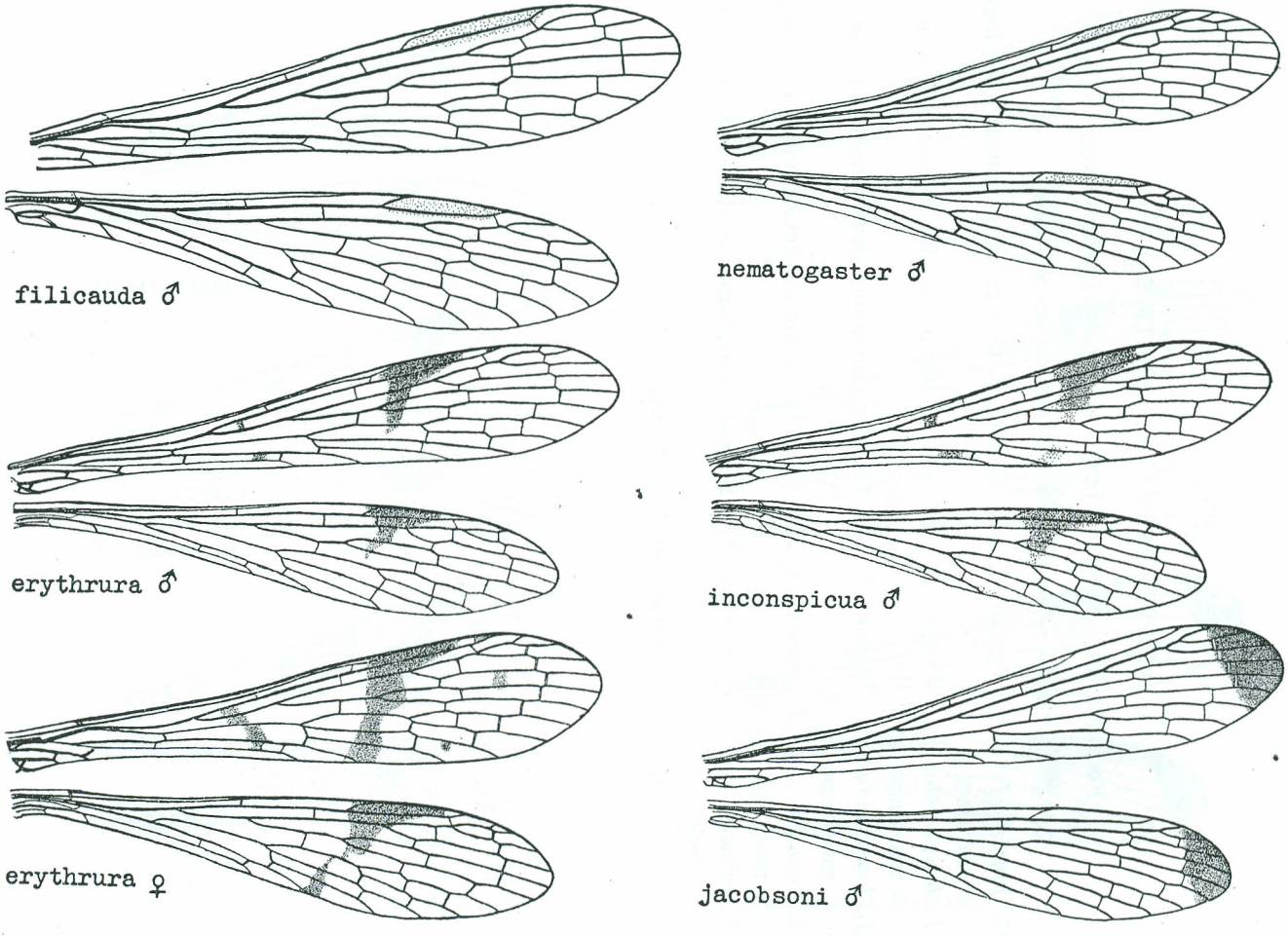
L. erythrura, sp.n. ♂ (paratype), Mt. Gedeh; maximum development of wing-markings.

L. erythrura, sp.n. ♀ (paratype), Mt. Gedeh; maximum development of wing-markings.

L. nematogaster (McLachlan) ♂, Mt. Goentoer.

L. inconspicua, sp.n. ♂ (holotype), Soekanegara; maximum development of wing-markings.

L. jacobsoni (v.d. Weele) ♂ (plesiotype), Mt. Oengaran.



M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 5.

Fore and hind wings of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. longicauda (v.d. Weele) ♂, Mt. Gedeh; minimum development of wing-markings.

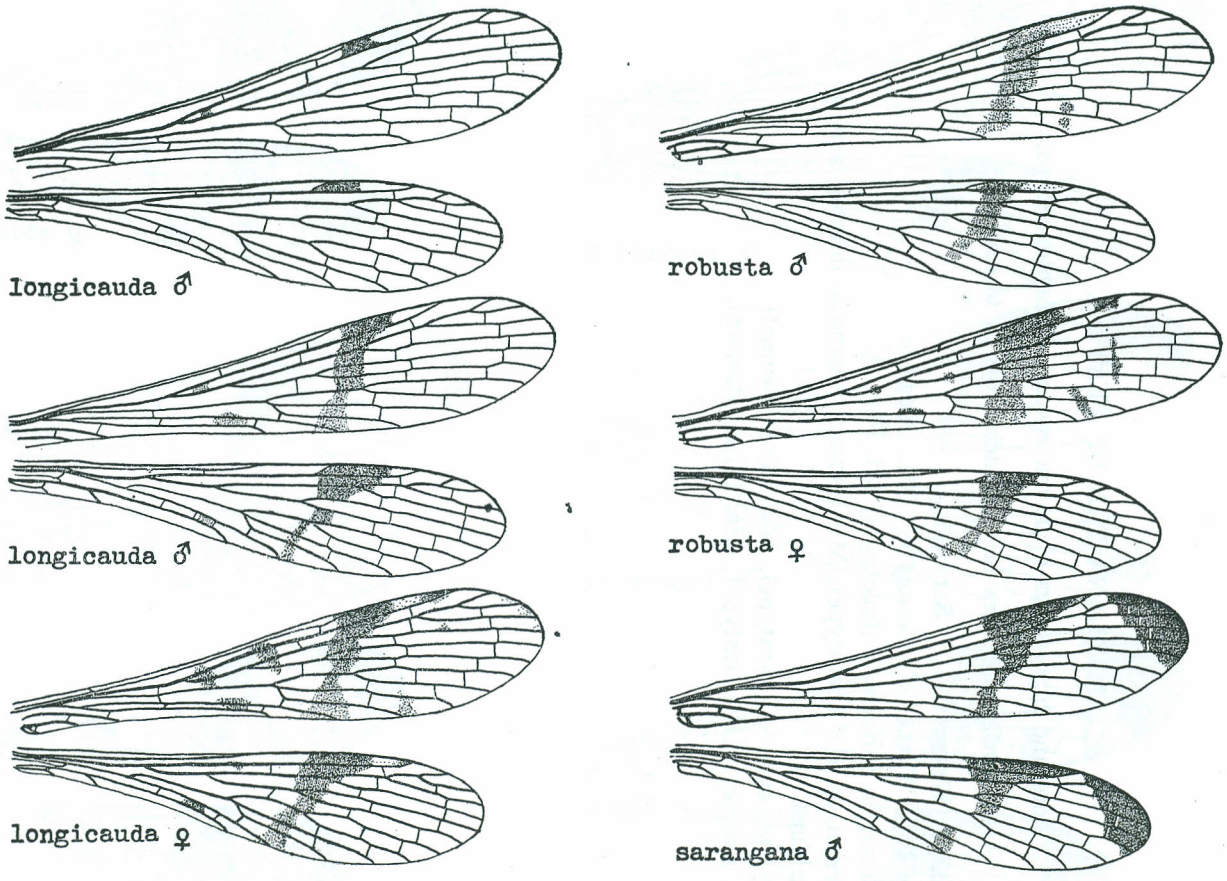
L. longicauda (v.d. Weele) ♂, Mt. Gedeh; maximum development of wing-markings.

L. longicauda (v.d. Weele) ♀, Mt. Gedeh; maximum development of wing-markings.

L. robusta, sp.n. ♂ (paratype), Mt. Slamat; maximum development of wing-markings.

L. robusta, sp.n. ♀ (paratype), Mt. Slamat; maximum development of wing-markings.

L. sarangana, sp.n. ♂ (paratype), Mt. Lawoe.



M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 6.

Fore and hind wings of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. javanica (WESTWOOD) ♀, Samarang.
L. pi pi (V.D. WEELE) ♂ (plesiotype), Mt. Oengaran.
L. pi decorata, subsp.n. ♂ (holotype), Mt. Slamat.
L. peterseni, sp.n. ♂ (paratype), Mt. Raoeng; minimum development of wing-markings.
L. peterseni, sp.n. ♂ (paratype), Mt. Idjen (Sempol).
L. peterseni, sp.n. ♂ (paratype), Mt. Idjen (Blawan).

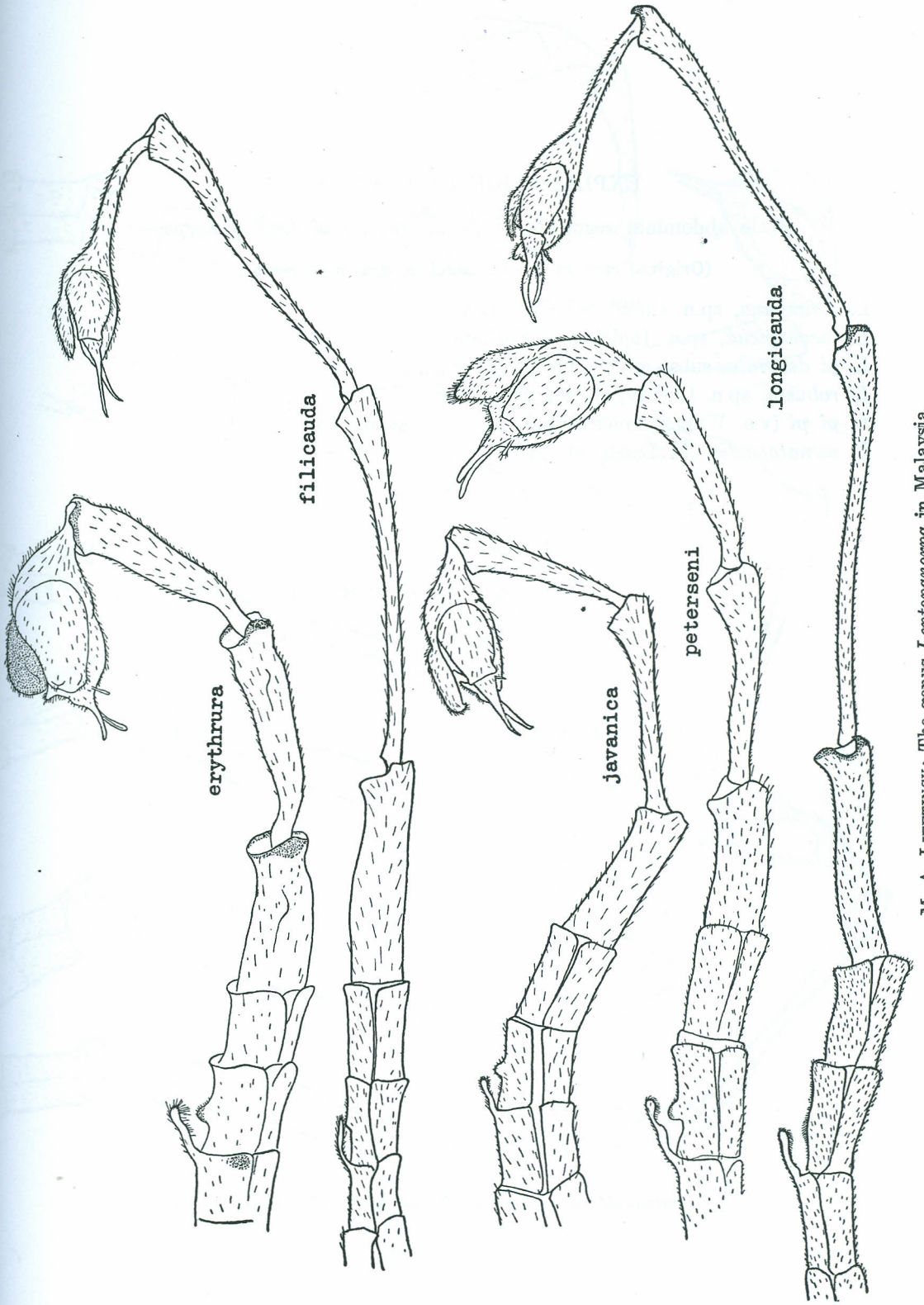
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 7.

Male abdominal segments of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. erythrura, sp.n. (holotype), Mt. Gedeh.
L. filicauda, sp.n. (holotype), Mt. Gedeh.
L. javanica (WESTWOOD), Noesa Kambangan.
L peterseni, sp.n. (holotype), Mt. Raoeng.
L. longicauda (V.D. WEELE), Mt. Gedeh.



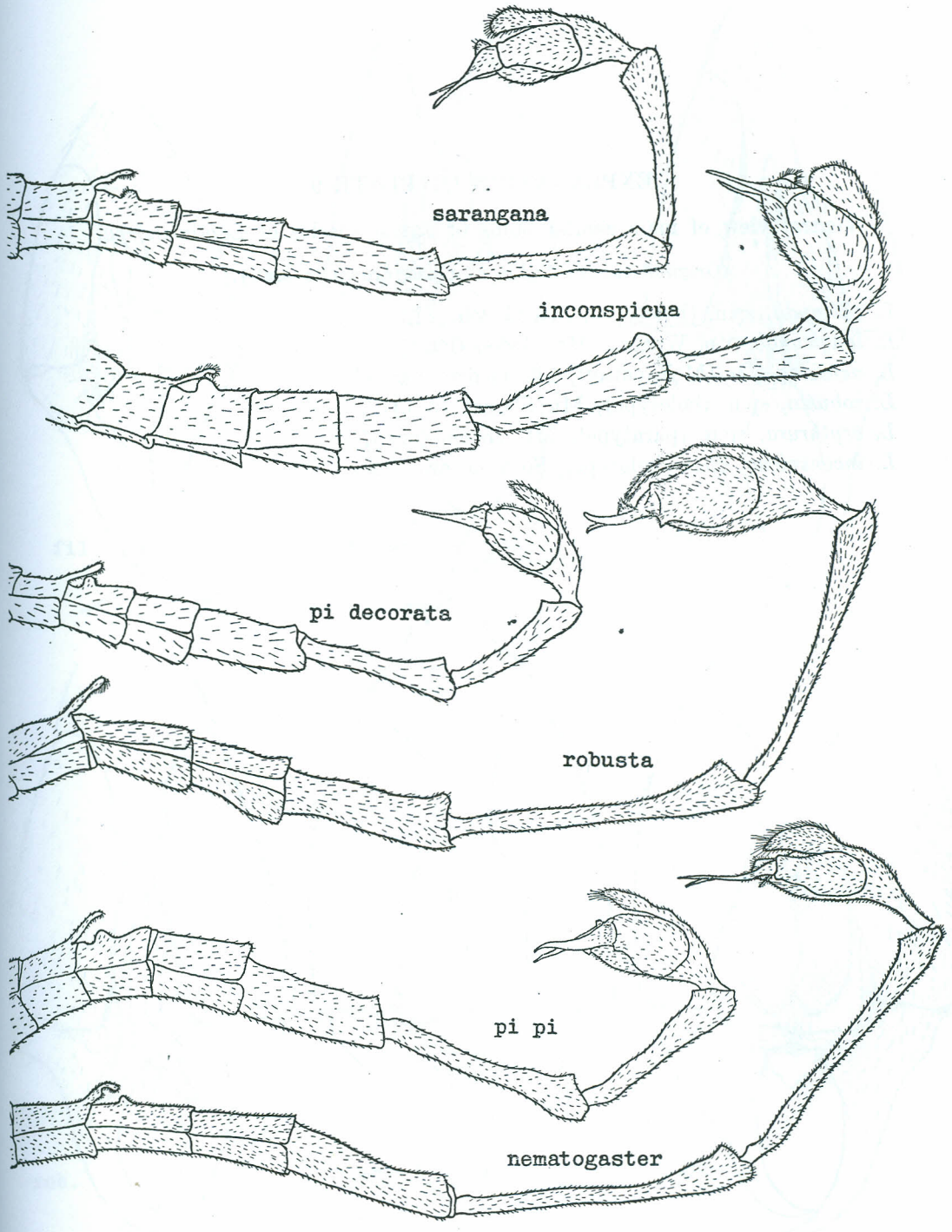
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 8.

Male abdominal segments of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. sarangana, sp.n. (holotype), Mt. Lawoe.
L. inconspicua, sp.n. (holotype), Soekanegara.
L. pi decorata, subsp.n. (holotype), Mt. Slamat.
L. robusta, sp.n. (holotype), Mt. Slamat.
L. pi pi (v.d. WEELE) (plesiotype), Mt. Oengaran.
L. nematogaster (McLACHLAN), Mt. Gedeh.



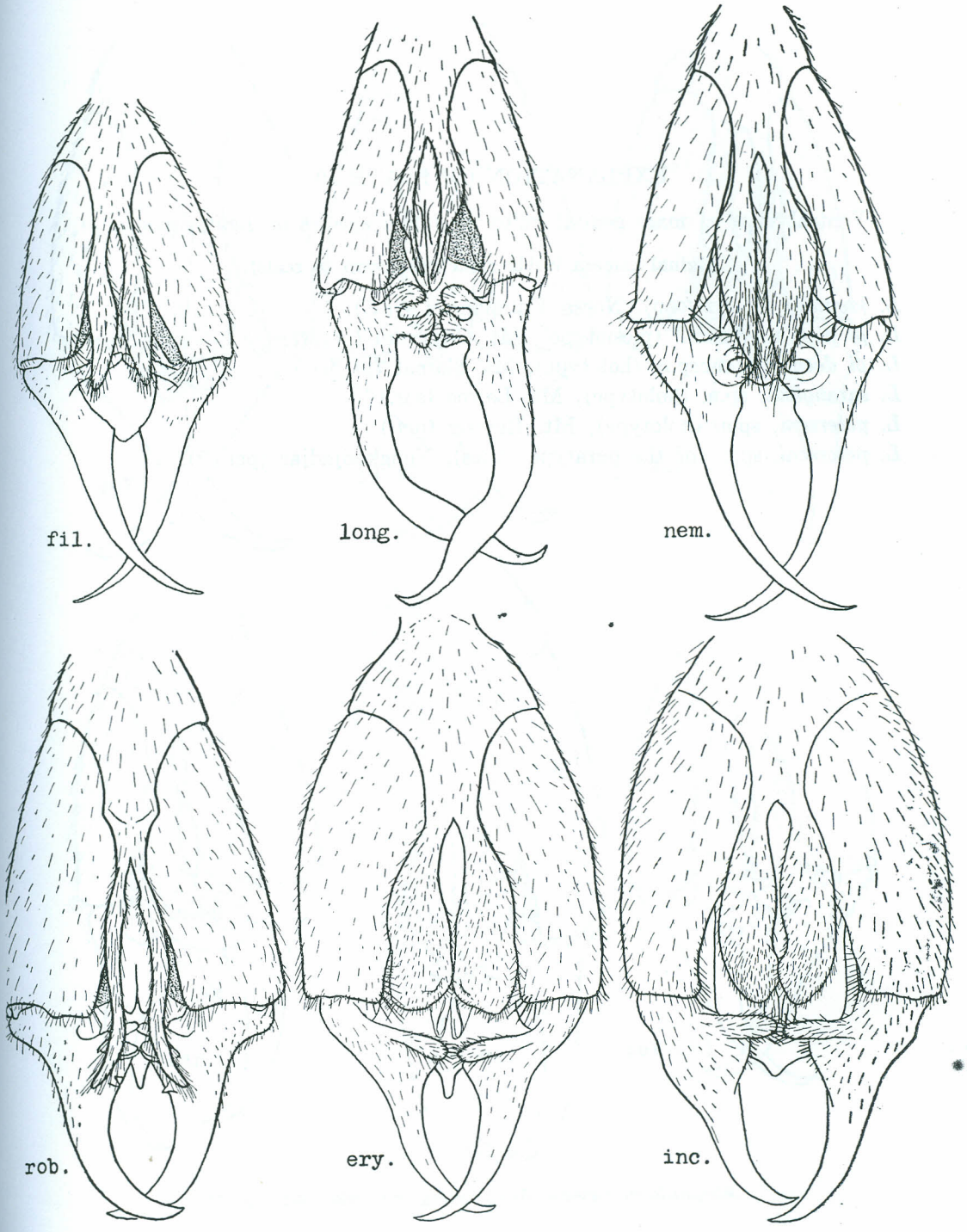
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 9.

Ventral view of male genital bulbs of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. filicauda, sp.n. (holotype), Mt. Gedeh (fil.).
L. longicauda (v.d. Weele), Mt. Gedeh (long.).
L. nematogaster (McLachlan), Mt. Gedeh (nem.).
L. robusta, sp.n. (holotype), Mt. Slamat (rob.).
L. erythrura, sp.n. (paratype), Mt. Gedeh (ery.).
L. inconspicua, sp.n. (holotype), Soekanegara (inc.).



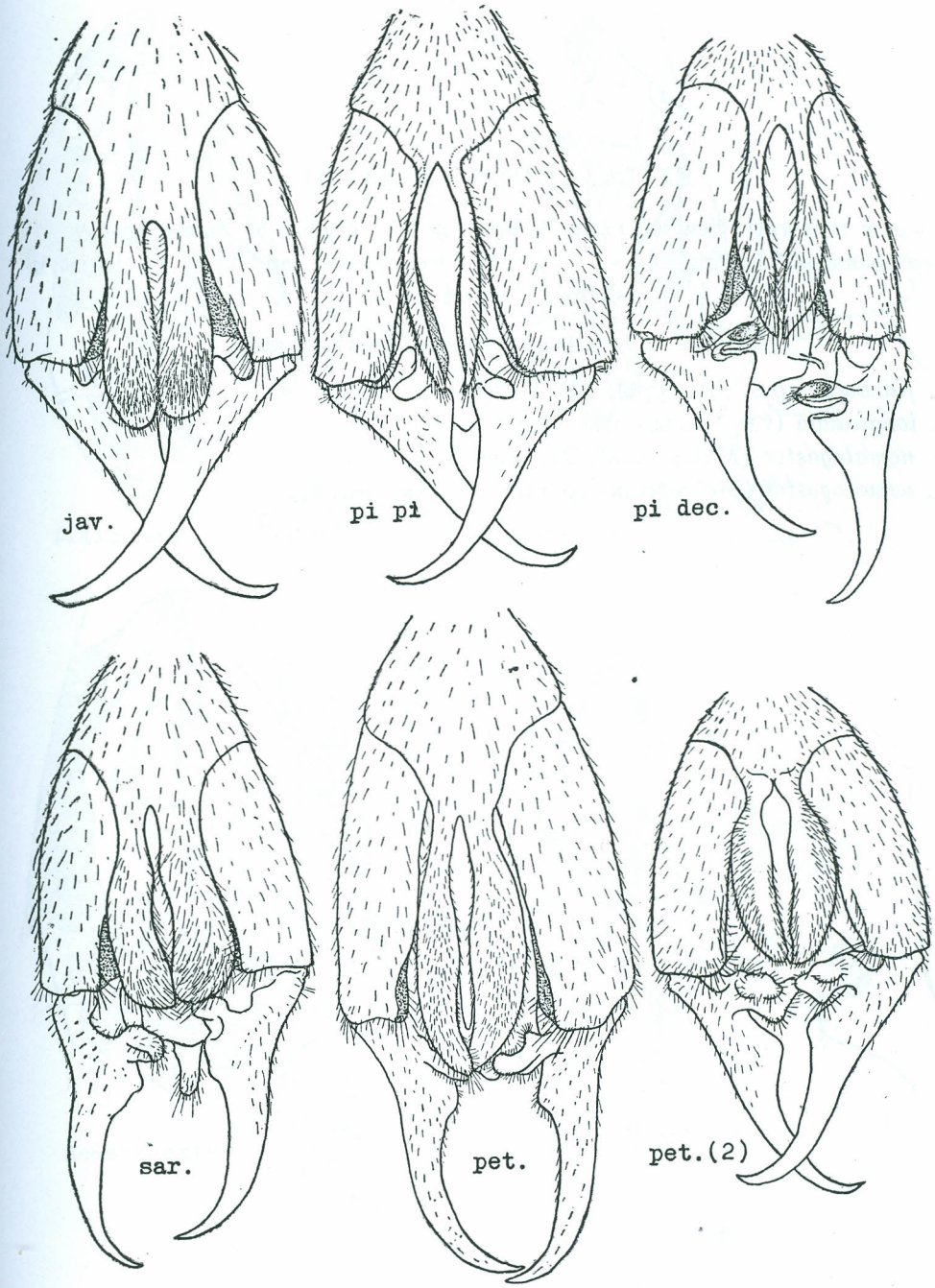
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 10.

Ventral view of male genital bulbs of Javan species of *Leptopanorpa*.

(Original camera lucida sketches, drawn to scale).

L. javanica (WESTWOOD), Noesa Kambangan (jav.).
L. pi pi (v.D. WEELE) (plesiotype), Mt. Oengaran (pi pi).
L. pi decorata, subsp.n. (holotype), Mt. Slamat (pi dec.).
L. sarangana, sp.n. (holotype), Mt. Lawoe (sar.).
L. peterseni, sp.n. (holotype), Mt. Raoeng (pet.).
L. peterseni, sp.n. (of the paratype series), Nongkodjadjar (pet. 2).



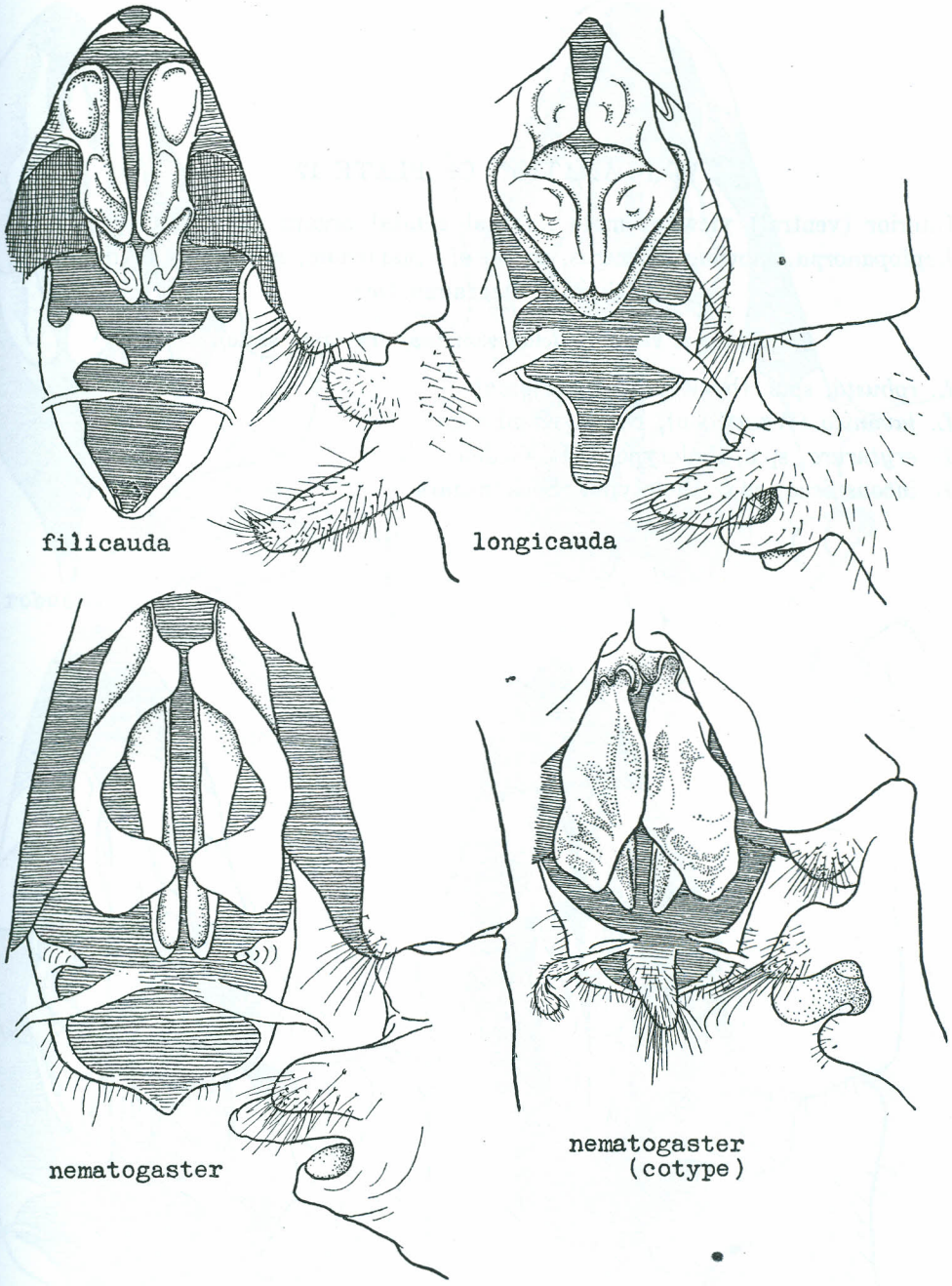
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 11.

Interior (ventral) view of male internal genital organs of Javan species of *Leptopanorpa*, showing aedeagus, shape of epiandrium, and bases of dististyli (slightly diagrammatic).

(Original camera lucida sketches, drawn to scale).

L. filicauda, sp.n. (holotype), Mt. Gedeh.
L. longicauda (v.d. Weele), Mt. Gedeh.
L. nematogaster (McLachlan), Mt. Gedeh.
L. nematogaster (McLachlan) (paratype!), Ambarawa.



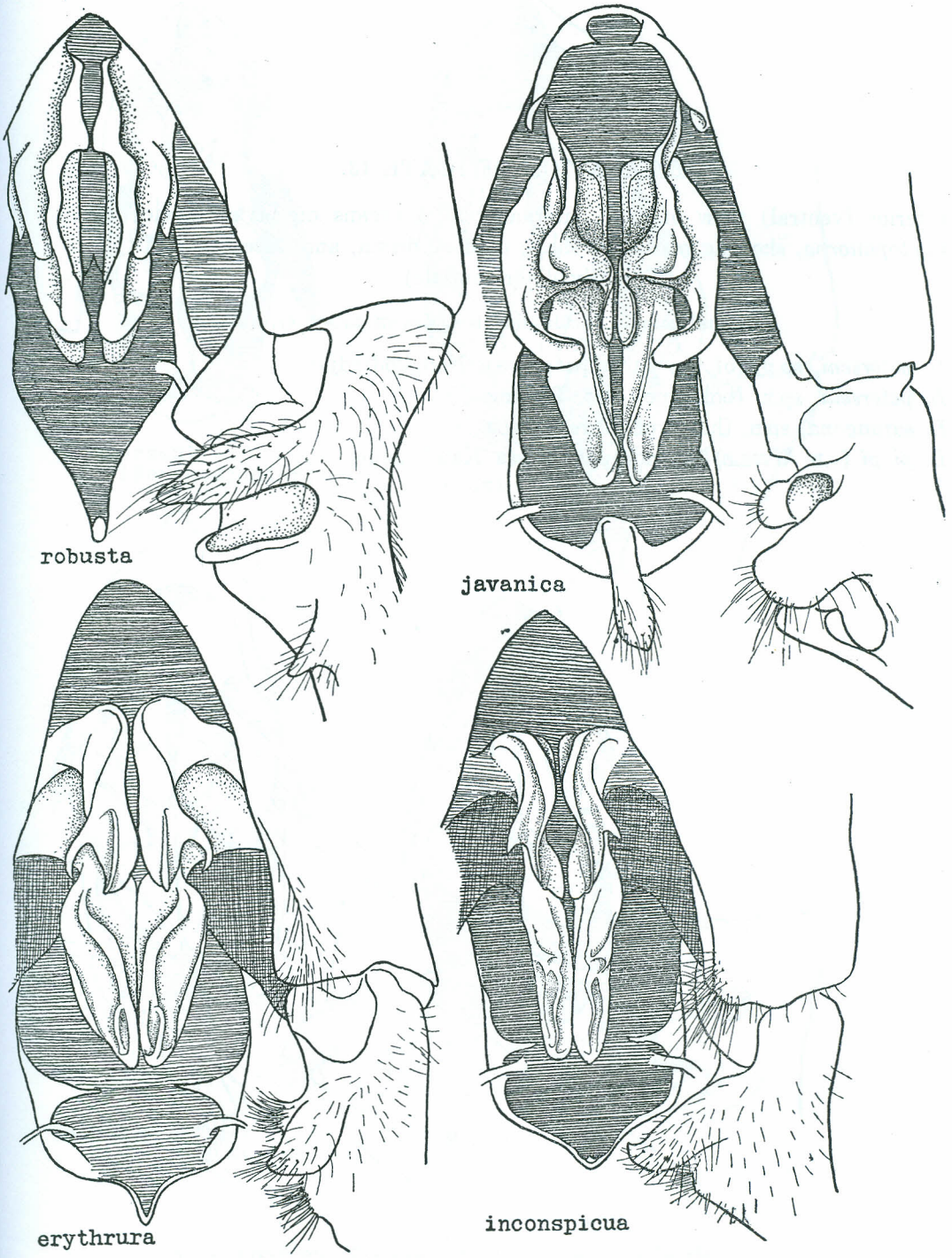
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 12.

Interior (ventral) view of male internal genital organs of Javan species of *Leptopanorpa,* showing aedeagus, shape of epiandrium, and bases of dististyli (slightly diagrammatic).

(Original camera lucida sketches, drawn to scale).

L. robusta, sp.n. (holotype), Mt. Slamat.
L. javanica (WESTWOOD), Noesa Kambangan.
L. erythrura, sp.n. (holotype), Mt. Gedeh.
L. inconspicua, sp.n. (holotype), Soekanegara.



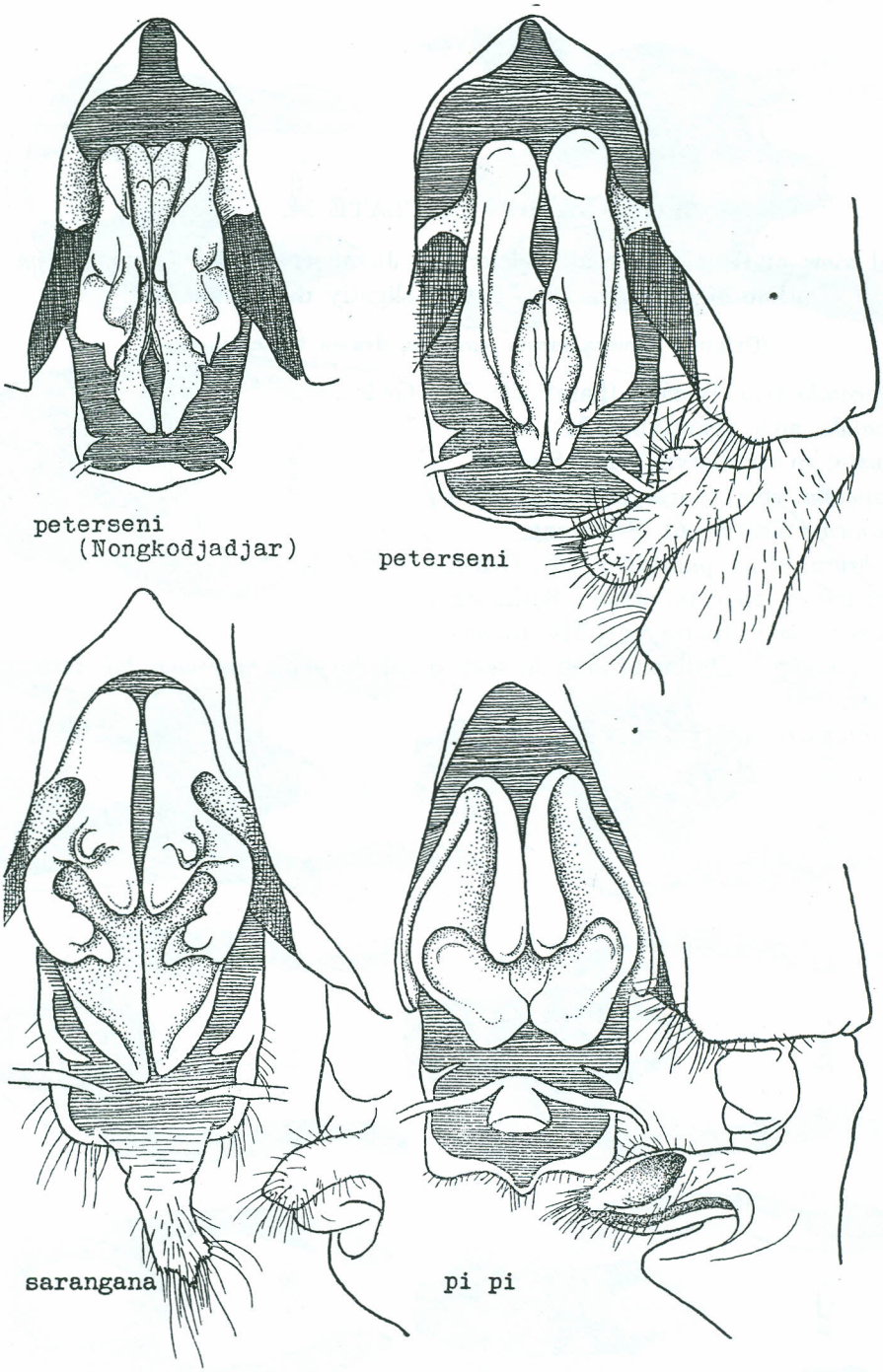
M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 13.

Interior (ventral) view of male internal genital organs of Javan species of *Leptopanorpa,* showing aedeagus, shape of epiandrium, and bases of dististyli (slightly diagrammatic).

(Original camera lucida sketches, drawn to scale).

L. peterseni, sp.n. (of the paratype series), Nongkodjadjar.
L. peterseni, sp.n. (holotype), Mt. Raoeng.
L. sarangana, sp.n. (holotype), Mt. Lawoe.
L. pi pi (v.d. Weele) (plesiotype), Noesa Kambangan.



M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.

EXPLANATION OF PLATE 14.

Ventral view of female internal skeletons of Javan species of *Leptopanorpa*. (Outline of soft connective tissues slightly diagrammatic).

(Original camera lucida sketches, drawn to scale).

L. longicauda (v.d. Weele) (paratype), Mt. Gedeh.
L. filicauda, sp.n. (paratype), Mt. Gedeh.
L. robusta, sp.n. (allotype), Mt. Slamat.
L. sarangana, sp.n. (paratype), Mt. Lawoe.
L. javanica (Westwood), Semarang.
L. erythrura, sp.n. (paratype), Mt. Gedeh.
L. inconspicua, sp.n. (allotype), Soekanegara.
L. peterseni, sp.n. (paratype), Mt. Raoeng.
L. peterseni, sp.n. Outline of internal skeleton of the same specimen, left lateral view.
L. nematogaster (McLachlan), Mt. Gedeh.

M. A. LIEFTINCK: The genus *Leptopanorpa* in Malaysia.