



MAP OF JAVA SHOWING LOCATION OF RESIDENCIES.

1 : 6.000.000

- I. Bantam
- II. Batavia
- III. Buitenzorg
- IV. Priangan
- V. Cheribon

- VI. Pekalongan
- VII. Banjoemas
- VIII. Kedoe
- IX. Samarang
- X. Klaten

- XI. Jogjakarta
- XII. Japara-Rembang
- XIII. Soerakarta
- XIV. Madioen
- XV. Bodjonegoro

- XVI. Kediri
- XVII. Soerabaia
- XVIII. Malang
- XIX. Probolinggo
- XX. Besoeki

**AN ANNOTATED LIST OF THE *ODONATA* OF JAVA,
with notes on their distribution, habits and life-history.**

By

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The first collector whose name should be quoted as having captured *Odonata* in Java is C. G. C. REINWARDT, a reputed botanist, whose stay in the island was of brief duration. Most of his collections were lost when on their way to Europe, but fortunately the material gathered by him during 1819-1821 came safely into possession of the Leiden Museum.

Considerable collections were also made by two well known zoologists, H. KÜHL and J. C. VAN HASSELT, who travelled all over the country from 1821 to 1823, assembling material in different parts of the island. Few years later, S. MÜLLER arrived in Java, and this enthusiastic explorer paid much attention to insects generally; his dragonflies were collected mainly, I believe, in Buitenzorg and Krawang from 1826 to 1827 and from 1830 to 1833.

Lastly, the names of HILLEBRAND, HEKMEIJER, VAN LANSBERGE, and a few others should be quoted as being repeatedly mentioned on the labels of old specimens kept in the Leiden Museum. Apparently, the first two collectors mainly explored the mountains of East Java.

Now, it is interesting to learn that several of these old collections have never been worked out, and although H. ALBARDA identified some of the commoner forms, the majority of specimens remained unnoticed in the store-rooms of the Leiden Museum.

After this, there seems to have been a long pause in the history and it was not before the close of the former century that H. FRUHSTORFER made very important collections in the southwestern parts of the island, including a few species which have never turned up again. Many of his captures, which now are in the Brussels Museum, are described as new species by DE SELYS LONGCHAMPS and the writer, and full use was made of the Libellulines and Aeschnids among them by F. RIS and R. MARTIN, who published their results in the magnificent Selysian 'Catalogues'. Next to FRUHSTORFER's insects, the only important additions to the Javan Odonate-fauna were made by EDW. JACOBSON, who obtained small samples in various districts, collected by himself from 1908 to 1911. Along with some interesting larval forms, this collection was discussed in detail by RIS in a special memoir (86).

Lastly, in this Recueil (Vol. 8, 1926, pp. 467-494), F. C. FRASER has published a brief account of the Dragonfly-fauna of our island, describing some new forms and listing 79 species. Unfortunately, FRASER's attempt of stock-taking was unsatisfactory and incomplete, owing to the fact that many of the older records, including all RIS's publications, remained unnoticed by him, most of the species described as new being not collected in Java. The necessary corrections to this list will be found incorporated in the present paper, arranged in an 'Appendix'.

In addition to records already available in the literature and the above, I have been able to compile my list from the examination of the large amount of old and partly undetermined material preserved in the collections of the Amsterdam and Leiden Museums, and in the Brussels Museum, formerly DE SELYS' collection. I am glad to have been given the opportunity of making a fresh list chiefly based on the collections made for me by Messrs. F. C. DRESCHER (Bandoeng), H. LÜCHT (Bondowoso), G. OVERDIJKINK (formerly Soekaboemi), L. J. TOXOPEUS (Bandoeng), Mrs. M. E. WALSH (Soekaboemi) and many other collectors, to whom I owe my sincerest thanks for their valuable assistance. Especially Mr. DRESCHER has contributed largely to our knowledge of the present fauna. Although I have had myself no sufficient opportunities whatever for making extensive collections, I have thought it worth while to include in my list not only the known localities and names of species represented in the collection, but also, as a result of random field work, brief notes on the biology, carried on as opportunity permitted and assembled almost entirely on Sunday-trips or week-end excursions, mostly in the surroundings of Buitenzorg. A more penetrating study of Odonate-life was made by me only in the Botanical Garden at Buitenzorg, in the Karimoen Djawa Archipelago, and on the Salak and Gedeh Mountains. A review of the pages which follow will show how incomplete my own observations on the biology still are. Without the aid of, especially, FRASER's most interesting field-notes on Indian species, to which references were made in many instances, it would have been impossible to get some impression of the chief peculiarities of each species. Otherwise, in order to avoid undue prolixity of the list, I have given references exclusively to faunistic papers, under the head of each species, the numbers following the name of an author referring to the full citations in the bibliography.

This paper makes no attempt to summarize completely all the material (over 13,000 specimens!) studied by myself, but to make it sufficiently useful I have without exception put on record all localities known to me applying to the less common or otherwise imperfectly known species. The localities are arranged somewhat in a topographical and also in a physiographical order, tracing them from west to east, each series of localities being followed by a roman cipher, which denotes the residency in which they are situated, and indicating roughly their geographical position (see map).

I have tried to make my list complete, that is, every species is recorded that has a satisfactory claim to be included. Doubtful records and species whose

systematic position is called in question are definitely removed from the list; experience learns that such doubtful records lead a persistent life in literature, and therefore I feel myself authorized to abandon their names. Species whose occurrence in the island is beyond dispute but of which I have not seen authentic material, are very few in number. Not to mention two species which will soon be described by Dr. SCHMIDT, these are: — *Caconeura humeralis* (SELYS), *Tetrathemis platyptera* SELYS, *Onychothemis abnormis* BRAUER, and *Gynacantha limbalis* KARSCH.

Of a total of 142 species known to occur in Java, 22 (including SCHMIDT's new species) are here recorded for the first time, and although one might possibly find this list to be fairly exhaustive on comparing it with the totals of species known from the neighbouring Sondaic Islands, I am deliberately of opinion that many more species will come to light. Several districts of Java have as yet remained practically unexplored. Speaking generally, we can say that no serious collecting has ever been done in the northern residencies of the island, except in N. Bantam, the western half of Batavia and in Samarang. In South Java little is known from Bantam, the virgin forests of South Priangan, and almost nothing from the entire southern hill-ranges in the residencies XI, XIII, XIV, XV, XVI and XVII, the fauna of the southern part of Djember being also entirely unknown.

A comparison of the Odonate-fauna of Java with that of the three other big landmasses, viz., the Malay Peninsula, Sumatra and Borneo, which together are known as the Sondaic area, meets with difficulties of various kind.

It is often held that dragonflies and other winged insects, such as *Diptera* and butterflies, should have strong powers of flight and accordingly are not expected to have a limited distribution. In a general way, "Dragonflies" and "Butterflies" indeed are strong fliers, but it is often lost sight of that the actual distribution of such insects is determined by the conditions under which the early stages are able to exist. Now, one must bear in mind that a fair percentage (over 30%) of our regional *Odonata* passes through larval stages which have exclusively rheophilous habits or live in clear, well aerated waters at rather high altitudes. Summarizing conclusions relating to geographical distribution are therefore not to be founded on migratory species or on those which have adapted a life in brackish water, but will rest only on those purely fresh-water forms which do not wander far from the waters in which they have passed their earlier stages or in which their offspring are capable of surviving. Examples of this kind are far more numerous than has generally been accepted. The family *Platystictidae* for instance, stands far apart from other *Zygoptera* and is of great zoogeographical interest. It is represented in Malaysia by two genera, *Drepanosticta* and *Protosticta*, which in their habitats are highly remarkable in that they are entirely restricted to the tropical rainy forest areas. The adults are small and excessively slender insects with a very weak flight which do not wander far from their breeding-places and are only found by patient explorers who are not deterred by a prolonged search in one

limited spot. Of *Drepanosticta* four species, all endemic, are now known to occur in Java, and all except *D. sundana* have a very limited distribution in the island. In Borneo no less than six endemic species have been discovered, but from Sumatra only two species are known, both being peculiar to the island. Further investigations in the Sondaic Islands will doubtlessly result in the discovery of many new species and a study of their relationships will, as stated before, probably prove of high zoogeographical value. The genus *Protosticta* has one endemic species in the Malay Peninsula and three in Borneo; it is absent from Java and Sumatra.

Similar examples of slow wanderers inhabiting small areas are the *Libellulinidae*, *Euphaeidae* and *Calopterygidae* whose members dwell in running waters, like the species of *Coeliccia*, the *Protoneuridae*, and probably also the genera *Macromia* and *Idionyx* among the *Corduliinae*. As has been stated before, our knowledge of the fauna of the islands under discussion is still very scanty, and it is not intended here to comment upon the relations of Odonate distribution to temperature, rainfall and other environmental factors as showing the limits which these factors set to the distribution of the insects in question. First of all many more forest- and stream-dwelling species should be traced.

On the other hand, we may be said to know where many species occur, but not where they do not occur. With the alarming progress in the clearing of primeval forests and drainage of virgin swamps and rivers we must probably expect the disappearance of many *Odonata*, and therefore a comparative and very careful investigation of such areas should soon be carried out, before any generalizations concerning their distribution can be made.

Yet, a few general observations on the proportionate numbers of Malaysian *Odonata* will not be out of place here.

Malay Peninsula. — LAIDLAW has recently listed 164 species occurring in the Malay States, inclusive of his later additions (64). To these I have added *Vestalis lugens* SELYS, from Kwala Kangsar, Perak and *Rhyothemis pygmaea* (RAMB.)¹⁾. The total number of known species, inclusive of *Drepanosticta silenus* LAIDLAW, from Perak, thus amounts at least to 167 species.

Sumatra. — The Odonate-fauna of this island is very imperfectly known. A critical survey is in course of preparation by the writer, and although my list of known species now includes already 180 different forms, it is safe to say that not more than 75% of its fauna has as yet been discovered.

Borneo. — Although LAIDLAW in 1931 has listed no less than ca. 180 species, we can safely admit that the extremely rich dragonfly-fauna of this island has by no means worked out sufficiently, only British North Borneo and Sarawak being fairly well known at present. Some idea of how little the island has been worked may be gained by taking the Western Residency as an example. This country is inhabited by at least 135 species, and of these about 30 belong to undescribed species or to forms not so far reported from the island. We may estimate the actual number of Bornean species at about 250, or even more.

¹⁾ M. A. LIEFTINCK, *The Odonata of Nias Island*. Misc. Zool. Sum., 59, 1931.

Java, with 142 species, makes no poor figure, although one of the most obvious features of the Java fauna is its relative poverty in comparison with that of the surrounding Sondaic Islands. This general poverty is especially evident on considering that Java, proportionally, has rather thoroughly been explored, and the total number of *Odonata* living in the island will not, I think, exceed much over 150 species.

In the next table I have entered the totals of all species, classed with their families, occurring in the Malay Peninsula, Sumatra, Java and Borneo. For convenience' sake in this table the *Agrionidae* and *Libellulidae* have been subdivided into their regional sub-families. With the exception of the numbers given for the Malay Peninsula, these totals are entirely new and have been obtained by adding up to the existing lists all species not previously recorded but represented in the Buitenzorg Museum collection, including several undescribed forms.

Family or Sub-family	Malaya	Sumatra	Java	Borneo
<i>Calopterygidae</i>	5	5	2	4
<i>Euphaeidae</i>	4	7	2	7
<i>Libellaginidae</i>	9	15	6	16
<i>Amphipterygidae</i>	1	1	—	1
<i>Lestidae</i>	2	2	3	2
<i>Megapodagrionidae</i>	2	3	1	5
<i>Platystictidae</i>	8	2	4	9
<i>Protoneurinae</i>	6	8	4	19
<i>Platyneminae</i> + <i>Agrioninae</i>	29	35	30	35
<i>Corduliinae</i>	8	6	11	10
<i>Libellulinae</i>	66	62	48	62
<i>Cordulegasteridae</i>	1	2	1	3
<i>Gomphidae</i>	14	17	15	19
<i>Aeschnidae</i>	12	15	15	21
Total	167	180	142	213

Taking the first four families together, the scantiness in Java of stream-dwelling 'Calopterygids' (*sens. lat.*) is at once evident. Malaya thus counts 19, Sumatra and Borneo each 28, and Java only 10 species. While Malaya partly owes its sum total to the mainland of Asia, Sumatra and Borneo both have a high percentage of precinctive species of *Euphaea*, *Rhinocypha* and *Libellago*, all conspicuous and not easily overlooked insects. The *Platystictidae* and *Corduliinae* are fairly well represented by a number of endemic species, but many others should occur in the surrounding islands, especially in Sumatra. Probably as a result of the rapid deforestation of the Javan lowlands, many typically malaysian *Libellulinae*, which in former times doubtlessly occurred

in the island, nowadays are no more in existence, or at any rate are so scarce as to be almost untraceable.

As will be seen from our general list, the majority of species has been recorded from West and Mid Java, whereas in East Java various species have not been found. These differences are, I think, mainly to be explained by the western parts of the island being more thoroughly investigated than East Java. An analysis of the Odonate fauna of Java brings to light a fairly high percentage of endemic species (not subspecies!), 28 or 19.7 per cent being confined to the island. These are:—

<i>Rhinocypha fenestrata</i>	<i>Pseudagrion infracavum</i>	<i>Burmagomphus javicus</i>
——— <i>heterostigma</i>	——— <i>nigrofasciatum</i>	<i>Macrogomphus parallelo-</i>
<i>Rhinagrion tricolor</i>	<i>Agriocnemis minima</i>	gramma
<i>Platylestes heterostylus</i>	<i>Aciagrion fasciculare</i>	<i>Amphiaeschna ampla</i>
<i>Drepanosticta gazella</i>	<i>Gomphidia javanica</i>	<i>Gynacantha stenoptera</i>
——— <i>siebersi</i>	<i>Megalogomphus jung-</i>	<i>Anaciaeschna montiva-</i>
——— <i>spatulifera</i>	huhni	gans
——— <i>sundana</i>	<i>Onychogomphus banteng</i>	<i>Orthetrum silvarum</i>
<i>Caconeura delicatula</i>	——— <i>thienemanni</i>	<i>Aethriamanta aethra</i>
<i>Coeliccia lieftincki</i>	<i>Burmagomphus inscriptus</i>	<i>Macromia gerstaeckeri</i>
		——— <i>septima</i>

Some — if not many — of these may occur also in Benkoelen and the Lampong districts of South Sumatra; this is a very rich country whose fauna shows much of a mixed character, being inhabited also by a number of common Javan forms previously considered preinictive to that island (e.g. *Vestalis luctuosa*, *Euphaea variegata*, *Notoneura insignis*, *Aciagrion aciculare*, *Procordulia artemis*, *Ictinus decoratus*, *Heliogomphus dröscheri*).

Of the 142 species recorded, 65 or 45.8 per cent are purely Malaysian (i.e. confined to the Malay Peninsula, Sumatra, Java, Borneo and Palawan, inclusive of their satellite islands and Bali), whilst of the genera only *Pericnemis* and *Orchithemis* are confined to Malaysia.

Other conclusions drawn from a study of the Odonate fauna of Java would seem to be premature and are better postponed until later.

Buitenzorg, September 1934.

N.B. — Since the present paper was handed over to the printers, I had a letter from Dr. ERICH SCHMIDT, in Berlin, who will soon publish the odonatological results of the “Deutsche limnologische Sunda-Expedition 1828/29” in the “Tropische Binnengewässer”, Bd. V. Dr. SCHMIDT kindly acquainted me with the names and localities of three new Javan species he will describe, allowing me to insert their names throughout the text of this paper and making our knowledge of the Javan fauna up to date. With regard to the forthcoming report of Dr. SCHMIDT, further changes in the text of my “Annotated List” have not been made.

Sub-ordo ZYGOPTERA.

Fam. CALOPTERYGIDAE.

1. **Neurobasis chinensis florida** HAGEN (121), SELYS (93, 120), HAGEN (43),
• RIS (86), FRASER (31, sub *chinensis*).

Locally common throughout the year along slowly or fast running streams and rivers from near sea-level (south-coast!) up to ca. 1300 meters alt. Chiefly a lowland species preferring open sunny places, and always restricted to the grassy borders of the water, flying close to its surface. Their curious fluttering flight is very suggestive of the skippers (*Hesperiidae*) among the butterflies, and the magnificently emerald-green hind wings make this striking species very conspicuous. When in flight the flatly spread hind wings act as planes whilst the fore serve to propel the insect as it skims the surface of a stream. Settles on drift-wood and grass blades close to the water-mark.

The ♀ is always accompanied by the ♂ during oviposition, which takes place in submersed roots and grass stems. This was observed in a stream near Soekanegara. The pair was sitting on a floating stem and both individuals walked slowly backwards, descending down the stem under water, until the ♀ was completely submerged and the ♂ partly so, holding its wings parallel to the water's surface. The ♀ remained under water for a very long time. The slender larva hides obstinately among submersed grass, twigs and rootlets near the river-bank.

The subspecies has a scattered distribution; it occurs in India and is also known from Borneo in a slightly modified form, but replaced by *chinensis* in Ceylon, Further India, Malaya and Sumatra.

West Java: Malimping, sea-level (I) Buitenzorg; Mt. Salak; Tjipeundeuj near Djasinga; Soekaboemi; Mt. Halimoen; Mt. Tjisoeroe, Djampang Tengah; Tjisolok; Wijnkoops Bay; Zand Bay (III) Radjamandala; Bandoeng; Mt. Tangkoeban Prahoe; Tjikaso River near Tjipitjoeng (IV).

Mid Java: Mt. Slamet, Batoerraden (VII) Mt. Merbaboe (VIII).

East Java: Mt. Wilis (XVI) Mt. Kawi (XVIII).

2. **Vestalis luctuosa** (BURM., 9) SELYS (93, 121) RIS (86).

Found commonly all the year round along brooks and streams in shaded localities. It frequents small forest-brooks in mountain districts to a height of 2000 m, and, though less commonly, breeds also in small streamlets almost at the level of the sea, seeking the cool shady places where the vegetation is rankest. Oviposits in the soft tissue of rank herbage at water-mark, or in submersed stems of *Commelinaceae*. The species occurs everywhere in Java and flies often in company with *Euphaea variegata* and *Rhinocypha fenestrata*. A detailed description with figures of the half-grown larva is found in RIS's paper. The ultimate larval instar was found by me under débris in small mountain brooks.

I have seen several examples of *luctuosa* from the Lampong district west of Telokbetong in South Sumatra (Wai Lima and Talang Padang country), where it flies in company with — and possibly outnumbers — the black *V. lugens* SELYS, which is quite common north of the watershed of the Sekampoeng River (Ranau distr.) and distributed throughout Central Sumatra. Otherwise not found outside Java.

Fam. EUPHAEIDAE.

3. ***Euphaea variegata*** (RAMBUR, 82), SELYS (93, 95, 121), RIS (86), KONINGSBERGER (50).

A common woodland species, distributed all over the island among mountain brooks as well as on small rivers with swiftly flowing water, from the sea-coast upwards to 1300 m. The males are frisky, sun-loving creatures. In flight they are often seen going through characteristic manoeuvrings, which are unrivalled. Two males are necessary for the performance. They fly up from some stone in the stream-bed with rapidly fluttering wings, rising into the air in a face-to-face dance, one a few inches in front of the other, when suddenly one will rise and pass over the other, which at the same time moves in a curve downwards and then upwards, while the other drops, swinging itself gracefully backwards and upwards so that the former position of the two is just the same as before. These motions kept up with rapidity and regularity give the observer the impression of two glittering circles of sparkling emerald and topaz which move in a perpetual up and down in the sunshine. The ♀♀ of this beautiful insect are often met with at some distance from the water, and owing to their uncoloured wings, are easily overlooked. The eggs are placed in rows within the soft tissue of all kinds of aquatic plants.

In July, 1934, I observed a solitary ♀ ovipositing in a hard, bark-bared piece of wood, stuck up between two boulders in a torrential stream near Tjisompét (Priangan). After alighting on the outstanding portion of the substratum, it descended down below the surface of the roaring water, walking slowly backwards until the body was completely submerged. The *Euphaea*, then, was well visible by its wings which appeared as if silver-plated, owing to their being surrounded by a complete film of air. The dragonfly felt about with its styles until a suitable place was found and then everted the terebra in the usual way, making an incision with the sharp points of the anterior processes in which the egg was placed. The whole body was then moved a short distance downwards and the act repeated on a new spot. The process was very slow but our insect did not show any trepidation when it was touched by hand; it remained under water for a quarter of an hour before it was captured, and an examination of the piece of wood showed that only seven irregularly placed holes had been made, five of them containing a single egg.

A general account and many figures of the curious larva was published by RIS (86). It is my hope to describe the eggs and the first larval stages of *Euphaea* in a separate memoir to be published elsewhere. They are found

lurking among leafy débris at the bottom of pools in the course of a small stream.

East Javan *variegata* differ in no way from western specimens.

I have seen large series of typical *variegata* from the S.W. part of the Lampong district in South Sumatra, from whence I have also received specimens of *E. aspasia* SELYS. Although Sumatran *variegata* are on an average smaller than West Javan individuals, the extension of the green patch on the hind wing of the male is variable to some extent in both series, this spot touching the hind margin of the wing in the majority of Sumatran specimens from Wai Lima an Mt. Tanggamaes. On the other hand, in a large series taken by myself on Mt. Salak, certain individuals have their wings rather narrower than usual, the green spot on the hind wings being also reduced in size. KRÜGER's subspec. *intermedia*, from Sumatra, thus appears not to have any significance.

4. **Dysphaea dimidiata** SELYS (93, 95, 96, 116, 121).

Since the time of its description, some eighty years ago, this species has not been found anywhere in Java and I have not seen any authentic specimens other than the typical series. It must be either extremely local or very rare. The original locality is merely given as 'Java', and only a few specimens, all ♂♂, have come to our knowledge. Typical specimens have been recorded from Sumatra, and a slightly modified form occurs in Malaya and Borneo. A thorough revision of the genus is urgently needed.

According to FRASER, the Indian representatives breed in swift submontane and montane streams. Mr. COOMANS DE RUITER, who has collected in West Borneo, writes me that both the variety *limbata* SEL. of *dimidiata* and *D. lugens* SEL., inhabit small streams in low country, the males being fond of settling on the dead branches of trees which have fallen into the water. In such inaccessible situations they often remain motionless for a long time, holding their wings closed over the back. The ♀♀ are only rarely seen.

Fam. LIBELLAGINIDAE.

5. **Rhinocypha anisoptera** SELYS (96), RIS (86).

Hitherto only found in East Java and very likely confined to that part of the island. Like the other members of the genus a forest-haunting species restricted to brooks and mountain streams with heavy stones in the bed. Found throughout the year and very abundant locally from 500 to ca. 2200 m. Its occurrence in several districts of Sumatra and complete absence in West Java is of particular interest.

East Java: Mt. Wilis (XVI) Mt. Welirang; Mt. Ardjoeno; Mt. Kawi, 1000 m; Nongkodjadjar, 1200 m (XVIII) Mt. Tengger; Mt. Semeroe (XIX) Idjen Plateau, 950 m; Mt. Raoeng, Bajoekidoel, 500 m (XX).

6. **Rhinocypha fenestrata** (BURM., 9) SELYS (93, 121) RIS (86) FRASER (31).

Very common everywhere in suitable places, especially so in the western districts of the island, from near sea-level (south-coast!) up to about 1000 m.

Apparently also fairly common in Mid and East Java from whence only few localities are known to me.

FRASER has described the peculiar habits and flight of *Rhinocypha* as follows: "When mating, the males perform a kind of nuptial dance before the female, during which they make a great display of the white pulverulent flexor surface of the hinder pairs of tibiae. The legs are trailed and show up dazzlingly white in the strong sunshine. Meanwhile the forewings flutter rapidly to support the insect, whilst that the hinder pair are held flat to display their wealth of colour. The ♀, perched on a prominent twig beside the stream, appears to be totally unconcerned by its mate's efforts to attract her. One very rarely sees a pair *in cop.*, although vast numbers of both sexes may be present on the banks of the stream". These habits can be studied almost on every forest-stream.

West Java: Common.

Mid Java: Isle Noesa Kambangan, sea-level, common; Mt. Slamet, Batoerraden, 850 m, common; Djeroeklegi & Koebangkangkoeng, sea-level (VII) Ambarawa (IX).

East Java: Mt. Kawi; Mt. Ardjoeno; Malang; Mt. Tengger (XVIII).

7. *Rhinocypha heterostigma* (RAMB., 82) SELYS (93) FRASER (31).

Confined to the mountain districts of West and Mid Java. Common along small rocky streams, often in company with *fenestrata* in submontane regions, solitarily at higher levels. Not found below 600 m and becoming increasingly common up to an altitude of 1300 m, but does not appear to rise above 1600 m in any part of the island. As in *fenestrata*, I have records of it from every month of the year and there appears a continuous succession of broods.

The extension of the dark wing colour is subject to considerable variation in both sexes; this variability is independent of the localities and apparently not caused by seasonal influences. In 1928 I have examined RAMBUR's type-specimens, a very mutilated pair in the Brussels Museum. Contrary to SELYS' statement, the female of RAMBUR is still in existence.

West Java: Mt. Salak, Goenoeng Boender, 800 m; Mt. Megamendoeng, 800 m; Mt. Gedeh, Tapos 800 m, Tjiboenar 1000 m and Tjibodas 14-1600 m; Mt. Halimoen and Mt. Tjisoeroe, Djampang Tengah, 500-600 m; Soekaboemi; Soekanegara, 700-900 m (III) Radjamandala, 500 m; Mt. Tangkoeban Prahoe, 1500 m; Mt. Goentoer, Kamodjang, 1400 m; Mt. Limboeng and adjacent mountains, 700-1000 m; Pengalengan (IV).

Mid Java: Mt. Slamet, Batoerraden, 850 m, common (VII).

Erroneously recorded by FRASER (31) from South Sumatra. The species is confined to Java.

8. *Rhinocypha selysi* KRÜGER (51).

A very rare species. New to Java.

West Java: 4 ♂♂, Mt. Halimoen, ca. 500 m, July-Aug. 1927, native coll. (III). Previously only known from Sumatra, from whence I have seen

examples of both sexes from different localities. The Javan specimens have the dark wing markings more extensive than those from Central and South Sumatra, but in this respect the species is a variable insect. Possibly a series from Mt. Tjisoeroe, Djampang Tengah, taken along with *R. heterostigma*, belongs also to *selysi*.

9. **Libellago lineata lineata** (BURM., 9) (SELYS, 93, 94, 121) (KRÜGER, 51) (WILLIAMSON, 126) (RIS, 86) FRASER (31) LIEFTINCK (70).

A moderately common insect occurring throughout the year in sago-marshes, among slowly running brooklets and, generally, along the banks of various streamlets and rivers in low country, sometimes forming large colonies. Though of very small size, the yellow and black bodied males are conspicuous insects, sharply contrasting with the dark surface of the water. Habits and flight quite similar to *Rhinocypha*. I have often observed the oviposition in pieces of driftwood and floating twigs along the banks of a river. Although widely distributed, the species shows a predilection for certain waters and therefore is not often noticed. The larva of Indian *lineata* was described by FRASER (24, 34).

West Java: Pasaoeran; Malimping (I) Depok; Tjiseëng; Tjileungsi; Tjiampea; Buitenzorg; Tjigombong, 500 m; Mt. Pantjar, 500 m; Tjisolak; Wijnkoops Bay; Mt. Tjisoeroe, Djampang Tengah, 600 m; Lake Njalindoeng, 900 m (III) Radjamandala, 350 m, Tjitaroem River (IV).

Mid Java: Patimoean and Djeroeklegi, south-coast (VII) Toentang and Samarang (IX).

10. **Libellago sumatrana** (SELYS, 96) LIEFTINCK (70).

A very rare species. Hitherto only known from the sunny streams near Pasaoeran in the extreme western part of Bantam residency, where seven ♂ and one ♀ were taken by the writer on May 23, 1931. It was flying in company with *lineata* at the rivers Tjilampir, Tjsoenkoei and Tjitjaloeng, but while the latter occurred in great abundance, *sumatrana* was very scarce. A single ♂ was recently captured by me in a sago-marsh near Malimping, south Bantam, April 24, 1933.

Fam. LESTIDAE.

11. **Lestes concinnus** SELYS (104).

This species has originally been described from a pair taken near Batavia. Considerable doubt has arisen whether the pale coloured specimens from China and the Philippine Islands might belong to the same species, the result of which was HAGEN's proposal to consider the olive-green and black Batavia insects distinct from the sandy-brown specimens from other countries, the former being named *amata* (HAGEN i.l.) SELYS, the latter *concinna* SELYS. I have discussed the matter with the late Dr. RIS and pointed out to him that in Java both forms occur together and that structural differences are entirely absent, so that the two forms evidently belong to one and the same species.

Both Dr. RIS and the writer were misled by the striking differences in colour but recent captures of Mr. DRESCHER in South Java have confirmed my later supposition that *amata* merely is the final melanotic colour-stage of *concinus*. After making careful comparisons with specimens of medium age I am now convinced that '*amata*' cannot claim specific rank. The very slowly advancing process of maturity is well known among *Lestidae*, and *concinus* is a striking example of this gradual development of colours.

L. concinns is a plain species, restricted to the coastal zone. Emergence takes place simultaneously, mostly in immense numbers. The teneral imagoes form very localized colonies, living at first in marshes, the adults being found amongst dry grass, sometimes far away from their breeding-place. The Tjilatjap specimens were taken from May to August in swamps containing slightly brackish water. Those from Noesa Kambangan, Patimoean and Djeroeklegi are fresh water insects, showing all colour-phases from uniform sandy brown to olive-green and black, and apparently are on the wing during the whole year. The extremes of both forms are strikingly different in general appearance. About 80 males and 50 females have been examined by the author.

West Java: Pasaoeran, coastal swamp (I) Batavia (II) Buitenzorg (III).

Mid Java: Patimoean; Djeroeklegi; Tjilatjap; isle Noesa Kambangan (VII) Samarang, teak forest (IX) Gedangan, hill-country in teak forest; Tjolo, Mt. Moerjo, 300 m (XII).

East Java: Padangan, teak forest (XV) Soerabaia (XVII).

In the Leiden Museum is a single ♂ (typical '*amata*') from the island Madoera, off the N.E. coast of Java, collected by C. J. A. STEEN.

L. umbrinus (SELYS), from Burma &c is no doubt the same species.

12. *Lestes praemorsus praemorsus* (SELYS, 104).

Not hitherto reported from Java. Probably widely distributed but apparently a rare species. Ranges from India to the Bismarck Archipelago and presumably forms local races for the definition of which an abundant supply of material from all its settlements is required. When at rest, this insect holds its wings half expanded, with the abdomen slightly drooped but strongly curved upwards at tip: a very peculiar attitude. The few males captured by me in the Botanic Garden flew round the border of a *Lotus* pond. Although the same pond has afterwards thoroughly been inspected whenever possible, no further specimens were secured. LAIDLAW, who collected this species near Kuala Aring, Malay States, quotes from his diary: "Aug. 20, 1899: I found to-day large numbers of a species of Dragonfly over a pond; I caught several pairs. Aug. 28, 1899: I noticed that the species which I had seen so abundantly near the pond had disappeared almost entirely. I have only found it in this one spot" (56).

The Malimping specimen in our collection was taken in a long-abandoned paddy-field with a rich vegetation and surrounded by shrubs with overhanging foliage. A description and figures of the larva (from Boeroe) have been published in one of the writer's earlier papers (67).

West Java: One ♂, Malimping, April 24, 1933, AUTHOR; one ♂, Klappers Is. (Poeloe Deli) off the S.W. coast, Febr. 17, 1932, native coll. (I). Four ♂♂, Buitenzorg, Sept. 29, 1929, AUTHOR (III).

13. *Platylestes heterostylus* LIEFTINCK (71).

* Known only from a single ♂ specimen, taken by Mr. DRESCHER among bushes in a swampy place near Djeroeklegi (South Banjoemas) in Mid Java, on Jan. 28, 1931. It has the habits of a *Lestes* and rests with the wings half open. *P. platystylus* (RAMB.) from Bengal and Burma is the second species known and, like *heterostylus*, one of the rarest *Zygoptera* found in southern Asia. The early stages are unknown.

Fam. MEGAPODAGRIONIDAE.

14. *Rhinagrion tricolor* (KRÜGER, 51).

Of this fine and very rare insect I have seen only a single male collected by M. C. PIEPERS on Mt. Tengger in East Java, without any further indication of habitat (Mus. Leiden). KRÜGER's description is based upon two males and one female, labelled 'Java', in the Stettin Museum. No further specimens are known. The members of this genus breed in small streams and are very locally distributed, occasionally forming small colonies.

I have found an unpublished memorandum concerning *Rh. mima* in the late Prof. FÖRSTER's hand-copy of KIRBY's Catalogue, where he remarks: "A. *mima* von Hochmalaka, im Gebirge an Baumstämmen". This points to a curious habit that should be traced further. Early stages unknown.

Fam. PLATYSTICTIDAE.

15. *Drepanosticta gazella* LIEFTINCK (66).

Small colonies of this tiny species occur in the forests of probably most of the mountains in West and Mid Java at altitudes from 500 to 1500 m. Especially to be looked for in ravines among bushes and wet rocks overhanging brooks, or in very damp jungle where a seepage finds its way down through ferns and mosses to the rocky bed of some stream. Found during the whole year.

FRASER's interesting account on the habitats of Indian *Platysticta*, a genus closely allied to *Drepanosticta*, is well worthy of quotation. They occur ".....in submontane and montane tracts, rarely at sea-level. They are found haunting the banks of mountain streams of small size, often a mere trickle over rocks or a chain of pools below a spring on a steep jungly hillside in dense shade. In flight they hover with the long attenuated abdomen held stiffly and horizontally out, whilst the insect advances or retires in a series of short jerky movements. Owing to their dull colouring, small size and dark surroundings they are remarkably inconspicuous" (38). These remarks are without reserve also applicable to Javan *Drepanosticta*.

West Java: Mt. Karang, Pasirangin, 600 m (I) Mt. Pantjar, 500 m; Mt. Salak, Goenoeng Boender, 600 m; Mt. Gedeh-Panggerango, Siteo Goenoeng, 1000 m and Tjisaroewa, 1000 m; Mt. Megamendoeng, 800 m; Poentjak pass, 1500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m; Soekanegara, 700 m (III) Mt. Limboeng, 900 m (IV).

Mid Java: Mt. Slammat, Batoerraden, 8-900 m (VII).

16. **Drepanosticta siebersi** FRASER (31) LIEFTINCK (66).

Known only from a very mutilated pair in the Buitenzorg Museum, collected somewhere in the Tengger Mts., at about 1700 m alt. (XVIII, East Java). The precise locality and the name of the collector are unknown.

17. **Drepanosticta spatulifera** LIEFTINCK (66).

Discovered in 1927 by Mr. DRESCHER in the forests near Batoerraden, on the slope of Mt. Slammat (VII, Mid Java). Only twelve males and fourteen females were captured during five years in succession and in all months of the year. Evidently a very scarce species. No other localities have come to our knowledge.

18. **Drepanosticta sundana** (KRÜGER, 51) (RIS, 86) LIEFTINCK (66).

Widely but sparingly distributed throughout the island, from sea-level up to ca. 900 m alt. Habits similar to the other species but less restricted to heavy jungle and often occurring in more open places such as bamboo groves and second-growth woods. The Tjarita specimen had just emerged from a tiny brook flowing through flat country near the sea-coast. Breeds also in rapid streams, the larva crawling to large stones along the edge of the water. A full description and figures of the aberrant type of larva is found in this Journal, 14, 1934.

West Java: Tjarita, sea-level; Mt. Karang, Pasirangan, 600 m (I) Mt. Salak, Waroeng Loa and Goenoeng Boender, 5-800 m; Bolang, near Leuwiliang, 600 m; Mt. Pantjar, 500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III) Mt. Limboeng, 900 m; Tjipitjoeng, 300 m (IV).

Mid Java: Isle Noesa Kambangan, sea-level; Mt. Slammat, Batoerraden, 850 m (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

Fam. AGRIONIDAE.

Subfam. Protoneurinae.

19. **Caconeura autumnalis** FRASER (27, 38) LIEFTINCK (68, sub *corvina*).

Originally described from Shillong, Assam and since then also reported from Burma and Tonkin. FRASER has correctly placed *corvina* m. as a synonym of this species. Apparently a wide-ranging insect and quite common at low levels, occurring throughout the year in Java. Breeds in woodland rivers and small brooks, also in cultivated areas. Owing to its retiring habits and black

colouring, *autumnalis* is a most inconspicuous and easily overlooked species. Ranges from sea-level up to 600 m alt.

In the Botanic Garden of Buitenzorg it breeds in a small sluggish stream flowing in a mud bed through woods. At many places clumps of bamboo grow on the immediate banks, and below the mass of tough fibrous roots which form a vertical bank are frequently pools of deeper water. *Autumnalis* flies in the shadow of these masses of roots, or hovers for many minutes over the black water so that a hurried collector might have passed up and down the stream without detecting the presence of this slender blackish insect. The ♀ oviposits in submersed rootlets of lianas, hanging down into the water, and is held by the ♂ during oviposition.

Occurs also plentifully in the forests of the Karimoen Djawa Islands, breeding in small leaf-bottomed brooks in shady surroundings.

In outward appearance and structure of caudal gills the larva resembles much the common type found in the *Agrionidae*.

West Java: Pasaoeran, sea-level, common along running water; Tjikoetjang, near Tjamara, sea-level; Malimping, streams in low country (I) Buitenzorg; Mt. Pantjar, 500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m; Tjisolak, small forest-streams in low country; Wijnkoops Bay, do. (III) Radjmandala, Tjitaroem river, 350 m (IV).

Mid Java: Djeroeklegi and Koebangkangkoeng, plain level (VII) Karimoen Djawa Is. (Java Sea) (XII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

20. *Caconeura delicatula* LIEFTINCK (68).

Also a plain species, but very rare. Decidedly more restricted to virgin country than *autumnalis*, hiding up in dense shade on the banks of rocky streams and in deep ravines where overhanging trees and shrubs produce a perpetual twilight. Apparently to be found throughout the year but always in very limited numbers. Like *autumnalis*, this species in shade is all but invisible on the wing, but as the males come out in the sunlight, hovering almost motionless near the water's surface, the bright orange thoracic spots suddenly appear like tiny flames to attract the attention of the collector. The larva is still unknown.

West Java: One ♂, Tjimataran between Pasaoeran and Tjarita, in dense forest, May 22, 1931, AUTHOR; one ♂, Bajah, 80 m (south-coast), Sept. 1934, M. E. WALSH (I) One ♂, Mt. Pantjar, 500 m, Dec. 11, 1931, in shady sago-marsh, AUTHOR (III).

Mid Java: Numerous specimens, isle Noesa Kambangan, virgin forest, all the year round; Djeroeklegi and Koebangkangkoeng, low country, locally common throughout the year, DRESCHER and TOXOPEUS (VII).

21. *Caconeura humeralis* (SELYS, 103) (FÖRSTER, 22) (RIS, 86) LIEFTINCK (68).

A single male from Moela on Mt. Sewoe, 150 m alt., has been described

and figured by RIS (86). This is the only dragonfly caught in the XIth residency, a country that might yield many other species of interest.

C. humeralis is evidently the same species as that reported from Java by FÖRSTER (22) as *Disparoneura verticalis delia* (KARSCH). I have not seen myself any authentic Javan example.

22. *Notoneura insignis* (SELYS, 115) (KRÜGER, 51) (RIS, 86) (FRASER, 31) (LIEFTINCK, 68).

Through the kindness of M. A. BALL, I have recently been able to examine the long-lost type of *insignis*, a single male from Sumatra in the Brussels Museum, and this has now proved to be the same as *fruhstorferi* (KRÜGER *et auct.*). I hope to comment again upon this and allied *Notoneura* at some other place. The type of *fruhstorferi* (male only) was described from 'Java'.

Widely but sparingly distributed over the whole island. Lives in similar places as *C. delicatula* but occurs from near sea-level up to a height of ca. 1000 m, being most commonly seen in submontane regions. Frequently found in company with *Coelliccia membranipes* and *Drepanosticta gazella* and *sundana*, throughout the year.

West Java: Pasaoeran, sea-level, in woody retreats; Bajah, south-coast, 80 m; Mt. Karang, Pasirangin, Pagerbatoe, Djoehoel, 300-700 m (I) Bolang, near Leuwiliang, 600 m; Tjipeundeuj, near Djasinga, 800 m; Mt. Pantjar, 500 m; Mt. Halimoen and Mt. Tjisoeroe, 5-600 m; Tjisolok and Wijnkoops Bay, plain forests (III) Radjamandala, 350 m; Bantarpeundeuj, between Pameungpeuk and Tjisompét, 200-500 m, common on small forest streams (IV).

Mid Java: Djeroeklegi and isle Noesa Kambangan, common; Mt. Slammat, Batoerraden, 850 m (VII).

East Java: Idjen Plateau, Blawan, 950 m; Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

Subfam. Platycneminae.

23. *Coelliccia lieftincki* LAIDLAW (63) RIS (86).

A rare woodland species, occurring sparsely throughout West and Mid Java, especially along small brooklets forming a network in swampy forest clad with *Araceae* and *Zingiberaceae*, not above 900 m. A shade-loving species. Apparently rather common all the year round on Noesa Kambangan and also not rare, though very local, at higher altitudes on Mt. Slammat, quite frequently in company with *C. membranipes*. The single imperfect ♂ from Noesa Kambangan, identified by RIS as *membranipes* and now in the Leiden Museum, belongs to this species (86).

West Java: Bolang, near Leuwiliang, 600 m; Tjipeundeuj, near Djasinga, 800 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III).

Mid Java: Koebangkangoeng; Djeroeklegi; Tjilatjap; isle Noesa Kambangan (all in plain country); Mt. Slammat, Batoerraden, 850 m (VII).

24. *Coeliccia membranipes membranipes* (RAMB., 82) SELYS (105, 115) KRÜGER (51) RIS (86, 91).

A forest-dwelling species, widely and commonly distributed over the island and occurring throughout the year in moist places from near sea-level up to 1800 m. Breeds in pools at the edge of swift streams but also in the shallow and slowly running waters of forest marshes, and never wandering far from these places. It is most commonly come across in submontane regions, restricted to damp jungle in low country. The ♀ is accompanied 'per collum' by the ♂ during oviposition. This takes place in the soft tissue of submersed *Commelinaceae* and other semi-aquatic plants. The larva is not easily noticed and is well concealed among rotten leaves on the bottom of some pool; when disturbed it may be seen moving stealthily over the dark bottom until it clings to a leaf-stalk or twig on which it is practically invisible. At times the adult rests with the wings half open.

25. *Copera annulata* (SELYS, 105).

Very rare. Not so far reported from Java. The two specimens mentioned below were seen along the borders of a weedy brooklet flowing through high grass and sedges, near the entrance of the lake. Known also from South Sumatra but not yet found in Borneo. According to FRASER, the *annulata* group breed in ponds and lakes, whereas the members of the *marginipes* group are typically stream-dwelling species.

West Java: One ♂, one ♀, Rawah Danoe, May 25, 1931, AUTHOR (I).

26. *Copera marginipes* (RAMB., 82) SELYS (105, 115) KRÜGER (51) RIS (86) KONINGSBERGER (50).

A plain species, found everywhere amongst undergrowth along slowly running water. Very common throughout the year in second growth woods, rubber plantations and sago-marshes. In Java this species breeds also in ponds, and I have observed the oviposition in *Utricularia*. In the Botanic Garden of Buitenzorg I found the larvae hiding among the silt assembled between the fine aerial rootlets of lianas pending freely into the water of a stream. The so-called "ghost" forms are teneral usually of a pure white or spotted with black, and are very conspicuous as they steal with jerky movements through the dark undergrowth (see also FRASER, 28). Probably the highest recorded altitude at which this insect has been taken is ca. 900 m, near Soekanegara (III).

Subfam. Agrioninae.

27. *Onychargia atrocyana* SELYS (106) HAGEN (44, sub *vittigera*).

Only reported from 'Java' by DE SELYS. A rare species though evidently widely distributed, also in Java. FRASER's interesting information on Indian specimens is very likely also applicable to Malaysian insects:—"Whilst great numbers of teneral are continually seen emerging, the adult insect is com-

paratively rarely come across, except when actually pairing. I believe this to be due to the fact that the adult retires to the shelter of trees on which I have occasionally seen them at a great height from the ground, a very rare habitat among Coenagrionines" (28).

The two specimens from Goenoengsari were found far from water, hiding among shrubbery along the roadside. Breeds in tanks and marshes.

West Java: One pair, not fully adult, Goenoengsari near Rawah Danoe, May 25, 1931, AUTHOR (I).

Mid Java: Patimoean and Koebangkangkoeng, marshy woodland, near the coast, numerous specimens, Jan. to May, and November, DRESCHER and TOXOPEUS (VII).

28. *Ceriagrion annulosum* LIEFTINCK (74).

Described from a single male, collected by FRUHSTORFER somewhere in the island. Quite recently, I have received a second male specimen from Dr. TOXOPEUS, captured by him in the Lampong districts in South Sumatra (Giesting, 500 m, Sept. 29, 1933). This example is smaller than the type, measuring: abd. 34, hw. 22.5 mm. Quite distinct from other species by the black apical rings encircling segm. 3 to 6 of abdomen; from *C. pallidum* FRASER (37), which also has blackish rings, it differs by the grass-green and yellow body, and by the knob-like upper anal apps. Evidently a rare species.

29. *Ceriagrion cerinorubellum* (BRAUER, 2).

New to Java. A permanent colony has established itself in a virgin forest-swamp between Tjiteureup and Tjileungsi, ca. 20 km north of Buitenzorg, in plain country. This marsh is entirely isolated, lying amidst cultivated land; it is full of boggy spots and is traversed by numerous small trickles and brooks about which is an abundant growth of the rare tree *Elaeocarpus littoralis* T. & B. and gigantic arums (*Cyrtosperma merkusii* (HASSK.)), with other lush vegetation. *Cerinorubellum* is extremely abundant in this forest, occurring especially about the boggy spots, resting on larger leaved plants and flying low and through brush to escape. The female oviposits in submersed leaves, preferably in *Utricularia* and is held 'per collum' by the male during the act of oviposition. It is a very conspicuous and swiftly flying insect, found all the year round in the same locality. The beautiful combination of colours will serve to its easy recognition.

Probably not rare but very local a species in Java. So far, Tjileungsi is the only locality known for this species.

30. *Ceriagrion coromandelianum* (FABR., 16).

New to Java. Rather stouter and larger than *erubescens*, and apparently fairly commonly spread over the swampy districts of Southwest and South Java. Chiefly a lowland species, often breeding in slightly brackish waters, but also found in submontane areas, flying among the reeds of tanks and ponds.

The conspicuously grass-green and citron-yellow males are swiftly flying and very rapacious insects, whereas the duller females are more often come across solitarily in scrub jungle or in plantations, often far from water. Once, in Oct. 1930, Mr. DRESCHER took scores of specimens, many *in cop.*, in dry hilly country near Djeroeklegi; the males of this series have a brick red abdomen, a grass-green thorax and the eyes dark blue. In Jan. 1931, similar individuals were found in copulation among rice-fields, at some distance of the previous locality. Quite a common species in South Banjoemas. In the Botanic Garden of Buitenzorg I once saw a male caught by a specimen of *Brachythemis contaminata*.

West Java: Pasaoeran; Malimping (I) Buitenzorg; Mt. Pantjar, 500 m; Mt. Gedeh, Tjibodas, 1400 m (III) Radjamandala, 350 m; Mt. Tangkoeban Prahoe, 1500 m; Mt. Papandajan, 1700 m (IV).

Mid Java: Babakan, Djeroeklegi and Patimocan, sea-level (VII) Telawa, near Djetès (XII).

31. *Ceriagrion erubescens* SELYS (117).

Also new to Java. This fine carmine red insect is very rare in Java, being found only in the sunny coastal swamps near Djeroeklegi (VII), where four ♂♂ could be taken by Mr. DRESCHER, on Jan. 12 and Oct. 19, 1929. Possibly widely distributed in similar situations, but undoubtedly much scarcer than its robust congener *coromandelianum*.

32. *Ceriagrion praetermissum* LIEFTINCK (66) RIS (86) FRASER (38).

Described from a pair in the Leiden Museum, collected by M. C. PIEPERS in 'Java'. This is the smallest species of *Ceriagrion* known. It is essentially restricted to large marshes and lakes where the surface of the water is concealed by extensive carpetings of *Pistia stratiotes* or other floating plants, such as *Eichhornia*, *Limnanthemum* &c. Here the species may be found in the greatest abundance, threading their way in jerks among the leaves. During oviposition, which takes place in the fine submersed roots of these plants, the ♀ is inseparably accompanied by the ♂. Though of much smaller size, the larva is very similar to that of *C. coromandelianum*, living well concealed among the thread-like rootlets of *Eichhornia* and *Pistia*-rozettes.

West Java: Rawah Danoe, May 25, 1931, very common, AUTHOR (I). Lake Tjigombong, 500 m, March 16, Sept. 1, 1930, and March 29, 1931, common, AUTHOR (III).

Mid Java: Djoeja, Febr. 1911, one ♀ taken by JACOBSON (XI); recorded by RIS sub *erubescens*.

A fine series of both sexes was recently captured by Dr. TOXOPEUS near Talangpadang (Lamongan distr.) in South Sumatra, July 1934.

33. *Pseudagrion bengalense* LAIDLAW (57).

Not previously reported from Java. Occurs very sparingly in West and Mid Java from the sea-coast upwards to rather high levels (highest recorded altitude:

marshes on Mt. Patoeha, ca. 1700 m). Breeds in weedy ponds and lakes with a rich submerse vegetation among which the larva hides. Not uncommon during the whole year in the Botanic Garden of Buitenzorg, but always far outnumbered by *P. microcephalum*, with which it is often mixed. Occasionally also breeding in lagoons containing slightly brackish water. A swift-flying insect, more robustly built and clearer coloured than *microcephalum*.

West Java: Tandjoeng Poetjoet, brackish water (I) Tjitajam; Tjileung-si; Tjiomas; Buitenzorg; Tjigombong; Soekanegara; Lake Njalindoeng, 900 m, very common; Siteo Goenoeng, 1000 m (III) Bandoeng; Mt. Patoeha (IV).

Mid Java: Djeroeklegi and Patimoean, sea-level (VII).

34. ***Pseudagrion infracavum*** SCHMIDT ¹).

This is another blue and black species, which, according to Dr. SCHMIDT (*in litt.*), is most nearly allied to *P. nigrofasciatum* LIEFT. Discovered on Lake Lamongan (XIX), East Java, by the German Limnological Expedition 1928-'29. Not seen by me.

35. ***Pseudagrion microcephalum*** (RAMB., 82) SELYS (107) DAMMERMAN (13).

Very common throughout the year in similar situations as *P. bengalense*, breeding also in sluggish streams and narrow irrigation channels, widely distributed in flat country and often found in brackish water marshes in the coastal districts. The highest altitude at which this insect has been taken in Java is 1400 m, ponds in the mountain garden of Tjibodas (Mt. Gedeh). The most eastern locality known to me is Ambarawa (IX), but there is hardly any doubt that it is also well distributed in East Java.

I have seen large series from Bali and almost all other islands of the Archipelago. DAMMERMAN collected a single full-grown larva from the brackish water pool on Verlaten Island, in April, 1920. This insect was provisionally identified by Col. FRASER as "*P. pruinoseum?* SEL." Recently, the adult was also found in this locality.

36. ***Pseudagrion nigrofasciatum*** LIEFTINCK (74).

Described from two ♂♂, one ♀ collected by HEKMEIJER in East Java (possibly on Mt. Ardjoeno?) (XVIII). Not yet found elsewhere. This species is allied to *P. bengalense* and *infracavum*.

37. ***Pseudagrion pruinoseum pruinoseum*** (BURM., 9) SELYS (107) CALVERT (10).

The original diagnosis of this species is based upon a single ♂ from Java, collected by DE HAAN. Afterwards, a very full description of both sexes was given by DE SELYS, drawn up from material sent to him by PLOEM, also from Java but without further indication. As has been pointed out by CALVERT, SELYS does not seem to have examined BURMEISTER's type, which possibly is not the

¹) This species will soon be described in „Tropische Binnengewässer“, Bd. V (Arch. Hydrobiol. Suppl.-Bd. XIII).

same as *pruinatum* auct. As, however, the identification of the type is impossible, I prefer to consider BURMEISTER to be the creator of this species.

A fairly common woodland insect, breeding in small streams usually containing slowly running water. Found throughout the year from near sea-level upwards to about 1500 m. *P. pruinatum* prefers shady surroundings, sometimes occurring quite abundantly in such places, keeping well out and low over the water's surface and often hovering for long periods over one spot. The larva is pale in colour and is found among submersed grass and roots near the border of a stream. I have seen but few specimens from East Java (Mt. Kawi, XVIII).

Although a small series from Mt. Tanggamoës (southern extremity of Sumatra) does not seem to present any differences with the Javan type, specimens from other regions (e.g. from E. Borneo) probably represent distinct subspecies.

38. *Pseudagrion rubriceps* SELYS (107).

Less frequently met with and less numerous than *microcephalum*, but evidently widely spread and common on muddy streams, irrigation channels and tiny water courses among rice-fields, frequenting those with a rich growth of aquatic vegetation. Chiefly breeding in running waters but also in ponds and woody marshes. As in the allied species of the genus, oviposition takes place in the tissue of leaves and stems of all kinds of plants, the female being always accompanied 'per collum' by the male during this act. In a small stream at Tjiampea, many pairs of *rubriceps* were observed depositing their eggs in submersed leaves of *Blyxa* which were lying flush with the water's surface, swept by the current but firmly anchored by their stems. The larva is wholly transparent green. I have seen males of this species hovering over trickles in mangrove swamps and slow running streams very near the coast. Highest recorded altitude about 1000 m.

West Java: Pasaoeran (I) Tandjoeng Priok; Antjol; Batavia (II) Tjiseëng; Tjibinoeng; Depok; Tjileungsi; Buitenzorg; Tjiomas; Tjiampea; Tjigombong; Tjisolak (near the Wijnkoops Bay) (III) Radjamandala; Bandoeng; Mt. Tangkoeban Prahoe (IV).

Mid Java: Djeroeklegi, sea-level; Koebangkangkoeng (VII).

East Java: Malang (XVIII).

39. *Archibasis melanocyana* (SELYS, 108).

New to Java. Two males, captured along trickles in dense scrub jungle near Koebangkangkoeng (South Banjoemas, Mid Java), Febr. 8 to 14, 1932 by Mr. DRESCHER, are the only individuals known from the island. During a two weeks' sojourn in the Karimoen Djawa Islands (Java Sea), in November 1930, I found large colonies of this species along the banks of small shady forest-brooks; with *Caconeura autumnalis* it was the only Zygopterid breeding in these places and no single *Pseudagrion* was found. The female is attended by the male during oviposition, the eggs being inserted in rows within the soft bark

of fine whitewashed roots of overhanging trees. The same species was again come across in the inaccessible coast swamps to the east of P. Karimoen, where *Mortonagrion falcatum* was discovered. It is a widely distributed species throughout Malaysia.

40. ***Teinobasis euglena*** LIEFTINCK (74).

This very slender Agrionid was discovered almost simultaneously in the swampy scrub forest of the Kinderzee district (S. Banjoemas) and in a forest-marsh near Telok Betong (southern extremity of Sumatra). It is essentially an inhabitant of the virgin forest swamps in the lowlands of South Java, where cultivation has not yet obtained a foothold. As in so many other *Teinobasis*, this species varies much in colouring, the teneral stage being entirely unlike the adult insect.

Mid Java: Djeroeklegi; Patimoean; Koebangkangkoeng (VII). Large series, all collected by Mr. DRESCHER, from Dec. to July, 1930-'33; frequently met with in the wet season months Jan., Febr. and March. A single male was found also by DRESCHER at light in Tjilatjap (VII), Dec. 10, 1930.

41. ***Pericnemis stictica*** SELYS (105, 108) KRÜGER (51) RIS (91).

Originally described from 'Java'. A rather rare species, decidedly restricted to primeval or second growth forests, sparingly distributed over the whole island and in all months of the year. In several places *P. stictica* shows a marked predilection for dark shady surroundings, such as bamboo groves and in the neighbourhood of small streams and marshes on steep heavily wooded hill-sides or in ravines. Although very local it is usually rather common in such places, forming definite and lasting colonies, restricted to small areas. Hitherto observed from sea-level up to about 900 m. The flight is weak and the insects cover only short distances.

The larva is still unknown but should it be discovered, it will probably prove to be similar to that of *Pseudagrion*, *Teinobasis* or *Archibasis*. It will be a matter of great interest to ascertain, by future observations, if the excessively long abdomen of the adult is a special adaptation to the life of their offspring in water-containing plants, such as *Bromeliaceae*, or if the attenuated body is correlated with peculiarities in length in the plants or other objects (stumps of old bamboo, tree-holes?) in which they possibly oviposit ¹⁾.

¹⁾ Lately, it has been my good fortune to obtain further evidence of this species living in water gathered in axils of plants and similar habitats. While collecting *Mecoptera* and other insects in a shady forest on the western slope of Mt. Bèsèr, near Tjiandjoer (III), ca. 1200 m alt., on Sept. 30, 1934, our attention was directed to a number of bamboo stools of giant size, which grow abundantly along the trail leading to the summit of this mountain. Some of the heavier bamboo-stems had been cut down by natives between the internodia, about three ft. above the ground, and many of the open tubes thus formed had allowed rain-water to accumulate in them. The majority of these water-filled bamboo-trunks were tenanted, in addition to the predacious mosquito-larvae of the genus *Megarhinus* and other *Culicidae*, by the curious tailed larvae of Cyphonid beetles, larvae and pupae of *Tipula pedata* (WIED.), and a large Syrphid larva. To my great surprise, in a nearly dried up hole, I found 4 whole and entire wings of a large zygopterous dragonfly which soon proved to be of an adult ♀ of

P. stictica is the largest Zygopteron of the Malay Archipelago. It is also known from Sumatra and Borneo, but I doubt whether specimens from these islands figuring under this name really belong to *stictica*. *P. triangularis* LAIDLAW, from N. Borneo, is certainly distinct.

West Java: Mt. Karang, Pasirangin, 600 m (I) Depok, 100 m; Mt. Pantjar, 500 m; Mt. Halimoen and Mt. Tjisoeroe, Djampang Tengah, 5-600 m; Soekaboemi, 600 m; Leuwimangoe, 600 m; Tjisolok and Wijnkoops Bay, sea-level (III).

Mid Java: Isle Noesa Kambangan, plain forest; Mt. Slamet, Batoeraden, 850 m (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

42. *Argiocnemis rubescens* SELYS (108) LIEFTINCK (73).

Recorded from Java by DE SELYS only. Although sparingly distributed, this species is abundant during most of the year along the borders of certain mountain lakes surrounded by virgin forest, and in marshes or ponds in similar situations in West and Mid Java at altitudes from 800-1500 m. Much rarer in coastal districts and always restricted to clear stagnant or slowly running waters in wooded country. Not so far discovered in the eastern part of the island. As is well known, this and allied species pass through fine red teneral stages which are entirely unlike the adult insect.

West Java: Mt. Gedeh, Poentjak pass: Telagawarna, 1480 m; Tjiboenan and Siteo Goenoeng, 1000 m; Soekaboemi; Lake Njalindoeng, 900 m; Soekaneegara, 900 m; Leuwimangoe, 600 m (III) Mt. Tangkoeban Prahoe, 1500 m; Mt. Goentoer, Kamodjang, 1450 m; Pameungpeuk-Tjisompet, forests up to 900 m (IV).

Mid Java: Djeroeklegi and isle Noesa Kambangan, low forest (VII).

Pericnemis stictica (pterost. white!). In the hour we remained after these wings were found, a number of other trunks were carefully examined, but no larvae were found and not a single grown dragonfly was observed here. On our way home we noticed only one specimen in the scrub-jungle, about two miles away from the original spot. Since, as stated above, the adults of *Pericnemis* frequently abide in bamboo-groves and often occur there in numbers, it is virtually certain that the usual living conditions of this insect were satisfied here or in similar situations.

As has been observed by CALVERT (Ent. News, 22, 1911: 402-411), the nymphs of other long-bodied Zygoptera, such as the neotropic *Mecistogaster modestus* SELYS, have exclusively plant-dwelling habits, living between the water-containing leaves of epiphytic *Bromeliaceae*. Of this species, CALVERT justly remarks: "... if *Mecistogaster's* eggs are deposited in the plant tissue in or near the contained water, in accordance with the general habit of Zygoptera, it would often be necessary for the female to reach far down into crevices possibly too narrow to admit of the entrance of her thorax and abdomen. The long abdomen with the ovipositor near its hind end would therefore be of distinct advantage..." (l.c. p. 410). Possibly, the ♀ of *P. stictica* whose wings were left in the bamboo-tube, was drowned during her attempts to escape, after or before depositing her eggs. It is evident that there still remains much to be done in exactly defining the conditions under which the early stages of *Pericnemis* are found. It may be noted here that THIENEMANN, in "Die Tierwelt der tropischen Pflanzengewässer" (Arch. Hydrobiol. Suppl. 13, 5, 1934: 31) mentions one Agrionid- and one Libellulid larva, both undetermined, found by him in „Bambustöpfe im Urwald", in South Sumatra.

43. *Xiphiagrion cyanomelas* SELYS (107) LIEFTINCK (66).

First described from Java by the author. Hitherto only found on the Idjen Plateau in East Java, and in the barren fields between the Kawah Domas and Kawah Djarian, two of the smaller but active craters of Mt. Tangkoeban Prahoe, in West Java. In the latter locality, the tiny blue and black *Xiphiagrion* occur along a small unsheltered brook meandering through these grounds. This streamlet is devoid of aquatic vegetation except algae, and contains tepid or hot sulphurous water, the temperature of which varies according to the depth of the water and the distance from its origin. Perhaps over 50 meters of its course *Xiphiagrion* abounds, hovering over the water or perched on overhanging twigs, and, when disturbed, keeps well out of the way, hiding up among dry scrub and boulders near the ground. The larvae are also found in the greatest abundance here, crawling and swimming freely around on the bottom of the stream where they are easily detected. At the time of our visits, the part of the streamlet in which *Xiphiagrion* breeds, had a temperature of about 42 °C. Numerous specimens were taken, mostly by Mr. DRESCHER, during ten months of the year, there being in all probability a continuous succession of broods. *X. cyanomelas* has a wide and scattered distribution, ranging from Simaloer Is. (off the W. coast of Sumatra) to the Bismarek Archipelago but has not as yet been reported from the mainland of Sumatra or Borneo. I have seen large series from Flores, Celebes and New Guinea, which probably represent an equal number of definable geographical races.

West Java: Mt. Tangkoeban Prahoe, 1450 m, crater-brooks (IV).

East Java: Idjen Plateau, Blawan, 950 m, Oct. to Dec., 1933, LUCHT (XX).

44. *Ischnura aurora* BRAUER (2).

New to Java. On this tiny red and azure-blue *Ischnura* FRASER writes: — "One of those insects which has made full use of the upper air currents, crossing seemingly impossible barriers of land and ocean" (38). Distributed all over the oriental region without forming geographical races. Very rare in Java but extremely abundant, probably the whole year round, in three localities at high altitude. On Mt. Patoeha (IV, West Java) it is quite common along the borders of the crater-lake Telaga Patengan, ca. 1600 m alt., visited by Mr. DRESCHER and Miss JUTTING in the dry season months April, May and June. Further, large colonies have established themselves among the lakes Tjebong, Warna, Dringoe, Merdada and Pengilon, on the Diëng Plateau (VIII, Mid Java) at an elevation of ca. 21-2200 m, where the insect was discovered in August 1930 by Miss JUTTING, and commonly met with again by Mr. F. DUPONT in August 1934. In this place it flies in company with *I. senegalensis*. Lastly, Prof. HANDSCHIN took large series on the borders of the mountain-lake Rance Pani in the Tengger Mts., Febr. 1931, at an altitude of 2100 meters (XVIII, East Java). The larva is quite similar to that of *I. senegalensis*.

Erroneously recorded from "Malaysia, the Sondaic Archipelago, Borneo" by FRASER (38, sub *delicata* HAG.).

45. *Ischnura senegalensis* (RAMB., 82) SELYS (107) RIS (86) DAMMERMAN (13).

This is by far the commonest species of *Agrionidae* in Java. It dominates almost everywhere, especially in cultivated areas, and is universally distributed from sea-level to over 3000 m, breeding in all stagnant waters. Found also in very lonely places, such as the windy grass-fields on the summit of the higher mountains, where even the shallowest marsh is sufficient to keep it up.

The author took specimens on three small and completely dry islets off the N. W. coast of Java, viz. HOORN, Enkhuizen and Dapoer, to which it was evidently blown by wind. DAMMERMAN collected both larvae and imagoes in the Krakatau group of islands. Occurs plentifully on the islands Bawean and Karimoen Djawa (Java Sea). Highest recorded altitudes: Mt. Panggerango, 3015 m, and Mt. Papandajan, 2350 m. Breeds also in oligohaline waters.

46. *Agriocnemis femina* (BRAUER, 6a) SELYS (108) KRÜGER (51) KONINGSBERGER (50) RIS (89) LIEFTINCK (72a).

One of the commonest of oriental Odonata and almost universally distributed. Found everywhere in Java at all altitudes up to about 1600 m. Breeds in lakes and shallow marshes, sluggish streams and ponds, occasionally also abundantly in brackish water swamps. *A. femina* is a common dragonfly in the cultivated region and one of the most important elements of the fauna of rice-fields (s a w a h), destroying throughout its development myriads of midges and other injurious insects occurring in these places. KONINGSBERGER is wrong in considering *Copera marginipes* and *A. incisa* SEL. (= *femina*) to be chiefly forest-dwelling insects since both species are decidedly more abundant in cultivated areas. Both have a wide distribution, *A. femina* ranging from the Seychelles to Australia. The adult ♂ with its dark head and black eyes and with its thorax overlaid with a snowy white pruinescence, in spite of its small size is a very conspicuous insect. DAMMERMAN found a few specimens on Sebesi, one of the islands north of the volcanic Krakatau group (April, 1921).

47. *Agriocnemis minima* SELYS (108) LIEFTINCK (68).

Originally described from a single ♂ collected in 'Java'. Few other specimens, captured by DRESCHER in South Java, have been discussed in the writer's paper, cited above. Since then I have come across this species near Buitenzorg, and in Bantam, while TOXOPEUS found it again in a coastal swamp in the same district. Apparently a scarce insect throughout West Java in flat country, but although easily escaping notice extremely abundant in suitable places. It occurs plentifully in the vast and inaccessible swamps of Rawah Danoe, living particularly in such places where the surface of the water is concealed by carpetings of *Pistia* and *Eichhornia*. When in flight it hugs the water's surface closely, stealing along in short jerky flights, usually resting on grass and leaves

hardly an inch above the water and therefore exceedingly difficult to take without wetting one's net. On the Danoe lake the tiny *A. minima* flies in company with *Ceriagrion praetermissum*, which is also a very common insect there. Also very abundant in the virgin forest-marsh near Tjileungsi, where I took large series in all seasons of the year and observed the oviposition in floating plots of *Utricularia*. The specimens from Tjarita came to a powerful carbid lantern-trap in the camp near the beach and probably originated from the marshes nearby.

West Java: Numerous specimens (♀ of the red and green colour-form) Rawa Danoe, May 25, 1931, AUTHOR; 3 ♂♂, one ♀, Tjarita, Oct. 4, 1930, TOXOPEUS (I) Tjileungsi, near Buitenzorg, forest-marsh, common (III).

Mid Java: Patimoean and Koebangkangkoeng, low country, common in Febr. and March, DRESCHER and TOXOPEUS (VII).

The species is confined to Java.

48. **Agriocnemis pygmaea** SELYS (108) (?RAMB., 82) HAGEN (40) RIS (86).

Ranges from India to Australia. Although less abundant than *femina*, this is also a very common insect found everywhere in Java in similar situations as *femina* and often flying in company with it. Highest recorded altitude 1700 m. Also known from the Karimoen Djawa and Bawean islands in the Java Sea (DAMMERMAN and LIEFTINCK), and occasionally observed along the beach in South Java. The males of this species are very rarely powdered with white on the back of their thorax.

49. **Mortonagrion falcatum** LIEFTINCK (74).

Not yet found in Java but doubtlessly occurring in the island. Described from a series of both sexes, captured by myself in the Karimoen Djawa archipelago, Nov. 25 to 29, 1930. This is a group of small islands in the Java Sea, lying slightly east of the centre point of the north coast of Java and about 38 miles from it.

Our species was found only in the coastal zone, keeping low to the surface of the water in well concealed deep pools, in the mangrove scrub.

Oviposition was not observed and no nymph which could belong to this species was found. For details of flight and habitats see the author's previous paper.

50. **Aciagrion aciculare** LIEFTINCK (66, 74).

The writer's description was based upon few specimens collected near Batavia by JACOBSON. Since then I have come across this tiny insect in various other localities in West Java. It is chiefly a plain species and a very common damselfly on some of the weedy ponds in the Botanic Garden of Buitenzorg, where it occurs throughout the year, swarming round the grassy borders and hunting close to the water's surface. Oviposition takes place in the leaves or stems of *Nymphaeaceae*, *Limnanthemum*, *Hydrilla* and various other plants.

Once, they were so numerous and so busily engaged with this action that I counted more than a dozen of couples crowded together on a single *Nymphaea* leaf. The species is especially abundant here during the first two or three weeks following on a long period of heavy rainfall, usually in the wet season months January and February. When freshly emerged, the teneral imagoes immediately leave the border of the pond, fluttering high up and straight on to the sheltering trees and shrubbery at some distance of the breeding place and hiding up there until the colours are fully developed. Once I took a few specimens in a damp situation in the virgin forest of Tjisaroea (Mt. Gedeh, ca. 1000 m.), but this is an exceptionally high altitude for this insect.

West Java: Batavia (II) Depok; Tjiseëng; Tjileungsi; Tjiampea; Buitenzorg; Bolang, near Leuwiliang, 600 m; Mt. Gedeh, Tjisaroea Est., 1000 m (III).

Mid Java: Djerboeklegi, plain country (VII).

51. ***Aciagrion fasciculare* LIEFTINCK (74).**

This tiny and inconspicuous insect was first discovered by the author in two or three shallow weedy marshes at the foot of densely forested hills, near Soekanegara, in West Java, about 900 m alt. It was commonly found there by TOXOPEUS and myself, in Dec., March and April. On lake Njalindoeng, some 20 km west of Soekanegara, this species is excessively abundant, frequenting the grassy shore-vegetation and hiding among the herbage in shady places. The oviposition takes place in decaying twigs and grass-stems, close to the water's surface, in most instances the female being held 'per collum' by the male during this act. The larva is much alike that of *Ischnura* and was found in the same place. Like *A. aciculare*, tenerals immediately leave the border of the lake after emergence, flying into scrub-jungle and trees, occasionally far away from the water.

Easily distinguished from *aciculare* by its purplish coloration. Females are dark green instead of purple. Evidently a very local species.

West Java: Lake Njalindoeng, 900 m, June and July, AUTHOR; Soekanegara, 900 m, TOXOPEUS and AUTHOR (III).

52. ***Enallagma malayanum* SELYS (107).**

Described from a single ♂ specimen, collected in 'Java'. Re-discovered by Mr. DRESCHER who took a male in a railway-compartment between Gombong and the tunnel Idjoe, in the plains of south Banjoemas (VII). This very rare species, which does not seem to have ever been found on the neighbouring islands, might still have a wide distribution in Java as well as in Sumatra.

On a hurried visit to the beautiful littoral districts of South Banjoemas, the writer spent a few hours' collecting in the lagoons and marshes behind the beach near Babakan, with the object of finding this species again. I managed to secure eight males in a brackish water lagoon, just behind the beach, by wading to my middle into the tepid water. It was very easily mistaken for

Pseudagrion microcephalum, flying exclusively over open water and "sculling" the surface closely; the males were fond of resting flat on floating plots of *Enteromorpha*, but were so shy as to be almost unapproachable. The species was far outnumbered by the *Pseudagrion*, but on looking out well could be distinguished by their slightly smaller size and deeper blue colouring. The female was not seen over the water. Early stages unknown.

Mid Java: One ♂, Gombong, May 9, 1930, DRESCHER; eight ♂♂, Babakan, sea-level, March 28, 1933, AUTHOR (VII).

Sub-orde ANISOPTERA.

Fam. LIBELLULIDAE.

Subfam. Libellulinae.

53. *Tetrathemis irregularis hyalina* (KIRBY, 48) KRÜGER (54) RIS (84).

Rare. Breeds in sunny forest-pools and marshes, usually in company with *Agrionoptera insignis* and allied genera. The adults perch on dead twigs of overhanging trees and owing to their cryptic colouring are difficult to detect among the foliage. Copulation was observed by DRESCHER in the months March, April and October. Early stages unknown.

West Java: Rawah Danoe, forest swamp, May 25, 1931, AUTHOR (I) Tjisolok, Wijnkoops Bay, forest pool, April 15, 1933, AUTHOR (III).

Mid Java: Plain country near Djeroeklegi, Febr. to April, and October; Koebangkangkoeng, Jan. to May and Oct. to November, DRESCHER (VII).

54. *Tetrathemis platyptera* SELYS (112) KRÜGER (54) RIS (84).

Recorded by RIS from South Java where FRUHSTORFER took five ♂♂ and one ♀. KRÜGER also appears to have seen a few specimens. These are the only individuals known from the island. It has a wide distribution outside our faunal limits.

FRASER has given interesting information on the egg-laying habits of this species: "In Coorg the act was performed well above water, the eggs being inserted into moss and lichen growing on a stump which was sticking up from the surface of the water. The females with their abdomen curled well under the body, hovered in front of the stump, darting in and out, stabbing their eggs into the moss at about two feet above water level. Owing to their smallness, the yellow colour of the body and saffronation of their wings, I first mistook them for wasps hovering round the stump" (28).

55. *Orchithemis pulcherrima* (BRAUER, 8) SELYS (112) RIS (84).

Species of this genus inhabit forest swamps and large marshes at low altitude, preferring sunny glades in the middle of dense jungle, where the blue and black or fiery red males rest on leaves and twigs with their wings sloping downward. Only a single male specimen of the dark stage has previously been recorded from Java by RIS. It was collected in 'Java' by PLOEM.

O. pulcherrima is a rare and very local species. I found it literally swarming in the damp virgin jungle around Rawah Danoe but did not meet with it again in the surrounding marsh or on the lake itself. All stages of maturity were found flying together on the same day, the very conspicuous adults being predominate on that occasion over the red teneral form. The only other finding-place in Java known to me is the isolated forest marsh near Tjileungsi, where a rich colony is settled. Flight weak and "hovering", covering short distances. I found numbers of exuviae, attached to leaf-stalks of grasses and *Commelinaceae*, close to the water's surface.

West Java: Rawah Danoe, May 25, 1931, very common, AUTHOR (I)
Tjileungsi, plain forest, common all the year round, AUTHOR (III).

56. *Lyriothemis cleis* (BRAUER, 6, 7) RIS (84).

Only a single ♂ and three ♀♀ were hitherto known from 'Java', without further indication of habitat. Rare and evidently a very local species, arboreal in its habits and seldom found far from the shelters of deep jungle, breeding in pools and marshes with clear water. Nothing, however, is known of its early stages.

West Java: Mt. Tjisoeroe, Djampang Tengah, 600 m, 1932, native coll. (III).

Mid Java: Three ♂♂, isle Noesa Kambangan, plain forest, Aug. 31, 1927, June 4 and Aug. 6, 1932, DRESCHER (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, Oct. 1931, LUCHT (XX).

57. *Lyriothemis magnificata* (SELYS, 112) RIS (84).

Previously known only from a single ♀ in MARTIN's collection, labelled 'Java'. Also a forest-dwelling species, quite unknown from the western part of the island but apparently rather common in a few places of the southern provinces, flying in company with the former species. It is particularly interesting to note that, on Noesa Kambangan, specimens of this fine insect are on the wing during most of the year, and this might be explained by the great rainfall and humidity of this island even in the driest period of the east monsoon, enabling many aquatic insects to produce a continuous succession of broods. In East Java practically all shallow stagnant waters dry up rapidly at the end of the west monsoon, so that dragonflies then soon disappear. Life-history unknown.

Mid Java: Five ♂♂, four ♀♀ taken in dense jungle on Noesa Kambangan, Aug. 31, 1927, April 22 and June 13, 1928, Nov. 15, 1929, June 9 and Oct. 4-11, 1930, Aug. 6, 1932 and Febr. 19, 1933, all taken by DRESCHER; three ♀♀, Koe-bangkangkoeng, dense forest, Febr. 8-14, 1932, DRESCHER (VII).

East Java: Slopes of Mt. Raoeng, Bajoekidoel Est., 500 m, Jan. 1932, LUCHT (XX).

58. *Agrionoptera insignis insignis* (RAMB., 82) RIS (84, 86) DAMMERMAN (13).

Originally described from Java. This species is entirely restricted to the littoral zone of Java, found abundantly throughout the year in mangrove-swamps, among pools in woody retreats near the sea-shore, or in the overflown scrub-wildernesses near the mouth of muddy streams. Quite unknown from the interior of Java. Breeds in almost all stagnant waters but, like the following species, is a forest loving insect preferring small shady pools. Numbers of males may be seen resting on the tips of projecting branches or dead twigs but owing to their dark blood-red and black colour-pattern are easily overlooked. Unlike *Lathrecista* it has the habit of hovering for long periods over the dark water, being motionlessly suspended in the air and fancying itself so well protected that it can be swept up with the greatest of ease. Oviposition was observed on various occasions and takes place in the usual way, the female being unattended by the male. I once observed two males resting on a twig some five feet above the surface of the water, anxiously watching the process of egg-laying until one of them got a chance of seizing its partner again.

A. insignis is one of the commonest, and certainly the most striking of all dragonflies inhabiting the islands of the Krakatau group; it was discovered by JACOBSON on Krakatau itself as early as 1908 (RIS, 86), and since then has been observed by subsequent visitors on Sebesi and Verlaten Island as well. It is also extremely abundant in the Karimoen Djawa group of islands (Java Sea), breeding freely in fresh-water tanks or pools, and in the mangrove-scrub.

West Java: Krakatau, Sebesi and Verlaten Is., JACOBSON and DAMMERMAN (Strait Soenda); Klappers Island (P. Deli), off the S.W. point of Java, Febr. 17-24, 1932, native coll.; Pasaoeran, mangrove-swamp, May 23, 1931, AUTHOR (I) Tjipanas near Tjisolak, April 15, 1933, common, AUTHOR; Wijnkoops Bay, Jan. 18, 1934, common, AUTHOR (III).

Mid Java: Babakan, Aug. 1927 and March 1933, DRESCHER and AUTHOR; isle Noesa Kambangan, not uncommon in Jan., Febr., April, Aug. and Dec., DRESCHER (VII) Karimoen Djawa Islands, May 1926 and Nov. 1930, very abundant, DAMMERMAN and AUTHOR (XII).

East Java: Banjoewangi, Sept. 25, 1932, along the beach, TOXOPEUS (XX).

59. *Lathrecista asiatica asiatica* (FABR., 18).

New to Java. A rather rare species with a wide distribution outside Java, occasionally found along the banks of slow running rivers in low country, yet only where jungle clothes the banks. Apparently more commonly spread in littoral districts and sometimes quite abundant in swampy woods near the coast in South Java. A shy and retiring insect but easily recognized by its light red abdomen. Usually found in company with *Agrionoptera insignis* and *Potamarcha obscura*, and with habits similar to the former. Breeds in pools and forest marshes, perhaps also in brackish water. The handsomely coloured

males are on the wing during most of the year. Females are rare and inconspicuous; only three examples are known to me, one from Buitenzorg and two from the Wijnkoops Bay and Babakan.

West Java: Pasaoeran, riverine, May 23, 1931, AUTHOR (I) Buitenzorg, Aug. and Sept. 1919, one pair determined by FRASER as *L.a. pectoralis* BRAUER; Depok, Oct. 1907, EDW. JACOBSON; Wijnkoops Bay, common in Dec. 1933 and Jan. 1934, AUTHOR (III).

Mid Java: One pair, Babakan, sea-level, Aug. 1927 and March 1933, DRESCHER and AUTHOR; Djerboeklegi, common, Febr. 1-28, 1931, DRESCHER; isle Noesa Kambangan, scarce, Dec. 1927 and May 5, 1930, DRESCHER (VII) One ♂, Kemiri, March 1916, W. ROEPKE (XII).

60. *Potamarcha obscura* (RAMB., 82) (HAGEN, 39) KARSCH (45) (SELYS, 113) KRÜGER (54) RIS (84).

One of the commonest Libellulines of the island. Occurs everywhere and in all seasons. Highest recorded altitudes Mt. Tangkoeban Prahoe, 1600 m and Kamodjang, near Garoet, 1450 m. It is extremely abundant in plain country and is more often found in cultivated than in forested areas. The insects may be observed swarming over muddy pools and round the borders of irrigating ditches, the turbid drinking places of buffalos being a favourite haunt. They prey upon all kinds of insects, especially syrphus- and dung-flies being noticed among these.

Unlike *Agrionoptera* this species wanders far from water and is particularly fond of settling on telephone wires. On auto-trips across the cultivated country of West Java hardly any such wire can be seen along the road during the ride that does not hold thousands of occupants. *Potamarcha* is also a very common species in the littoral zone and numerous specimens may be observed in the low bush behind the beach in South Java. Breeds in all stagnant and slowly running waters, also where the water is slightly brackish. The oviposition is accomplished without the male's attendance and the larva lives in the mud of pools, rice-fields and marshes. Both sexes are attracted by light at dusk. I possess a ♂ collected by DELSMAN, in June 1920, on Bawean Is. (Java Sea) and Mr. VAN DELDEN caught a ♀ on Kangean Is., in April 1932. Both specimens are true to typical *obscura*.

61. *Cratilla lineata* (BRAUER, 8) RIS (84).

Recorded from 'Java' and Buitenzorg by RIS.

A rather rare woodland species with a wide distribution in Java, occurring from near the sea-shore upwards to altitudes varying between 600 and 850 meters. A very local dragonfly, only exceptionally found in great numbers in one locality, preferring shady leaf-bottomed forest pools. In its habits *C. lineata* has much in common with *Potamarcha obscura* with which I have always found it associated. Though larger, it is at first easily mistaken for it, yet *Cratilla* is a much warier insect. The dark males perch on the ends of prominent branches

and twigs with their body held straight out and with wings downward; they dart up on the slightest move but usually to the same spot as before.

On a visit to the forest marshes at the foot of immense mountains immediately joining on to the beach of the Wijnkoops Bay, I met with a great abundance of Libelluline dragonflies, among which of the *Potamarcha* series of genera were represented, viz. *threcista*, *Potamarcha* and *Cratilla*, the latter being the scarcest. A single ♂, collected by DOCTERS VAN LEEUWEN on Krakatau Is., markedly from Javan specimens by its dark colours. It is identical to the race occurring in South Sumatra and Borneo. I have seen several examples. Local races of *lineata* will very probably be distinguishable.

As in *Potamarcha* and *Orthetrum*, the larva lies up in the dead leaves on the bottom of small pools.

West Java: One ♂, Malimping, sea-level, April 24, 1934. Three ♂♂, Bolang near Leuwiliang, ca. 800 m, forest pool, July 22, 1934. Two ♂♂, Tjipeundeuj, near Djasinga, 800 m, July 22, 1934. Buitenzorg, Aug. 1919, determined by FRASER as *P. obscura* 1. Tjisoeroe, Djampang Tengah, 650 m, March and May, 1933. One ♂, Wijnkoops Bay, Jan. 18, 1934, AUTHOR (III). Two ♂♂, one 350 m, March 27, 1934, forest pool, TOXOPEUS (IV).

Mid Java: Mt. Slamet, Batoerraden, 850 m, local throughout the year, DRESCHER (VII).

62. *Cratilla metallica* (BRAUER, 8) SELYS (116) RIS (84).

Reported from 'Java' by DE SELYS without further comment.

I have examined a single damaged male in the collection of the Natural History Museum, labelled: "*Orthemis Wallacii* SELYS, ♂ var. Java", in his writing. The species should be rediscovered sooner or later.

Ranges from Burma and Cambodia throughout Malaya. It is common in forest-marshes. I have seen specimens from the point of Sumatra, Banka and Borneo.

63. *Orthetrum chrysis* SELYS (117).

New to Java. Chiefly a plain species, widely but sparingly all over the island in woody districts, breeding in leaf-bottomed marshes and small brooks. Moderately common, but local, and much rarer in submontane areas where it is replaced by *O. gloriosum*. The glorious red males prefer open sunny places near the water's edge, on the prominent twigs of faggots, or on stones beside their breeding places. A shy and active species, easily recognized on the wing from *O. gloriosum*, the head and thorax being darker and by the vividness of its coloration. On Mt. Tangkoeban Prahoe and in various other localities it is found to fly together, and in such places the females are practically indistinguishable from the males.

During my stay in the Karimoen Djawa archipelago (Nov. 1930), *O. chrysis* was met with in the greatest abundance, disporting over clear forest brooks. Copulation was often observed there and is accomplished in flight; it lasts many minutes, and during the act of oviposition the female remains incessantly accompanied by the male. Sometimes, when the ♀ is about to oviposit, the ♂ releases its partner, alights on a twig close by and defends her carefully against competitors, attacking boldly any passing dragonfly. The larvae were found under débris and leaves in pools.

West Java: Rawah Danoe, fairly common along brooks in the marsh, May 25, 1931, AUTHOR; Malimping, April 24, 1933, common, AUTHOR (I) Tjileungsi, common in the forest during most of the year, AUTHOR; Tjipeundeuj, near Djasinga, July, AUTHOR; Tjisolok, April and June, and Wijnkoops Bay, Jan., AUTHOR; Zand Bay, July, DOCTERS VAN LEEUWEN; Soekanegara; Pagelaran; Leuwimangoe, Dec. 1931, AUTHOR (III) Radjamandala, Sept. 23, 1931, AUTHOR; Mt. Tangkoeban Prahoe, 14-1500 m, Sept., Oct., Febr., December, common with *O. testaceum* and *pruinatum*, DRESCHER (IV).

Mid Java: Djeroklegi, sea-level, April 14, 1929 and Jan. 20, 1931, DRESCHER (VII) Karimoen Djawa Is., Java Sea, AUTHOR (XII).

64. ***Orthetrum glaucum*** (BRAUER, 1) RIS (84).

First recorded from 'Java' by RIS. Moderately common. Distributed throughout the island in all months of the year, occurring from sea-level up to about 1400 m. Breeds in streams or in brooks flowing through marshes and very often the males are seen hawking up and down roadside brooks. Oviposition was observed here or in pebbly shallows of the stream, the ♀ being unaccompanied by the ♂. The species is readily distinguished from its congeners by the uncrossed triangle of the hind wing and by the bright blue pruinescence of its abdomen. In aged females the body is sometimes also densely powdered with blue.

West Java: Pasaoeran, riverine; Tjikoetjang near Tjemara; Malimping; Bajah, south-coast (I) Mt. Gedeh, Tjiboenar Est.; Soekaboemi; Mt. Halimoen and Mt. Tjisoeroe, Djampang Tengah; Soekanegara; Pagelaran; Leuwimangoe; Tanggeung; Tjisolok; Wijnkoops Bay (III) Mt. Tangkoeban Prahoe; Mt. Limboeng near Tjisompel (IV).

Mid Java: Mt. Slamet, Batoerraden; Djeroklegi (VII).

East Java: Mt. Lawoe, Sarangan (XIV) Popoh, beach (XVI) Mt. Raoeng, Bajoekidoel Est. (XX).

65. ***Orthetrum luzonicum*** (BRAUER, 6 and 7) RIS (84).

A mountain species, not yet found below 700 m. Rare, but apparently widely distributed and forming isolated colonies in certain districts at high elevation. Breeds in marshes and lakes with an abundant growth of cat- and horse-tails, a stream flowing through a marsh being a favourite spot. The adult is easily captured, except on hot days; it flies over short distances, hovering for long

periods in the air and settles on scrub or reed-stems. Oviposition takes place solitarily or 'per collum', in most cases the ♀ being attended by the ♂. Copulation was observed in March, Aug. and Dec. The larvae have gregarious habits, lying up in the mud or among curtains of algae. In Telaga Saät all larval stages are represented the whole year round.

West Java: Mt. Gedeh, Tjibodas and Telaga Saät, Poentjak pass, 14-1500 m, common in marshes, AUTHOR; Wanasari above Soekaboemi, 1300 m, July, W. ROEPKE; Mt. Tjisoeroe, Djampang Tengah; 600 m, July, native coll.; Soekanegara and Leuwimangoe, 900-700 m, fairly common in marshes, March, Oct. and Dec., TOXOPEUS and AUTHOR (III) Mt. Patoeha, Telaga Patengan, 1600 m, Nov., W. ROEPKE; Pengalengan Plateau, Tjitere, 1400 m, July, J. VAN DER VECHT (IV).

Mid Java: Diëng Plateau, 18-2100 m, very common in August along small brooks and in marshes, T. VAN BENTHEM JUTTING and F. DUPONT (VIII).

66. *Orthetrum pruinatum pruinatum* (BURM., 9) (BRAUER, 2) SELYS (112) RIS (83, 84) KONINGSBERGER (50).

Originally described from Java. A very common species all the year round and distributed over the entire island. Restricted to mountainous regions. It was recorded by RIS from Batavia, Buitenzorg and Soerabaia, but at such low altitudes it is seldom come across in abundance and usually replaced by *O. testaceum*, which is a common insect in low country. It occurs very sparingly in the Botanic Garden of Buitenzorg, and I have seen only few specimens from altitudes below 500 meters above the sea. The purplish red males are very conspicuous insects on the wing; they are often seen patrolling sunny forest-paths, roadside brooks and pools, mostly in large numbers. Frequently found in shallow marshes and among leaf-bottomed ponds in wooded country, where from some twig or stone they watch the traffic, attacking all passing animals. A bold and swift-flying insect.

The ♀ prefers sheltered retreats, going only to the water to oviposit, while the active ♂♂ constantly patrol the shore on the lookout for females or for their insect prey. Immediately after each copulation the ♀ proceeds to ovipositing which is accomplished without the male's attendance. The larvae are found in similar situations as *O. chrysis*.

67. *Orthetrum sabina* (DRURY, 15) NEEDHAM (81) RIS (84, 86) KONINGSBERGER (50).

Extremely abundant throughout the whole of Java. One of the best known and most easily recognized dragonflies of Java and a dominant species in cultivated country, breeding in all stagnant and slowly running waters. Owing to its insensibility to changes in temperature and rainfall, it can stand in almost any country, from sea-level up to about 2500 m.

Unlike other members of the genus it frequents rank herbage round the borders of ponds, lakes and rivers, darting stealthily about among grasses and

harmonising well with its surroundings. It feeds principally on microlepidoptera, bugs and zygopterous dragonflies, and, as FRASER justly remarks, "is a veritable shark amongst these small defenceless insects" (28). In the coppice around the forest-marsh near Tjileungsi, I once observed considerably numbers of *sabina* being in pursuit of the large bluish white Flatid *Bythopsyryna tineoides* OLIV., which mimics a Lycaenid on the wing (March 26, 1934).

O. sabina flies swiftly over short stretches, but quite unlike other *Orthetra* is mostly seen resting in long grass or among leaves in the shrubby undergrowth. The copulation was often observed in the grass round the water's edge; it lasts from 68 seconds to over 5 minutes and each act of copulation may take place with a different male. The eggs are laid singly, although sometimes the ♂ retains his hold of the prothorax of the ♀. Breeds also in brackish waters. I have seen or captured myself specimens on the arid coral-islets Onrust, Enkhuizen and Hoorn, off the northcoast of Java, and Messrs DELSMAN and DAMMERMAN took it on Bawean Is., in the Java Sea. During my stay in the Karimoen Djawa archipelago only few individuals of *sabina* were observed. The larva has been described and figured by NEEDHAM, from specimens collected in Buitenzorg.

68. ***Orthetrum silvarum* LIEFTINCK (75).**

Described from a series of males, taken by myself near a forest-pool on the northern slope of Mt. Gedeh-Panggerango, June 5-16, 1932 (III, West Java). A shade-loving species, probably confined to forest-marshes at high elevations. Owing to its cryptic colouring, *silvarum* is a remarkably inconspicuous insect; it has the habit of resting on leaves among dense foliage, and, accordingly, is easily overlooked. The female is still unknown.

69. ***Orthetrum testaceum testaceum* (BURM., 9) KIRBY (49) RIS (84) KONINGSBERGER (50).**

The type comes from Java. This is chiefly a lowland species, universally and commonly distributed all over the island, breeding in almost any waters. Habits similar to *O. chrysis* and, although often found in company with this species, less selective with regard to its haunts. *O. testaceum* becomes increasingly rare as traced higher in the mountains, the highest recorded altitude lying at about 1500 meters above sea-level.

When on the wing the ♂ is distinguished from *chrysis* by its lightly coloured head and by the orange-red of the body being less intensive. No intermediate examples have ever come under my notice.

70. ***Orthetrum triangulare triangulare* SELYS (112).**

New to Java. Of this species, I have lately received four adult males, captured by a native hunter in April 1933, and May 1934, on Mt. Tjisoeroe at ca. 600 m above sea-level (Djampang Tengah, III, West Java). Evidently a very rare species in Java.

Ranges from India through Malaya to Sumatra, whence it has first been recorded by RIS, in 1927. Previously not known elsewhere. The discovery of this species so far south is of great zoogeographical interest.

In Western India, according to FRASER, *O. triangulare* is a mountain species with palaeartic tendencies, found at altitudes above 5000 ft. Its lower line of distribution meets, but rarely merges with that of *O. glaucum*, although their habits and breeding-places are identical. They appear to be inimical to one another and FRASER does not ever remember seeing the two species in the same locality.

71. **Brachydiplax chalybea chalybea** (BRAUER, 6).

Not so far reported from Java. Not common but apparently widely distributed in non-cultivated wooded country, and essentially restricted to the plains. Moderately common in the coastal districts of West and South Java, breeding in ponds, marshes and backwaters, flying mostly over open water. The blue-powdered males have the habit of resting on dead twigs and on vegetation growing on the pond, keeping well out of the reach of an insect net. It is a very shy dragonfly, darting away on the slightest movement and flying very swiftly from one obstacle to the other, alternating its flight by short periods of hovering. Sometimes specimens are found numerous in disused boggy rice-fields with a rich aquatic vegetation. Thus, during my stay in the Karimoen Djawa islands, every bit of such low swampy ground was swarming with them during November. Also very common in May on the Danoe lake in Bantam, where great numbers were seen perched on the tips of rush-stems growing in the swamp. Females are only occasionally seen and prefer the seclusion of bamboo-groves and other shadowy places, often far from the neighbourhood of water. The eggs are laid without the male's assistance. Breeds also in oligohaline waters. Both sexes come to light at dusk.

West Java: Tjilegon; Rawah Danoe; Malimping (I) Batavia (II) Tjileungsi; Tjiampea; Tjiomas; Buitenzorg (III).

Mid Java: Patimoean; Koebangkangkoeng; Djeroeklegi; Babakan; Tjilatjap; all at sea-level (VII) Karimoen Djawa Islands (XII).

72. **Raphismia bispina** (HAGEN, 42) LIEFTINCK (74) DAMMERMAN (13, sub *Brachydiplax farinosa*).

Also new to Java. This is exclusively a littoral species, distributed all over the eastern islands of the Malay Archipelago, but hitherto not known further westward than Borneo and restricted almost everywhere to the coastal zone. First discovered on the Krakatau group of islands, in Dec. 1919, but since then also found on the little coral-reef islets off the N.W.-coast of Java and in the mangrove forests near Batavia. Probably occurring scatteringly in all similar situations in Java.

R. bispina is an easily captured insect, resting on twigs and roots with wings half open; when fully matured, the pruinose males are entirely unlike

the teneral stage. I have seen it literally swarming among the mangrove vegetation of the Karimoen Islands, both sexes being equally well represented. No specimens were observed outside these surroundings. The larva is very similar to *Diplacodes*.

West Java: Verlaten Island (Krakatau group), Dec. 1919, April 1921, Nov. 1932; former specimens identified by FRASER as *Brachydiplax farinosa*. Edam and Hoorn Is., in the Bay of Batavia, May 7, 1931, T. VAN BENTHEM JUTTING; Antjol, near Tandjoeng Priok, Jan. 25, 1931, AUTHOR (II).

Mid Java: Karimoen Djawa Islands (Java Sea), May 1926, DAMMERMAN, and Nov. 22-30, 1930, AUTHOR (XII).

73. *Acisoma panorpoides* (RAMB., 82) RIS (86).

The whole of Java, restricted to plain country. Fairly common, but local, in shallow marshes, among the swampy shore-vegetation of lakes and ponds, and in rice-fields. Hides among grass and sedges low to the water's edge, and owing to its cryptic colouring is a very inconspicuous and easily overseen insect. Flight weak. Habits otherwise much as in *Diplacodes trivialis*. Apparently also breeding in slightly brackish waters. The species was taken on the volcanic island of Krakatau, in Dec. 1919, and DAMMERMAN took two ♀♀ on Bawean Is. (Java Sea) in May, 1928.

74. *Diplacodes nebulosa* (FABR., 17) RIS (84, 86).

This species is found only in low marshy areas, occurring in small colonies in swamps and ponds. It is strictly limited to the neighbourhood of water and, according to FRASER, never leaves the marshes in which it has been bred. TILLYARD took this species in North Queensland and reports on it: "It flies about ten yards out from the edge of the swamp and keeps very close to the surface of the water. It can only be captured by wading. The motion of the wings is so quick that it is exceedingly difficult to see this insect when flying, though its actual progress is slow and very zigzag. It is fond of sitting on the very tips of grass and reed-stems sticking out of the water, with its wings depressed." (124). A larva from Bekassi, near Batavia, presumably referred to this species, was described by RIS (86). Very rare in Java and possibly only occurring along the north-coast at sea-level. Reported from near Batavia by RIS. I have seen only three females, all taken by JACOBSON near Batavia, in Dec. 1907, and in Febr. and Nov., 1908.

75. *Diplacodes trivialis* (RAMB., 82) BRAUER (2) NEEDHAM (81) RIS (86) KONINGSBERGER (50) DAMMERMAN (13, larva sub *D. nebulosa*).

Extremely abundant everywhere and at all elevations throughout the year. Frequents low, dry situations, mostly far from water. A very common insect in gardens or by roadsides where it rests on bare patches of ground, on foot-tracks through low grass, or on gravel-paths. The males are often seen skimming over the hot bitumen-roads and numerous specimens fall a victim of the radiator of passing automobiles. It is a very wary but inquisitive insect. When at rest

on some stone or wall, it turns about the observer, carefully studying his intentions, taking on a very peculiar attitude, viz. by holding the body almost straight up, while the wings are pressed strongly down.

The ♂ and ♀ are both, for many weeks after emergence, of a dull brown colour, with black markings. Later on, when quite matured, the thorax and abdomen of the male, and more rarely of the female also, become covered with a bluish bloom, except on the last segment or two, which are jet-black. The insect then appears entirely different from the described brown type. Breeds in all stagnant and slowly running waters. In the bush *D. trivialis* often falls a victim of large Asilid flies. Also common on the islands of the Krakatau group, on the coral islets in the Bay of Batavia, on Dapoer Is. (Thousand Islands), and in the Karimoen Djawa archipelago. I have further seen specimens from the Bawean and Kangean islands, in the Java Sea. NEEDHAM's larvae from Buitenzorg are, I think, correctly placed in this species.

76. **Brachythemis contaminata** (FABR., 17) RIS (84).

An easily recognised and common insect everywhere in the plains of Java, but occasionally also fairly abundant at high altitudes on mountain lakes. Highest recorded altitude 1460 m (Telagawarna, old crater-lake on Mt. Gedeh), and Danoe Pateungteun, 1500 m, near Garoet. It is on the wing in every month of the year, a continuous succession of broods appearing. Prefers shallow fish-ponds, lakes and tanks, where it is seen skimming the waves. Flight often interrupted, settling on floating leaves of *Nymphaeaceae* and low herbage round the borders of a pond. It is never seen away from water. The larva lives freely among choke-weed and other plants. Breeds also in drainage-channels and sluggish streams. The female oviposits unaccompanied by the male. Extremely abundant in the Botanic Garden of Buitenzorg. I once saw a female capturing an adult male of *Ceriagrion coromandelianum*.

77. **Neurothemis fluctuans** (FABR., 17) (BURM., 9) SELYS (113) CALVERT (10) KRÜGER (55) RIS (84) KONINGSBERGER (50).

Recorded from Depok and Buitenzorg by RIS. Moderately common and rather widely distributed throughout the year in West and Mid Java, but exceedingly local. Chiefly a plain species, but occasionally occurring also at high, or even very high altitudes. It restricts itself to lakes, big ponds or paddy-fields (s a w a h's), where it usually forms thickly populated colonies. A large colony, containing almost black-winged males, occurred on lake Danoe, favouring the damp jungle and the swampy area round the border of the lake. On occasions it may be seen flitting in countless swarms in paddy fields, and in such open country the males appear to have their wings less intensively marked with brown. On Mt. Slamet and in a few other localities (Soekanegara) this species probably intermingles with *N. palliata* and *terminata*, and I possess several perfectly intermediate specimens from these localities which doubtlessly are the result of cross-breeding. The female of Javan *fluctuans* belongs to a pale heterochromatic form. The larva has plant-dwelling habits.

West Java: Rawah Danoe; Malimping (I) Buitenzorg; Depok and surroundings, common; Mt. Gedeh, Tjibodas and Siteo Goenoeng, 1000-1400 m; Mt. Tjimerang, Djampang Tengah; Lake Njalindoeng, 900 m, common; Soekane-gara, 900 m (III) Mt. Papandajan, Tegal Marioek, 2200 m, March 31, 1930, one male, C. VAN STEENIS (IV).

• Mid Java: Noesa Kambangan, sea-level; Mt. Slamet, Batoerraden, 800 m (VII).

78. *Neurothemis intermedia excelsa* LIEFTINCK (75).

The Javan representative of this palely coloured species is rather intermediate between Indian *intermedia* and *N. nesaea* RIS, which in the writer's opinion is the most easterly distributed race of *intermedia*. The species is unknown from Sumatra and Borneo but very likely also inhabits the former island. Only two specimens, from widely distant localities, are known from Java.

Mid Java: One male (juv.), Patimoean, sea-level, April 19, 1929, DRESCHER (VII).

East Java: One male (ad.), Kedangan, 40 m, Dec. 2, 1927, F. VERBEEK (XV).

79. *Neurothemis palliata palliata* (RAMBUR, 82) RIS (84).

Only a single ♀, collected by FRUHSTORFER somewhere in Java, has previously been known from the island. Distributed all over Java. Rare and exceedingly local, but very plentiful where found. Habits identical to *fluctuans*, frequenting the immediate neighbourhood of water and preferring the grassy border of lakes. Very common throughout the year on lake Tjigombong, near Buitenzorg. On Mt. Pantjar I once met with large flocks swarming in a paddy field; a series here taken shows considerable variability in size and all specimens have more than one cross-vein in the cubito-anal field of the hind wing. Locally common on Mt. Slamet in all months of the year; among typical individuals several are exactly intermediate between *fluctuans* and *palliata*; and there is much evidence of these specimens being hybrids. Similar transition forms were taken by me near Soekane-gara. As a rule, the male has more darkly pigmented wings than *fluctuans* and *terminata*. One out of a series of ca. 50 isochromatic females, from different localities, belongs to the clear-winged heterochromatic form (Mt. Slamet).

Oviposition was observed on lake Tjigombong, and is accomplished without the male's attendance; the ♀ skims over stretches of open water, hovering for a time over a definite spot and then drops swiftly, curving its abdomen strongly under the body, striking off her cluster of eggs two or three times and then again rises in search of a fresh spot.

West Java: Mt. Pantjar, 500 m; Tjigombong, 500 m; Wijnkoops Bay, sea-level; Soekane-gara, 800 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III).

Mid Java: Mt. Slamet, Batoerraden, ca. 800 m (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

80. ***Neurothemis terminata terminata*** RIS (84, 86) (RAMBUR, 82) (BRAUER, 3, 7) (SELYS, 113) (KRÜGER, 55) DAMMERMAN (13).

The typical race of this species was originally described from Java. Rather a homogeneous species, commonly and widely distributed all over the island, from sea-level upwards to altitudes varying between 1400 and 1500 meters. *N. terminata* is not essentially gregarious in its habits, being found almost everywhere and in all seasons in moisty places, preferring marshes, ponds and rice-fields. Also abundant in forest-swamps, in woody meadows and in bamboo-groves. Breeds in still waters. Oviposition similar to *palliat*a.

Javan females are heterochromatic and easily recognized by their smoky wing tips. The isochromatic form is very rare in Java; I have seen isolated specimens from the following localities:— Klappers islet (Poeloe Deli), off the S.W. point of Java, Febr. 1932; Mt. Karang, May 1931 and Malimping, April 1933 (I) Mt. Tjisoeroe, Djampang Tengah, Dec. 1932, and Soekanegara, Dec. 1931 (III) Tjipitjoeng, July 1934 (IV). I have examined a small series of males from Bawean Is., in the Java Sea, collected by DELSMAN and DAMMERMAN, April 1920 and May 1928, which do not differ in any way from specimens of West Java. A single heterochromatic ♀ from Kangean Is. (Java Sea), taken in April 1932 by VAN DELDEN, might eventually belong to *N. terminata obscura* FRAS. Once, Mr. DRESCHER took a male at light in Tjilatjap, on Jan. 17, 1928, which is exactly intermediate between *fluctuans* and *terminata*. Lastly, DAMMERMAN captured a single ♂ on Verlaten Is. (Krakatau group) in April 1920, and a heterochromatic ♀ on Krakatau Is. (Zwarte Hoek) in June, 1932; both specimens are true to the type.

This species is replaced in the Karimoen Djawa archipelago by:—

80a. ***Neurothemis terminata obscura*** FRASER (31).

Considered as a distinct species, but doubtlessly belonging in the same formenkreis. Differs very markedly from the typical race by the brown of the wings being more extensive, covering almost the entire wing surface. It is further distinguished by its closer neuration and decidedly darker pigmentation. *N. terminata obscura*, besides being darker, is on an average much smaller than typical *terminata* and the wings are comparatively broader with the tips more rounded. Extremely abundant in the Karimoen islands, breeding exclusively in fresh stagnant waters and avoiding the mangrove vegetation. Favours weedy marshes and paddy fields where it forms overcrowded colonies. In one such, near the capital village on P. Karimoen, the numbers were so great in November as to blacken the swampy rice-fields of the natives. Both colour-forms of the ♀ are equally well represented and all intergrades of the two extremes occurred in the same locality. Flight swift and buzzing, low to the ground. Also quite common on forest-paths and clearings in the wood, settling on branches and leaves in the sunshine. First noticed by DELSMAN, in Oct. 1920 and afterwards taken by DAMMERMAN in May 1926, and by myself in Nov. 22-30, 1930.

A single ♂, not morphologically different from true *obscura*, was captured by DAMMERMAN on Sebesi Is., off the southcoast of Sumatra, in April 1921. Curiously enough, the two examples collected in the proper Krakatau group (some 10 miles distant from Sebesi) do not differ from typical *terminata*.

81. ***Neurothemis tullia feralis*** (BURM., 9) CALVERT (10) RIS (84, 86) DAMMERMAN (13).

Widely but sparingly distributed in the coastal districts of the entire island, often far from water. A rather rare and very local species, but fairly common throughout the year in the marshy land around Batavia and also forming well populated colonies in southern Banjoemas, favouring marshes and flying over ponds. Apparently quite common in north-east Java, thus in the Samarang residency, from whence large series have come under my notice. According to FRASER, the typical race breeds in weedy tanks, their colouring being apparently protective in nature as they enjoy a total immunity from the aggression of birds (28).

I have examined two ♂♂ from the coral-reef islet Enkhuizen, in the Bay of Batavia, taken in Nov. 1919, and DAMMERMAN took a single ♂ on Krakatau, Oct. 23, 1923.

West Java: Tandjoeng Priok; Batavia; Bekasi (II) Buitenzorg; Tjibaroesa; Tjiseëng; Mt. Gedeh, Tjibodas, 1400 m, six ♂♂, three ♀♀, Sept. 1895, CANNegiETER (III). The last mentioned locality is quite unusual for this species.

Mid Java: Patimoean; Koebangkangkoeng; Djeroklegi; isle Noesa Kambangan. All taken by DRESCHER (VII) Samarang; Telawa, teak forests, L. KALSHOVEN misit. (IX and XII).

East Java: Rembang; Padangan; Gedangan, common in the teak plantations, KALSHOVEN and F. VERBEEK (XV).

82. ***Crocothemis servilia*** (DRURY, 15) BRAUER (2) KRÜGER (54) NEEDHAM (81) RIS (84).

A very common species everywhere in Java, chiefly in plain and submontane countries, but also found on lakes high up in the mountains. Highest recorded altitude 2150 m (Tegal Boengbroeng, Mt. Papandajan, IV). The imago is on the wing during the whole year. Breeds alike in running and still waters.

Countless numbers of the glorious red males enliven the shore of our ponds and lakes, struggling for the mastery of their domain in the pursuit of other dragonflies. They perch on twigs or on the tips of leaves, and from such vantage-ground make sudden dashes at passing insects. A very pugnacious and swift-flying species.

The female is not accompanied by the male during oviposition and the eggs are deposited by tapping the water's surface in the usual Libellulid manner. In most cases the ♀ is let alone during the process of egg-laying, but each act of copulation which lasts from 5 to 15 seconds, may take place with a different ♂.

The larva lives freely among water-weed and aquatic plants. NEEDHAM's two specimens from Buitenzorg, referred to *Crocothemis* with much doubt, evidently belong to *Brachythemis contaminata*. On the other hand, the numerous larvae from the same locality, and identified by NEEDHAM as *Trithemis aurora*, agree closely in all respects with my material of *Crocothemis servilia* (81).

C. servilia is one of the chief representatives of the aquatic insect-fauna of the rice-fields (sawah's) and, because of its destruction of mosquito larvae doubtlessly is of great economic importance as a really beneficial insect.

I have seen specimens from the coral-reef islet Enkhuizen, in the bay of Batavia, and a small series from Bawean Is., in the Java Sea, which do not differ from Javan specimens.

83. *Rhodothemis rufa* (RAMB., 82).

The only specimen heretofore known from the island, is the typical male that, according to LATREILLE, was discovered in Java. Distributed all over the island in low country up to about 600 m, being in flight in all seasons of the year. Not uncommon and sometimes very abundant, yet easily overlooked and mistaken in flight for *Crocothemis* and *Urothemis*, two species with similar habits with which it is often seen in company. The brilliantly scarlet red males are sun-loving and very wary insects, flying swiftly over the extensive *Pistia* fields and *Eichhornia* vegetation covering the surface of lakes, ponds and large tanks, and mostly keep well out of the reach of an insect net. The female has more retiring habitats and is very often seen away from water, hiding up in rank jungle, such as bamboo-groves in the immediate neighbourhood of its breeding place. The eggs are laid solely among plots of floating plants, and the curious black-bellied larvae are mostly found among *Spirogyra* and other weedy growth, keeping near to the water's surface.

Rhodothemis is fairly common on the *Lotus*-ponds in the Botanic Garden of Buitenzorg, but the localities in Java where it has been observed are still few in number.

West Java: Rawah Danoe; Malimping (I) Depok; Tjiseëng, Tjibaroesa; Tjiampea; Buitenzorg; Tjigombong (III).

Mid Java: Djeroeklegi; Koebangkangkoeng (VII).

East Java: Popoh, south-coast (XVI).

84. *Trithemis aurora* (BURM., 9) RIS (84).

Rather rare. Reported from 'Java' by RIS. Occurs sparingly at all elevations, from sea-level up to about 1600 meters, frequenting the borders of fish-ponds, mountain-lakes and, more rarely, streams flowing through swampy land. It is on the wing during the whole year. According to FRASER, this species prefers streams as a breeding-place in Western India, but in Java I have only met with small colonies over large ponds and lakes at rather high levels. On lake Pangkalan, I observed the oviposition of a ♀ flying over open water and dipping her abdomen in floating plots of *Utricularia*. The species is very abundant on

lake Njalindoeng, south of Soekaboemi, where I counted hundreds of specimens emerging from the grassy border of the lake, early in the morning of July 1, 1934. The nymphal skins were picked up from grass-stems, close to the water level.

Owing to their wariness, the males of this brightly coloured insect are very difficult to approach. They are fond of sitting on the projecting tips of dead branches, over open water, with their wings sloping.

West Java: Mt. Gedeh, Tjibodas and Lake Telagawarna, 14-1500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m; Lake Njalindoeng, 900 m; Soekaneegara, ca. 800 m; Zand Bay, sea-level (III) Mt. Patoeha, Telagapatengan, 1600 m; Mt. Limboeng, Tjisangiri River, 1000 m; Mt. Malabar, Pengalengan; Tjinjirean, 1700 m; Danoe Pangkalan near Kamodjang, 1500 m; Mt. Kendang, Daradjat, 1650 m (IV).

Mid Java: Djeroeklegi, sea-level (VII) Samarang, teak plantations, low country (IX).

East Java: Mt. Ardjoeno (XVIII) Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

85. *Trithemis festiva* (RAMB., 82) RIS (84).

This is decidedly a riverine species, found commonly throughout Java over small rocky streams in wooded country at all levels up to 1500 meters. The males are never found away from the neighbourhood of water where they take up positions on rocks in the stream, often in considerable numbers. In southern Banjoemas, Mr. DRESCHER took this species in company with *aurora*, but this is the only record known to me of a locality in which both species occur together. The female is a rare insect and only seen when coming down to the water to oviposit. This is performed in a very rashly manner in shallow, swiftly flowing water, great stretches of a stream being patrolled by a single individual in search of a suitable spot.

West Java: Pasaoeran, plain streams; Bajah, south-coast (I) Mt. Salak, Waroengloa; Wijnkoops Bay and Tjisolak, plain streams; Mt. Gedeh, Selabintanah; Mt. Tjisoeroe, Djampang Tengah; Soekaneegara (III) Radjmandala, Tjitaroem River; Mt. Tangkoeban Prahoe; Tjikaso River, near Tjipitjoeng (IV).

Mid Java: Djeroeklegi, plain level; Mt. Slamet, Batoerraden (VII) Samarang (IX).

East Java: Mt. Wilis (XVI) Mt. Raoeng (XX).

86. *Onychothemis abnormis* (BRAUER, 6) RIS (84).

In the collection of the Brussels Museum are one ♂ and two ♀♀ taken by FRUHSTORFER in 1893, probably in the southern districts of West Java, and a single ♂, lacking any locality-labels, collected by VAN LANSBERGE. These four insects are the only specimens known from the island.

O. abnormis doubtlessly is one of the rarest Libellulines still living in the

primeval forests of Java. The species should be looked for in deep ravines at the foot-hills of South Java, in dense jungle. It breeds in swift streams.

87. *Onychothemis culminicola culminicola* FÖRSTER (21) RIS (84).

Previously only known from a single ♀ (W. Java, STEUBEN, 1889), preserved in the Senckenberg Museum collection.

Rare. Widely distributed throughout the island, from 100 to about 900 m above sea-level in wooded country. Prefers the large sunny streams with a rich shore-vegetation along which it courses with swift flight at low elevation. Inhabits also rivers where the clay banks are high and are strewn thickly along the water's edge with boulders of various size; in such places the insect keeps well out of the banks, hawking rapidly to and fro over open water. The flight is frequently broken by long periods of rest on shrubs or on the foliage overshadowing the stream, mostly high above the water-mark. Females are only taken by chance; most specimens in my collection were put up by beating. The larva is unknown.

West Java: Pasaoeran, Tjilampir River, May (I) Depok, along the banks of a muddy stream with slowly running water, Febr.; Buitenzorg, July and Aug.; Mt. Halimoen, May; Mt. Tjisoeroe, Djampang Tengah, Jan. to Febr., May, June, July, Oct.; Soekanegara, Tjimonteh River, Dec. (III) Radjamandala, Tjitaroem River, Jan. (IV).

East Java: Mt. Raoeng, Bajoekidoel Est., April, Sept. (XX).

88. *Zygonyx ida ida* SELYS (109, 118) KARSCH (47) RIS (84).

Originally described from 'Java', and reported by RIS from the Priangan and the Tengger Mts.

This Corduliine-like dragonfly is found only in submontane regions, from 500-1600 m altitude, and distributed all over the island in all seasons of the year. Moderately common, though entirely restricted to dense original forest where the males may be seen hawking high in the air above forest-paths in the immediate neighbourhood of swift mountain streams. The very inconspicuous males are often seen hovering over rapids in midstream and are therefore difficult to get at. As in the Indian *Z. iris* SELYS, the females only come down to the water to oviposit and the males rendez-vous there to meet them, hawking slowly up and down stream on a limited beat, settling at times on low bushes or twigs overhanging the stream (FRASER, 28).

I have watched the oviposition of a ♀ hovering over a mountain-torrent just above the waterfall in the Tjimonteh, near Soekanegara. On that occasion the eggs were immediately dragged away by the water which roars over the boulders in this stream and probably settled down only at the foot of the cascade. The curious compact and strongly keeled larvae are found in rapid streams and take up a strong foothold against rocks, clinging to boulders and stones at transformation. Numbers of juvenile specimens were seen on emergence along the banks of the rocky Tjitaroem, near Radjamandala.

West Java: Mt. Megamendoeng; Mt. Gedeh, Tjiboenar Est.; Mt. Tjisoeroe, Djampang Tengah; Soekanegara (III) Radjamandala; Priangan; Pameungpeuk-Tjisompet, forest-streams, 300-900 m, common (IV).

Mid Java: Mt. Slamet, Batoerraden; specimens taken *in cop.* during the months June, Sept., and Dec. 1928 (VII).

East Java: Mt. Wilis (XVI) Tengger Mts (XIX) Mt. Ijang; Mt. Raoeng (XX).

89. **Zyxomma obtusum** SELYS (112).

Until recently, this widely distributed Trameine has remained unknown from Java. This is to be explained by its nocturnal habits and its remarkably secluded habitats. Contrary to my first supposition, I now have a definite proof of its occurrence in various localities in Java, from the coastal zone upwards to about 850 m above sea-level. The mysterious chalk-white males first appear on the wing between 5.30 and 6 *a.m.*, and then again between 6 and 6.15 *p.m.*, hovering like a phantom over forest-pools and shady tanks, and by reason of the white pruinescence of the entire body and the milky-white wings, are very striking insects when skimming over the black water. As a breeding place *Z. obtusum* seems to prefer still waters above streams, although L. MARTIN took the same species in North Celebes along streams, remarking: "fliegt nur Abends über fliessendem Wasser von 5.30 bis 6.15; sieht sehr hübsch und distinguiert aus durch ihre weisse Farbe über dem dunklen Wasser" (RIS, 84). JACOBSON, who captured *obtusum* on Simaloer Is., off the W. Coast of Sumatra, notices: "Diese Art ist schwer zu fangen wegen ihrem äusserst schnellen Flug. Fliegen nur kurz vor der Dämmerung von 5-6 Uhr Abends; verbergen sich im Tage" (RIS, 88). Similar observations have been made by Prof. HANDSCHIN in Bali, and by Prof. WOLTERECK in Central Celebes. In Java our species is remarkable in that it displays a high adaptability to human makings, inasmuch as tubs and all kinds of artificially made reservoirs in the open are frequently selected as a place for brooding. Thus, in the garden of the Zoological Laboratory at Buitenzorg, it has found a suitable breeding-place in a large cemented cistern, which sometimes is used as washing tub for tools and animal skins. Throughout the year this tank is teeming with mosquito-larvae and is continuously populated with tadpoles of two species of *Rhacophorus*, viz. the well-known "tree-frogs", whose frothy nests are attached to some bough overhanging the tank. The larvae of *Zyxomma* prey chiefly upon the mosquito-larvae and young Notonectid bugs living in the cistern.

On an inspection of the gulleys and drainage-canals on the factory-site of the rubber estate Radjamandala, I once found many cast skins attached to the cemented walls of the eduction-gullies dugged out around the factory. Messrs DRESCHER and BENNER took a fine series of both sexes in the morning-twilight just before sunrise, on the emplacement of an oil-factory near Tjilatjap, where the males were seen hawking mosquitos in the depths of two deep wells, flying close to the water's surface. According to these observers, the insect quite

suddenly disappears soon after sunrise. The nocturnal specimens, watched in the Botanic Garden also have a very short period of flight and not a single individual is to be seen after 6.30 *p.m.*

The larvae are bottom-dwellers, hiding among rotten leaves and débris, or crawling against the slithery growth of algae covering the wall of a tank. Females are rarely seen and only come down to the water to oviposit. The adult insect was captured or observed during the whole year.

West Java: Buitenzorg; Tjigombong, larvae; Wijnkoops Bay; Tjisolok, forest-pool (III) Radjamandala, tanks and gullies, exuviae (IV).

Mid Java: Tjilatjap, tanks; one juv. ♂ taken at light; Mt. Slamet, Batoerraden, beaten up in dense forest near mountain-brook (VII) Telawa, near Semarang, numerous specimens (IX).

East Java: Mt. Raoeng, Bajoekidoel Est. (XX).

90. *Zygomma petiolatum* (RAMB., 82) RIS (84).

Only a single ♂, labelled 'Java', has been made known from the island. Possibly rather a common species in the lowlands. Like the foregoing, this elusive insect has typically crepuscular habits, the duration of its flight being rather longer than in *obtusum*. In the Botanic Garden of Buitenzorg the first individuals appear at about 5 *p.m.* in the dry season, becoming increasingly abundant towards sunset, c.q. shortly before 6.15 *p.m.* Usually all insects have disappeared soon after night has set in for good, but I have observed stray specimens (males) coming to the light as late as 11 *p.m.* *Z. petiolatum* is the most inconspicuous and quite the swiftest dragonfly I have ever seen on the wing, "pursuing a rapid irregular restless flight round the borders of tanks", which coupled with the obscurity of its thin body, its transparent wings and the darkness of the surroundings renders it a most difficult insect to take. FRASER has captured it in Western India after dark by striking at its shadow as seen silhouetted against the light reflected from the surface of the water; and this is really the only way to obtain a fair series of specimens in one locality, for the insects themselves are nearly invisible (FRASER, 25, 28).

In Australia it was taken by TILLYARD "in only one spot, some ten miles out of Cairns, Queensland, flying swiftly up and down a creek in the guava scrub, at dusk. It often hovers quite motionless in the air for a long time and when flying, almost skims the surface of the water" (125).

In the Botanic Garden of Buitenzorg, *petiolatum* occurs plentifully in a dark corner of the Victoria pond where the water is shallow and devoid of aquatic vegetation. Near the outlet of this pond a dark recess is formed by the foliage of some big *Nephelium* trees overhanging the water, and when the last rays of the sun illuminate the trees, this quiet place is suddenly enlivened by the glittering wings of the tiny dragonfly which in passing may be seen hovering very low over the water. The females are the first on the wing and on cloudy days appear at 4.30 *p.m.*, thus at a time when the sun is still brightly shining. These early arrivals, on account of their pale brown abdomen,

are more easily noticed than the ♂♂, and come down to the pond chiefly to deposit their eggs. This is performed in a very nervous manner by tapping the end of abdomen against floating leaves which have just swept down into the water. The eggs are produced singly, or but a few at each stroke and are enveloped by a very sticky gelatinous substance which immediately adheres to the substratum. In July and August it is not before 5.45 p.m. that the ♂♂ appear, and from then onward scores of them fly round the border of the pond. Most of the ♀♀ are then snatched away and carried along with their mates to the dense foliage of adjoining trees. I have not been able to ascertain the duration of the copulatory act, but I think it will soon be accomplished. The period of development, from oviposition till emergence, amounts to about six months.

So far as my own experience goes, *Z. petiolatum* breeds only in still waters, frequenting shallow leaf-bottomed ponds and muddy forest-pools. The larvae hide among débris and dead leaves and are well protected against enemies. The nocturnal habits of the adult account largely for its comparative rarity and scarceness in collections. I have observed the ♀ ovipositing in Febr. and Aug. (Buitenzorg), and in March (Babakan). A detailed account of the life-history will be published at some other place.

West Java: Tjileungsi, forest-swamp, May; Buitenzorg, Febr., Aug., Dec.; Tjibadak, Febr., in railway compartment; Soekaboemi; Mt. Tjisoeroe, Djampang Tengah (III).

Mid Java: Babakan, near Tjilatjap, March (VII).

91. **Tholymis tillarga** (FABR., 18) (BURM., 9) CALVERT (10) RIS (84) KONINGSBERGER (50).

Of this widely spread and common insect only few authentic specimens, collected a century or so ago, have been reported from Java. Yet, it is quite an abundant species, found everywhere from sea-level up to considerable altitudes. So far, the highest recorded locality is on Mt. Tangkoeban Prahoc, 1500 m. Like the last, *Tholymis* is decidedly a crepuscular insect, displaying the same restless flight as is characteristic to the species of *Zyxomma*. The following remarks are quoted from FRASER's observations on Indian examples: "In Bombay *tillarga* appears on the wing soon after 6 p.m. and from then onward till long after dusk a continuous stream of the insects may be seen pursuing each other round the borders of tanks. The males are the first on the wing and by reason of the opalescent patch on the hind-wings, which has a distinctly luminous effect not unlike phosphorescent paint, it is easily distinguished. The females appear later and, as they have not the same distinctive mark as the male, they are seen with difficulty" (25). "In Coorg the insect appears on the wing at a quarter to six (Dec.-Jan.), one or two at a time, but quickly augmented until the air is swarming with them. Their flight and actions are apparently governed directly by that of the small insects on which they feed, for at one moment the swarm flights high and at another descends

to skim the surface of the ground. At a quarter past six the whole swarm disappears with dramatic suddenness" (28).

From my own experience in the field I have noticed that the whirling flocks of males as twilight comes on fly nearer and nearer the water's edge as the flocks of small *Diptera* settle on the earth. In Java *T. tillarga* is occasionally seen flying during the day over shady pools and forest-marshes, but usually they hide up under the shelter of bushes from which places they may often be beaten up. Breeds chiefly in still waters, such as ponds, canals and paddy-fields, but on various occasions I have watched the oviposition in shoals of muddy streams. Like *Pantala* it is a species with strong migratory tendencies, occurring abundantly near the sea-shore and breeding freely in brackish water marshes.

In April, 1921, DAMMERMAN took a ♀ on Sebesi Is. (Strait Sunda), and I have captured it myself in the Karimoen Djawa islands. Along with other nightflying species, such as *Zygomma* and most of the regional Aeschnines, *Tholymis* is one of the principal mosquito-destroyers and therefore of great economic importance. Adults are on the wing the whole year round.

In general appearance, the larva is rather intermediate between that of *Zygomma* and *Rhyothemis*.

92. ***Pantala flavescens*** (FABR., 18) SELYS (102) CALVERT (10) KRÜGER (54) RIS (84) KONINGSBERGER (50) DAMMERMAN (13).

Cosmopolitan and chiefly circum-tropical. Found very commonly in almost any environment, often far from water. A migratory species, breeding in all stagnant and slowly running waters, from sea-level up to ca. 2800 m alt. This species has gregarious habits and big swarms may be seen flying promiscuously over roads and lawns, where they are preying chiefly upon mosquitos, mayflies, &c. Although it moves swiftly, sometimes at a considerable height from the ground and but seldom alights, *Pantala*, by its inquisitiveness is easily captured on the wing. It is also a very common insect near the watering places of buffalos and horses, and large flocks are sometimes seen flying high in the air over pools frequented by cattle. Near Malimping, in S. Bantam, I have watched this species sailing over buffalo-tracks and actually preying upon cattle- and dung-flies which were very numerous there. The copulation takes place on the wing but is not often noticed. The larva is rather similar in outward appearance to *Tramea* but easily distinguished from other Trameine larvae by the shape of the mask and the black tarsi of middle and hind legs. They may be sought in weedy tanks, rice-fields and ponds where they contribute greatly to the extermination of mosquito-larvae. It may safely be maintained that *Pantala*, in the imaginal as well as in the larval stage should be considered as of the utmost beneficial importance.

RIS has called attention to the fact that, corresponding to the exceptionally broad and also thin and flexible anal field of the hind wings, we find in *Pantala* a faculty of planing or sailing flight which faculty is probably responsible for its excessively wide distribution. It has been recorded from

many oceanic islands not inhabited by any other dragonfly and has repeatedly been observed on board ships far from shore. Various records testify to it being a wanderer and sometimes assembling in immense numbers. In November 1932, DAMMERMAN took a single ♂ on Verlaten Is. (Krakataugroup), and on various occasions I have observed specimens on the dry coral-islets in the Bay of Bajavia. Occurs also in the Karimoen Djawa group of islands and often comes to light after dusk.

93. **Rhyothemis phyllis phyllis** (SULZER, 123) BRAUER (2, 4, 7) CALVERT (10) KRÜGER (54) NEEDHAM (81) RIS (84, 86) DAMMERMAN (13).

Terra typica unknown, but possibly Java. Reported from Batavia and Samarang by RIS. Moderately common and locally abundant in swampy country, from sea-level up to 1400 m alt. Chiefly a plain species, breeding in marshes, ponds and old weedy tanks. Although adorned with a strikingly beautiful wing-pattern, *R. phyllis* is rather an inconspicuous insect when on the wing. This is due greatly to its peculiar habit of swarming socially round the tops of bushes and small trees, often high in the air. Solitary specimens may often be seen fluttering up and down round the grassy border of some pond, displaying a very characteristic weak undulating flight, alternated by long periods of hovering.

On lake Danoe in Bantam, I have observed scores of this dragonfly fluttering in couples about two meters from the ground and driven off by a strong wind to find shelter in the neighbouring scrub.

The larva has adapted a life in shallow, mud-bottomed ponds and is but rarely found among aquatic plants.

R. phyllis is distributed over the entire island and eastern specimens are not different from the West Javan type, except for being of rather smaller size. It is often noticed in the coastal regions and possibly breeds also in oligohaline waters (Antjol near Batavia; Babakan near Tjilatjap). On Hoorn Is., I once observed a swarm flying round the top of a high tree. It is quite a common species in the Botanic Garden of Buitenzorg. A description and photograph of a full-grown larva, collected in this locality, was published by NEEDHAM (81).

94. **Rhyothemis triangularis** KIRBY (48) RIS (84).

In the collection of the Brussels Museum are two ♂♂ of this very rare species, labelled 'Java, FRUHSTORFER', which have been discussed by RIS. I have examined five other (much damaged) individuals, collected many years ago by REINWARDT and v. EYNHOVEN, all bearing the locality-label 'Java' without further comments. These are the only known *triangularis* from the island. With the excessive cultivation this species has possibly become extinct in Java. According to FRASER, Indian *triangularis* breeds in tanks (28).

95. **Hydrobasileus croceus** (BRAUER, 5) RIS (84).

Rather rare. Previously only known from a single ♀ in the Brussels Museum, collected by FRUHSTORFER in Java. Widely but sparingly distributed all

over the lowlands of West and Mid Java, breeding in marshes, lakes and ponds. Highest recorded altitude 850 m (Mt. Slamet).

Like *Tramea* and *Rhyothemis* it favours shallow waters with an abundant growth of rushes and cat-tails round the border and with a rich vegetation of aquatic plants. On hot sunny days it may be observed in every time of the year flying over two or three *Lotus*-tanks in the Botanical Garden, of Buitenzorg. The males are easily distinguished from *Tramea* on the wing by their pale brown dress and graceful sailing flight. It always keeps well away from the water's edge, hovering infinitely over *Lotus*- and waterlily-plants but disappears suddenly as soon as the sky becomes overcast. Its egg-laying habits and copulation are much the same as in *Tramea* and have very effectively been described by FRASER: "The males are found ceaselessly perambulating over weedy tanks, awaiting the arrival of females. Should a pair of males meet, they at once engage in fierce combat, ascending to a great height and often lost to sight. The conquering male, however, soon returns to the tank and this with magical swiftness. A male and female, when linked up, travel low over the water's surface tandem fashion, searching for a suitable spot to oviposit in. Meanwhile the female steadily exudes a mass of eggs which can be clearly seen, even from a distance, as a rapidly growing white spot at the end of the abdomen. Often the pair hover for a time over a definite spot and then apparently not satisfied pass on to another. The reasons for this are the dangers of being snapped up by fish or frogs, very real dangers too as frogs are constantly seen to leap at the hovering insects. The male apparently assumes full responsibility for the safety of any spot for it voluntarily releases the female which drops swiftly and deposits her bunch of eggs on some floating weed and again rises, the male adroitly resuming his hold on her neck. The search for a fresh spot is then resumed" (28).

The larva is a very graceful, transparent green creature which lives freely among soft aquatic plants, and owing to its cryptic coloration is not easily detected.

West Java: Pasaoeran; Malimping (I) Buitenzorg; Tjigombong; Mt. Tjisoeroe, Djampang Tengah (III) Lake Pantjaloe, Tasikmalaja (IV).

Mid Java: Mt. Slamet, Batoerraden; Djerboeklegi; Babakan (VII).

96. *Tramea limbata euryale* (SELYS, 112) (KRÜGER, 54) NEEDHAM (81) (RIS, 84, 86) DAMMERMAN (13).

Originally described from 'Java'. Like the last chiefly a lowland species, preferring open sunny country; much commoner than *Hydrobasileus* and almost universally distributed. It is a migratory insect par excellence, often wandering far from its breeding places and ascending to high altitudes (e.g. Mt. Tangkoeban Prahoe, 1600 m). It is quite a common insect in the littoral zone, great numbers being usually seen in low marshes behind the beach, where I have watched the oviposition of pairs flying over shallow lagoons with a rich growth of *Enteromorpha*. Also a regular visitor of old paddy-fields, where

solitary males may occupy a certain area for many successive days, although it often remains unnoticed because of its hawking high in the air. Sometimes large flocks are assembled flying round tree-tops in the pursuit of small insects, or hunting wildly together in forest-clearings. Breeds in all stagnant waters including those which are brackish. Habits and mode of oviposition otherwise very similar to *Hydrobasileus* with which it is often mixed.

In the Botanic Garden of Buitenzorg the males, which in the early morning are flying high and wide, come to the ponds on the look-out of females when the heat of the midday has increased activity. The females are usually caught on the wing, every one having a very attentive male companion. While holding her the pair flies about over the surface of the pond, stopping occasionally to oviposit and poising few inches above the water. The ♂ then releases its partner and remains poised while she drops and with a short swing taps the surface two or three times, when she again rises to the ♂ who instantly grasps her thorax with his claspers without first seizing her with his feet. This quick release and the almost immediate reclasp of the ♀ is a very dexterous performance and was first described by KENNEDY, for the nearctic *T. lacerata* HAGEN.

The yellow eggs are almost circular in outline; of a great number laid on March 10, the first larvae hatched out in the laboratory on March 18, and on the 21th of that month nearly all eggs had produced young larvae. These grow rapidly and the metamorphosis is completed within five months.

NEEDHAM has published a short description, accompanied by a photograph, of the full grown larva, collected by FAIRCHILD somewhere in Java.

Of this insect I noted stray specimens on the coral-reef islet of Hoorn, in the Bay of Batavia; and DAMMERMAN once took a ♂ on Verlaten Is. (April, 1920). Quite common in the Karimoen Djawa islands (Java Sea), and not morphologically different from Javan specimens.

97. *Camacinia gigantea* (BRAUER, 3) RIS (84).

Previously recorded by RIS from 'Java' (one ♂). A single ♀ in the Leiden Museum is labelled 'MÜLLER, Java'.

A rare and probably very local species with a wide distribution outside Java. It is the largest Libelluline inhabiting the island. Restricted to low country and found principally in non-cultivated areas, preferring the sunny border of weedy ponds or boggy situations in the midst of marshy land. On calm days the males are easily recognized insects when soaring over some waterlily-pond, but the females live secretly, hiding up in long grass in the vicinity of their breeding-place. Mr. DRESCHER took a fine series of this species in the swampy districts of S. Banjoemas, where both sexes occurred plentifully over small puddles cram-full of *Nymphaeaceae*, which were almost dried up. In 1930, on April 5, four males were here seen for the first time, perambulating over one of the ponds, and on a second visit to this spot, on June 20 and 21, the same pool had dried up completely but the insect was still present, three

of resting on twigs is quite unique among the larger Trameines and found back again in the more specialized genera *Urothemis*, *Macrodiplax* and *Aethriamanta*.

In the mangrove scrub of Karimoen Djawa (Java-Sea), I have been fortunate enough to make the same observations on two males of *gigantea* flying slowly back and forth over a brackish water pool, enclosed by a tangly growth of *Sonneratia* and dead shrubbery. Occasionally, they suddenly rose high up into the air, settling on the tip of a dead branch, often many yards above the ground and remaining quite inert for a considerable time. Over the same pool a few males of *Neurothemis terminata obscura* were fluttering about and now it happened that, whenever *Camacinia* came within striking distance, *Neurothemis* flew straight aloft, following its trail closely until being at fault and swinging round to its former resting-place. This behaviour made strongly the impression as though both insects stood on a footing of intimacy with each other, the resemblance both in colours and attitude being very striking. To my great surprise, I noted afterwards that LAIDLAW, who observed our species in the Malay Peninsula at Kuala Aring, was struck by a quite similar coincidence, writing as follows: "Two fine males were taken at Kwala Aring, where this species is fairly abundant near pools in open spaces. It is very difficult to catch, being a powerful flier. It haunted the same localities as *Neurothemis stigmatizans* [*N. fluctuans* F. is here meant], which resembles it very closely in colour, though of course much smaller". (56). In the previous event, I was particularly struck by this difference in size being entirely abolished by the distal portion of the wings of *Camacinia*, which is wholly transparent and hence invisible during flight.

I have watched the oviposition of two ♀♀ in an old paddy-field on Karimoen Is. The insects were seen skimming the green meadow closely and then suddenly duck away amidst sedge-hassocks and grass, hovering motionless for many minutes just above the water's surface with legs pressed closely to the body and with the thick abdomen bent downwards under a right angle, tapping violently the end of it against plots of slithery weed on the surface of the very shallow water. The protruding eggs are brightly pink-coloured and are released singly, one or two eggs only being laid with an interval of one second between two dips. This curious operation was observed during some length of time before it was put an end by a stroke of my net. Most of the eggs deposited on Nov. 26, hatched out between Dec. 5 and 8, the first larva being noticed on Dec. 2, 1930. The full-grown larva will be described elsewhere.

Besides numerous specimens from the Karimoen Djawa group of islands taken by myself in Nov. 23-30, 1930, I have received some examples of the Kangean archipelago, taken by Mr. VAN DELDEN, in April 1932.

West Java: One ♂, Buitenzorg, Oct. 20, 1930, "at lamp", VAN STEENIS (III).

Mid Java: Numerous specimens, Djeroeklegi and Koebangkangkoeng, April, June, Oct., Nov. and Dec., 1930, 1932, DRESCHER (VII) Karimoen Djawa Is. (Java Sea) (XII).

98. **Macrodiplax cora** (BRAUER, 3, 4) RIS (84, 86) DAMMERMAN (13).

A rare species with strong migratory tendencies, found during the whole year but almost exclusively in the littoral zone. It prefers open breezy situations, such as brackish water marshes, lagoons and river-mouths, where both sexes may be found flying along the grassy border of the water. Locally very abundant in the mangrove vegetation and in dry bush near the coast. In several places found to be gregarious, scores of males being sometimes seen perched on prominent twigs of the highest tree-tops and shrubs. It is one of the wariest dragonflies I have attempted to take. Flight swift but often interrupted. In South Banjoemas I have observed the oviposition of a ♀ in a coastal lagoon where the water is brackish, and on a short visit to the coral-reef of Enkhuizen, in the Bay of Batavia, I saw great numbers of *cora* resting on heads of long grasses and dead twigs, just behind the beach. In one spot I found the hot wind had driven a swarm to the shelter of a tree, where hardly a twig could be seen that had not its occupant. These dragonflies were evidently blown by wind and may readily disperse to other islands (May 22, 1934). In Dec. 1919, DAMMERMAN took a ♀ on Verlaten Is. (Krakatau-group). I have further examined a number of larvae collected by Mr. HOEKS on lake Bagendit, near Garoet (IV). This is the only locality known to me so far inland.

West Java: Enkhuizen Is., May, common; Tandjoeng Priok, March; Batavia, July; Antjol, common in the mangrove scrub, Jan. (II) Lake Bagendit, near Garoet (IV).

Mid Java: Babakan, sea-level, common throughout the year in coastal marshes; isle Noesa Kambangan, June (VII) Samarang, July 1910, JACOBSON (cf. RIS) (IX).

East Java: Soerabaia (XVII).

99. **Urothemis signata bisignata** (BRAUER, 6, 7) SELYS (114, 119) RIS (84, 86).

Only a single ♀, captured by JACOBSON near Samarang, has previously been reported from the island by RIS. Probably distributed widely throughout Java in low country, and locally abundant but easily overlooked and mistaken for *Rhodothemis* and *Crocothemis*, two species with which it is often seen in company. Prefers the sunny borders of lakes, ponds and sluggish streams, especially where the surface of the water is concealed by a rich vegetation of *Pistia* or *Eichhornia*. In such situations the brightly crimson males may be

seen boisterously pursuing each other, settling at times on leaves and reed-stems but keeping always well out of the reach of an insect net. On Lake Tjigombong the males frequently rest on the tips of dead *Gleichenia* ferns overhanging the water. Besides being distinguished from other red-bodied species by a jet-black streak on segm. 8 and 9 of abdomen, the body is broader and most intensively blood-red in colour. It is a shy, swift-flying insect and hence very hard to catch. Our collection contains but few specimens.

On various places I found the young transparent larvae between rootlets of aquatic plants, such as *Eichhornia crassipes*. The copulation was observed by me in September, and by DRESCHER in March and July, so that we may safely assume that it is in flight the whole year round. Moreover, the larvae are to be found at any time of the year. The ♀ oviposits unaccompanied by the ♂, the eggs when freshly deposited being grass-green in colour.

The various races of the Indian *U. signata* (RAMB.), including *U. abbotti* LAIDLAW from Malaya, will very likely turn out to represent distinct species. I cannot judge whether the Javan form is subspecifically distinguished from typical *bisignata* as I have not examined Philippine specimens. Sumatran examples of *signata* have never been described.

West Java: Rawah Danoe, abundant in May, AUTHOR (I) Batavia, VAN LANSBERGE; Lake Nagrok, near Pagadenbaroe (Krawang), ult. Nov., B. M. HOEKS (II) Depok, Sept., AUTHOR; Buitenzorg, Botanic Garden, rare throughout the year, AUTHOR; Lake Tjigombong, March, Sept., common, AUTHOR (III) Lake Bagendit, near Garoet, May-July (IV).

Mid Java: Djerboeklegi, Jan., March, Aug., fairly common, DRESCHER (VII) Samarang, June-July, JACOBSON (IX).

100. *Aethriamanta aethra* RIS (84, 86).

Of this very interesting little species I have examined the unique type-specimen, a ♂ in the late Dr. RIS's collection and four further examples, one defective ♂ and three ♀♀, which are preserved in the Leiden Museum collection. The latter unfortunately remained undescribed, but I hope to discuss the ♀ at some other place. The incomplete ♂, just mentioned, is not yet matured, lacking entirely the delicate bluish pruinescence covering the thorax and part of the abdomen of the adult, which looks quite different from teneral examples.

On a visit to the virgin forest-marsh Rawah Danoe, in Bantam, countless males of this species were observed by me resting on the tips of bull-rushes with their wings drooping and the abdomen held straight out. From this lofty look-out they made sudden dashes at passing insects and, when disturbed by the approach of our 'prahoe', they flew up from afar but soon returned to the tips of some other rush-stem. It was found a very wary insect and extremely difficult to catch. The ♀ was not seen, but I managed to secure a few larvae from between the submersed rootlets of *Trapa* and *Pistia stratiotes*, while several nymphal skins were collected from the leaves.

West Java: Two ♂♂ ad. (numerous seen), Rawah Danoe, May 25, 1931, AUTHOR (I).

Mid Java: One ♂ semiad., Samarang, June 1909, JACOBSON (IX).

The other specimens (♂ and 3 ♀♀) were collected by GROEN, somewhere in Java.

Subfam. Corduliinae.

101. *Hemicordulia tenera* LIEFTINCK (68).

Originally described from Mt. Slamet in Mid Java, from where only a single ♂ has come to our knowledge. A second specimen was taken in the hill-country south of Pasir Nangka, near Leuwimangoe, at an elevation of ca. 600 m above sea-level. This was hovering about 6 ft. high over a small brook with deep water flowing through marshy land; it was the only specimen seen.

Apparently a very scarce species, though possibly widely distributed, for I have also received specimens from near Singkawang, in West Borneo, where it is said by Mr. COOMANS DE RUITER to fly also after dusk. The only Bornean species reported from that island by LAIDLAW is *asiatica* SELYS. *H. tenera* is most closely related to *silvarum* RIS, from New Guinea, and is one of the slenderest species known. The members of this genus are swift and inconspicuous insects, whose larvae breed in clear weedy bog-ponds, or in slowly running waters.

West Java: Leuwimangoe, 600 m alt., Dec. 25, 1931, AUTHOR (III).

Mid Java: Mt. Slamet, Batoerraden, 850 m alt., Febr. 14, 1929, DRESCHER (VII).

102. *Procordulia artemis* LIEFTINCK (68, 72a).

Until recently only known from Java. It is a fairly common mountain species, occurring in colonies throughout West and Mid Java in all seasons of the year. Breeds in forest pools, marshes and mountain-lakes, round the borders of which the males may be seen hawking speedily up and down, usually keeping low to the surface of the water. Owing to its dull colouring and slender body, they are taken with difficulty. The ♀ oviposits in boggy situations, usually in stagnant waters. Elsewhere full information upon the habits and life-history of *P. artemis* has been given.

West Java: Mt. Salak, Siteo Hiang, 1300 m, crater-lake, very common, AUTHOR; Mt. Gedeh, Telagawarna and Telagasaät, Poentjak pass, 14-1500 m, fairly common, AUTHOR (III) Mt. Tangkoeban Prahoe, 1500 m, forest pool, DRESCHER; Mt. Goentoer, Kawah Kamodjang, 1650 m, common in marshes, AUTHOR; Mt. Kendang, Lake Tjibeureum, 2100 m, very abundant, AUTHOR; Mt. Papandajan, 2000 m, AUTHOR (IV).

Mid Java: Diëng Plateau, ca. 2000 m, common, T. VAN BENTHEM JUTTING and F. DUPONT (VIII).

Dr. TOXOPEUS informs me that this species is very abundant on Mt. Tanggamoës, southern Lampong districts, South Sumatra, where he captured a fine series of males, from 1700 m upwards to the very summit of this mountain,

2100 m above sea-level, in June and July, 1934. Possibly, *artemis* has a wide range in the mountains of Sumatra.

103. **Procordulia sumbawana** (FÖRSTER, 20) FRASER (31, sub *karnyi*) LIEFTINCK (68, 72a).

Like the last restricted to high altitudes, from 800 to 3000 m above sea-level. Occurs throughout the year in most parts of the island and, though breeding only in running waters, much a commoner insect than *artemis*. Many specimens were taken by myself at elevations above 1500 m. Below this its place seems largely to be taken by *artemis*, which breeds only in stagnant waters. On Mt. Papandajan and the Diëng Plateau both species occur together but while *artemis* inhabits the marshes and lakes, *sumbawana* is either found hawking over forest-brooks or over small streams in open country. Quite common on Mt. Gedeh and various other volcanoes in West Java. Like *artemis* the males have the habit of hovering for long periods in the air and, accordingly, often remain unnoticed. Their flight is usually low and takes place only during sunshine, a cloud passing over being the signal for their immediate disappearance. In the Gedeh and Papandajan mountains the males were often observed flying high and airily over forest-ridings, or patrolling the banks of very small brooks flowing through *Anaphalis* wildernesses. Solitary males readily choose small sunny glades in thick forest or deep ravines, where the sun only penetrates at its zenith.

Further notes concerning life-history and distribution are to be found in the author's two papers on *Procordulia*.

West Java: Mt. Mas, 1450 m; Mt. Gedeh-Panggerango, 800-3000 m (III) Mt. Tangkoeban Prahoe, 13-1400 m; Mt. Papandajan, 15-2500 m (IV).

Mid Java: Mt. Slamet, 850 m (VII) Diëng Plateau, 2150 m; Mt. Merbaboe, 1500 m; Mt. Soembing, 1800 m (VIII).

East Java: Mt. Lawoe, Sarangan, 1300 m (XIV) Tengger Mts., 1500 m (XVIII).

104. **Idionyx montana montana** KARSCH (45a) KRÜGER (53) MARTIN (79) FRASER (31).

Described by KARSCH from 'Java' and reported also from the island by KRÜGER and MARTIN. The last author discusses two ♂♂ and three ♀♀ captured by FRUHSTORFER in southwest Java, 1893 and deposited in the Brussels Museum collection. *I. montana* is a rare woodland species, occurring in hilly regions. Apparently distributed all over the island in suitable places, breeding in forest-pools and possibly also in slowly running waters. Nothing is known of the life-history. The Indian species of *Idionyx*, according to FRASER, vary much in the selection of their breeding-places, and while some are rather crepuscular in habit, not appearing on the wing until late in the day, others are sun-loving and have habits quite similar to *Procordulia*. Many species of eastern distribution breed in rivers, the males being then observed following the course of mountain streams, hugging the water closely, apparently searching

for females. The latter are said by FRASER to oviposit in mud or wet sand, often penetrating deep undergrowth for this purpose. The larva is unknown.

Male specimens in my collection from South and Central Sumatra, from where it was also recorded by RIS, are not different from Javan individuals. From Borneo I have only seen typical *I. dohrni* KRÜG., a species likewise found in Sumatra. According to LAIDLAW, Bornean specimens of the last figuring under the name of *I. dohrni borneensis* LAID., are racially distinct from *dohrni*, but RIS is inclined to place them in the *montana* formenkreis. About 20 Javan specimens of both sexes, taken at various intervals and in all months of the year, have come under my notice.

West Java: Mt. Tjisoeroe, Djampang Tengah, 600-800 m, all the year round, native coll. (III).

Mid Java: Mt. Slamet, Batoerraden, 850 m, June to Dec. 1928, and May 11, 1929, DRESCHER (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, Jan 1933, LUCHT (XX).

105. *Macromia cincta* (RAMB., 82) SELYS (110) MARTIN (79) LIEFTINCK (65).

Terra typica unknown. Beside RAMBUR's types, a pair in very dilapidated a state of preservation, I have examined a ♂ and ♀ collected by S. MÜLLER somewhere in Java, preserved in the Leiden and Brussels Museum, respectively. These are the only specimens which I have seen from the island. *M. cincta* is typically a species of the plains and very likely breeds in stagnant or slightly running waters. In West Borneo it has been observed in cultivated country as well as in original growth forest, flying up and down by-paths in wooded districts. Apparently extremely rare in Java.

106. *Macromia gerstaeckeri* KRÜGER (53) MARTIN (79) LIEFTINCK (65).

Originally described from a single pair taken in 'Java'. In the collection of the Brussels Museum is a ♀, lacking its abdomen, taken by FRUHSTORFER in southwest Java. MARTIN adds Borneo and Tonkin to its habitation, but these records are at the best very doubtful. No further specimens appear to have ever been found in Java.

107. *Macromia moorei fumata* (KRÜGER, 53) (MARTIN, 79) LIEFTINCK (65).

Likewise described from Java. Four examples, three ♂♂ and one ♀, in the Brussels Museum are labelled "Java, FRUHSTORFER 1893".

A rare woodland species, occurring sparingly in the mountains of West Java at altitudes varying between 600 and 1600 m. There is much evidence of this species being on the wing during most time of the year, for it was captured by Mr. DRESCHER and his native assistants on Mt. Tangkoeban Prahoe in five different months.

First discovered flying over a very small muddy pool, situated in the depths of a funnel-shaped ravine surrounded by dense primeval forest where the sun penetrates only from about 10 to 12 o'clock in the morning. Solitary

specimens of both sexes were seen hovering over this pool during five years in succession but only five specimens could be secured on as many occasional visits! On May 10, Mr. DRESCHER caught a ♀ ovipositing in the wet mud at the border of this pool; hence there is definite proof of *moorei fumata* breeding in stagnant water. From Mr. BARTELS I have lately received a couple of males captured by him along a stream on the southern slope of Mt. Gedeh. The life-history and larva are as yet unknown.

West Java: Two ♂♂, Mt. Gedeh, Sept. 1934, M. E. WALSH and two ♂♂, Mt. Gedeh, Siteo Goenoeng, along the Tjigoenoeng, 1000 m, Oct. 1933, E. BARTELS; one ♂, Mt. Halimoen, 600 m, July-Aug., 1927, native coll.; one ♂, Mt. Tjisoeroe, Djampang Tengah, 600 m, 1932 (III) Two ♂♂, three ♀♀, Mt. Tangkoeban Prahoe, 15-1600 m, Aug. 24, 1929, May 10 and June 23, 1930, Dec. 27, 1932, and March 29, 1934, DRESCHER (IV).

108. *Macromia septima* MARTIN (78, 79) LIEFTINCK (65).

The type is a ♀ from 'Java', the allotype being described by me after a specimen taken by FRUHSTORFER in southwest Java, now in the Brussels Museum. A small species, hitherto only known from the low mountains of the Djampangs in West Java where it is possibly not uncommon locally. A few other specimens in the Senckenberg Museum (formerly Ris's collection) bear the locality-label 'Soekaboemi', but the only definite locality where it is found is the Djampang district. I possess three ♂♂, taken by native hunters on Mt. Tjisoeroe, Djampang Tengah, 600 m, June 1932, and Jan. to March, 1933 (III).

In 1934, on July 11, I found a nymphal skin of possibly this species, attached to the underside of a big stone in a forest-stream near Bantarpeundeuj, 400 m alt., 15 km north of Pameungpeuk (IV).

109. *Macromia westwoodi* SELYS (111) LIEFTINCK (65).

Locally common and probably universally distributed in the damp forests of the lower mountain zone. Occurs also in Malaya, Banka and Borneo, but not so far reported from Sumatra. I have studied two ♀♀, labelled 'Soekaboemi', which in all probability came from Mt. Tjisoeroe or Mt. Halimoen, in the Djampang districts. These are the only West Javan specimens known to me.

Apparently quite a common insect in the forests on the southern slope of Mt. Slamet, from where I have received over hundred specimens, all caught by DRESCHER and his assistants. Breeds in forest-pools and roadside brooks and is in flight the whole year round. The copulation was observed in October, but it is almost certain that oviposition takes place at any time of the year. A single full-grown larva was found in a rice-field by Mr. DRESCHER, July 9, 1929, but nothing definite is known on the habits and life-history of this fine species.

West Java: Two ♀♀, 'Soekaboemi' (purchased from Mrs. WALSH); one ♀, Mt. Tjisoeroe, Djampang Tengah, 600 m, May 1934 (III).

Mid Java: Numerous specimens, Mt. Slamet, Batoerraden, 850 m, all the year round, DRESCHER (VII).

East Java: One ♀, Mt. Raoeng, Bajoekidoel Est., 500 m, May-June 1931, LUCHT (XX).

110. *Epophthalmia vittata sundana* LIEFTINCK (69).

The Malaysian race of the Indian *vittata* is still only known to me from West Java, where it appears to be commonly distributed in low country. The males are most brilliantly coloured insects of great size and may be seen patrolling the sunny borders of weedy tanks, fish-ponds and lakes. Their flight is extraordinarily swift and low over the water's surface, and each male's beat covers a distance of many yards. It is seen over the water only in the morning hours, from 9 to 12 a.m., disappearing as soon as the sky clouds over. For notes on egg-laying habits, flight and details of life-history see the writer's general treatment of the genus.

111. *Epophthalmia vittigera* (RAMB., 82) SELYS (110) MARTIN (78, 79) RIS (85, larva) FRASER (31) LIEFTINCK (69).

Widely but sparingly distributed from sea-level upwards to an altitude of 1400 meters. Breeds in still waters, the males frequenting the sunny borders of large ponds and lakes. I have observed this giant species on various occasions, flying rapidly some six ft. above the surface of deep water, but I never succeeded in capturing any myself. Only solitary males are seen on the wing, the females apparently having retiring habits and only come to the water to oviposit. Found throughout the year. The larva was described by RIS and in the author's previous paper on the genus.

West Java: Batavia (II) Depok; Tjiseëng; Buitenzorg; Tjigombong; Mt. Gedeh, Siteo Goenoeng, 1000 m, April and Tjibodas, 1400 m, Sept.; Mt. Tjisoeroe, Djampang Tengah, 600 m; Lake Njalindoeng, 900 m (III) Lake Padalarang, 650 m; Garoet, in town, 800 m (IV).

East Java: One ♀, labelled "Java or., MULIÉ", in the Leiden Museum.

Fam. CORDULEGASTERIDAE.

112. *Chlorogomphus magnificus* SELYS (97, 98, 100, 101, 122) KRÜGER (52) FRASER (31, 36) SCHMIDT (92).

Confined to the lower mountain forests of West and Mid Java. Very rare. By its large size, its great scarceness and striking colours, this insect is no doubt one of the most interesting among regional dragonflies. The history of *magnificus* is as follows. The brilliantly coloured ♀ was described by DE SELYS in the Synopsis as early as 1854, along with the unique ♂, both forming part of the Leiden Museum collections. The only examples of *Chlorogomphus* s.str. known to SELYS were the ♂ and ♀ types in the said Museum, and ♀♀ of uncertain origin, but probably from Java, in his own collection and that of HAGEN. Al-

though in the Monograph (1858) SELYS was inclined to think that the ♂ and the ♀♀ might belong to different species, the name *hyalinus* for the ♂ appears for the first time in the 2nd additions to the Synopsis, in 1869. While he may have intended to mention *hyalinus* ♂ in 1859 but failed to do so, he did not consider it necessary to give a fresh description of this ♂ because a diagnosis of the ♂ had been given already in the Synopsis 1854, and a full description and figures in the Monograph 1858, and SELYS himself in his list of 1873 (3rd addit.) gives the Synopsis 1854 as the place in which the description of *hyalinus* is to be found. Early in 1928, I have examined the fragments of the ♂ holotype, which now consists only of four wings and abdominal segments 1-7; this ♂ bears a printed label "MÜLLER, Java", the ♀ allotype being labelled "Sumatra". The terra typica of our species thus is Java and Sumatra, not Sumatra only, as has erroneously been stated by SELYS and various subsequent writers. FRASER (1929) gave a wing-photograph of the type but the ♂ itself remained unknown to him. The late F. RIS informed me that SCHMIDT's specimen, which was used for dissection purposes in his paper of 1912, was taken in 1892 by FRUHSTORFER on Mt. Gedeh in West Java. Until recently this was the only authentic ♂ of Java.

The habits and life-history of *magnificus* are still shrouded in mystery. Some of the better known species have the habit of soaring slowly in wide circles over dense jungle at the source of rivers, or over ravines and forest roads, usually at considerable heights. Of Indian species it is stated by FRASER that the copulation takes place sometimes a long way from the breeding grounds, the female seeking these out afterwards and oviposits unaccompanied by the male. The males are very much alike *Macromia* in flight, for which they have often been mistaken. Like other members of the genus, *magnificus* probably breeds in mountain streams near their source and the larva may be found buried deep in the sand at the foot of miniature waterfalls in moderately deep pools. At transformation it clings to trees or to rocks alongside the stream. The larva of Indian *campioni* has habits quite similar to *Cordulegaster*. Beside the type specimens and a few ♀♀ lacking further indications of habitat, the following material has been studied by me.

West Java: Six ♀♀, Mt. Halimoen, 500 m, April 18, June and July-Aug., 1927, native coll.; Mt. Tjisoeroe, Djampang Tengah, 1932, idem; two ♂♂, Mt. Gedeh, Tjiboenar Est., near Perbawatie, 1000 m, Nov. 8, 1929, idem, DRESCHER acq. (III) One ♀, "Preanger", in Mus. Leiden (IV).

Mid Java: One ♀, Mt. Slamet, Batoerraden, 850 m, Nov. 24, 1928, DRESCHER (VII).

Fam. GOMPHIDAE.

113. *Ictinus decoratus* SELYS (97, 122) (BURM., 9) CALVERT (10) LAIDLAW (60).

Fairly common throughout the year in low country and almost universally distributed in the plains of West and Mid Java. It is both a rapacious and pugnacious dragonfly, prying upon all kinds of insects and pursuing even such large dragonfly species as *Anax* and *Epophthalmia*.

Quite common in the Botanic Garden of Buitenzorg. The males are never seen away from the neighbourhood of water and may be seen perched on prominent twigs around the border of ponds and lakes, or near the banks of canals. Rests with horizontally outspread wings and with the solid abdomen held stiffly and straight out. From such coign of vantage they keep a sharp look-out, indulging in short and swift beats up and down the border of a tank, always however returning to the original resting place. The ♀ often wanders far from water and rests on dead twigs, railings or telegraph-wires. Like *I. melanops*, it breeds exclusively in stagnant waters, although in Tjisolok I once observed the oviposition in shallows along the banks of a small sunny stream. Pairing takes place over water and is of very short duration. The ♀ oviposits unaccompanied by the ♂ and this is performed by swift dips of the abdomen, few eggs being released at each stroke.

The larvae are bottom-dwellers whose legs are adapted for burrowing in the mud; they feed principally on *Orthetra*- and ephemerid larvae, worms and snails, which are rummaged out in large quantities, but only at night. At transformation the larva crawls to large stones, or drift-wood along the borders of a pond. On lake Tjigombong I found numerous cast skins on the leaves of *Eichhornia*, ferns and submersed stems of sago-palms, just above water mark.

West Java: Common.

Mid Java: Djeroeklegi, plain country; Poerwokerto; Mt. Slamet, Batoerraden, 850 m, all the year round (VII).

East Java: Bondowoso (XX).

In 1929, on June 1, Mr. DRESCHER captured a male near Talangpadang (foot of Mt. Tanggamoës), in the southern Lampong district, S. Sumatra. This is the only Sumatran specimen of *decoratus* which I have examined; it agrees in all respects with Javan specimens.

114. *Gomphidia javanica* FÖRSTER (20) KRÜGER (52) LAIDLAW (60).

Originally described from a single ♂ collected by PAGENSTECHER near Malang. Very rare, but apparently well distributed in wooded country over the entire island. Confined to Java. The genus is closely allied to *Ictinus* and its members have similar habits. *G. javanica* is a shade-loving species. The ♂ from Mt. Raoeng was caught in a gloomy bamboo-grove, settled high on the branch of a tree overhanging a small brook, and after being dislodged returned to the original spot time and again. Life-history and larva unknown.

In the Brussels Museum is a fine series of males taken by FRUHSTORFER, probably in southwest Java, and a ♂ from Pengalengan. KRÜGER also has seen five ♂♂ from the island.

West Java: Two ♂♂, Mt. Tjisoeroe, Djampang Tengah, 600 m, Febr.-March 1926 and Nov. 1932, native coll. (III) One ♂, Pengalengan, 1300 m (?), 1893, FRUHSTORFER, in Mus. Brussels (IV).

East Java: One ♂, Malang, PAGENSTECHER (FÖRSTER) (XVIII). One ♂, Mt. Raoeng, Bajoekidoel Est., 500 m, Nov. 23, 1932, TOXOPEUS (XX).

115. *Megalogomphus icterops* (MARTIN, 77) LAIDLAW (60).

Described from a ♂ in the Paris Museum, collected in Java. In the Brussels Museum are two ♂♂, whose colour-patterns and measurements are exactly identical, the one coming from Borneo (Sarawak), the other from Java, captured by FRUHSTORFER. With MARTIN's, this is the only male known from the island. Species of this genus are given by FRASER to breed in small mountain streams, the habits closely resembling those of *Ictinus*, for which they may be mistaken when on the wing or resting.

116. *Megalogomphus junghuhni* LIEFTINCK (75).

Only a single ♀, with a locality-label 'Java, HEYNE' is known of this fine insect. It is the largest and possibly one of the rarest Gomphids known from the island.

117. *Onychogomphus banteng* LIEFTINCK (66) LAIDLAW (60).

Apparently also a very rare species, known only from the unique ♂ collected by W. ROEPKE on the slopes of Mt. Salak, Pandan Aroem Est., near Tjibadak, about 1000 m above sea-level, June 1916 (III). The specimen is in the author's collection.

The habits and breeding-places of the allied Indian species *nilgiriensis* FRASER have been described by him as follows: — "The insect which is very local, frequents shady mountain streams, generally those with clean gravelly bottoms and is found settled on rocks or twigs in mid stream. When disturbed it immediately rises perpendicularly to trees overhanging the stream. In Coorg it prefers streams almost entirely hidden and closed in by overhanging cane brakes where it may be found settled on rocks or on the gravelly beach or occasionally hawking to and fro over runlets or rapids to which places the female usually resorts to lay her eggs. Whilst ovipositing the female hovers some two feet or less over the stream" (29).

The larvae are adapted to a life in shallow running water and are characteristic by their flattened leaf-like body and broadened antennae.

118. *Onychogomphus geometricus geometricus* SELYS (97, 99, 122) LAIDLAW (60) LIEFTINCK (66).

The type is a ♀ in the Leiden Museum, collected in Java more than a century ago by KÜHL and VAN HASSELT. Paratypes and several other specimens of old date have been examined by me in the Brussels and other Museums. They have shortly been discussed in the author's previous paper.

So far known a very scarce species, but apparently widely spread and possibly not uncommon locally in densely forested hilly regions. Breeds in streams with rapidly flowing water. The pair from Tanggeung was caught by TOXOPEUS and myself in the bush near the bridge over the Tjiboeni, which finds its way through a steep and heavily forested ravine. Habits and life-history quite unknown.

West Java: A small series by FRUHSTORFER (Mus. Brussels). One ♂, six ♀, Mt. Tjisoeroe, Djampang Tengah, 600 m, March, July and Oct., 1933, native coll.; one ♂, one ♀ Tanggeung, south of Pagelaran, 300-400 m, Dec. 26, 1931, AUTHOR; one pair, Wijnkoops Bay, in coll. FÖRSTER (III).

East Java: Two ♂♂, Tengger Mts., alt.?, H. FRUHSTORFER, in Mus. Brussels (XVIII).

119. *Onychogomphus modestus fruhstorferi* LIEFTINCK (76).

A small and darkly coloured insect, inhabiting large streams in wooded country. The type is a ♂ from W. Java collected by FRUHSTORFER and is now in the Brussels Museum. A second ♂ in Mus. Leiden, lacking its head, is an old specimen collected by S. MÜLLER in Java. Evidently a very rare species.

East Java: Two ♂♂, Mt. Raoeng, Bajoekidoel Est., 500 m, May-June, 1931 and Jan. 1932, LUCHT (XX).

120. *Onychogomphus thienemanni* SCHMIDT ¹⁾.

To be reported from 'Java', leg. FRUHSTORFER (SCHMIDT, *in litt.*). Not seen by me.

121. *Mesogomphus reinwardti reinwardti* (SELYS, 97) LIEFTINCK (66, 76) LAIDLAW (60).

The material on which the first description was based, has been discussed in my 1929 paper. I have seen several other examples collected again by FRUHSTORFER in West Java. The typical race is confined to Java and seems to have a wide distribution.

Very local, but fairly common where found. Breeds in forest streams. The males sit on large rocks in mid stream or on gravel banks near its border, where their cryptic body-colouring renders them very inconspicuous. A description of its haunts and notes on the larva are to be found in the author's latest paper.

West Java: Bajah, south-coast, 80 m, Sept. 1934, M. E. WALSH (I) Buitenzorg, Botanic Garden, 250 m, Jan. 1931, along shady stream, AUTHOR; Wijnkoops Bay and Tjisolok, sea-level, common locally along small forest streams, April to June, AUTHOR; Mt. Tjisoeroe, Djampang Tengah, 600 m, 1932, native coll. (III).

Mid Java: Djeroeklegi, sea-level, Oct. to Nov., locally abundant along small brooks, DRESCHER; Mt. Slamet, Batoerraden, 850 m, June 19, 1930, a single ♂, DRESCHER (VII) Samarang, 50 m, teak-forests, June 1926, KALSHOVEN (IX).

East Java: Padangan, 40 m, July 27, 1927, VERBEEK (XV).

¹⁾ This species will soon be described in "Tropische Binnengewässer", Bd. V (Arch. Hydrobiol. Suppl.-Bd. XIII).

122. **Burmagomphus inscriptus** (SELYS, 101) RIS (86, sub *jacobsoni*) LIEFTINCK (66) LAIDLAW (60).

The type of this graceful little species is a ♀, collected more than a century ago by KÜHL and VAN HASSELT somewhere in the island. The ♂ was discovered by JACOBSON near Samarang and has been described and figured by RIS. I have figured the genital organs in my paper of 1929. Evidently an extremely rare species which possibly has arboreal habits. According to FRASER, all species so far known are jungle inhabitants, frequenting streams in ravines in montane and submontane areas. Males are found resting on stones in the stream or on rocks or foliage beside these waters. The larvae are of the torpedo shape, resembling rather closely those of *Onychogomphus*; all are stream-dwellers. Besides the typical series, I have seen from:

East Java: One ♂, Batokan near Tjepoe, 40 m, Febr. 4, 1926, VERBEEK (XV).

123. **Burmagomphus javicus** SCHMIDT ¹⁾.

Early in 1933, I received from Mrs. WALSH, Soekaboemi, a single ♀ of a small Gomphid belonging to an undescribed species of the *vermiculatus* group of *Burmagomphus*. By the absence of the ♂ a description of it was postponed until later. Dr. E. SCHMIDT, to whom I sent the specimen for comparison with a new *Burmagomphus* he proposed to describe from Java, now informs me (*in litt.*, Oct. 3, 1934), that the two specimens are conspecific.

The type male is from 'Java', taken by FRUHSTORFER.

West Java: One ♀, Mt. Tjisoeroe, Djampang Tengah, ca. 600 m, April 1933, native coll. (III).

124. **Macrogomphus parallelogramma** (BURM., 9) SELYS (97, 99, 101, 122) CALVERT (10) RIS (86) KONINGSBERGER (50) LAIDLAW (60).

The type, a ♀, was described from 'Java' and is figured in the Monograph. HAGEN's careful description of the ♂ is also based on a Javan specimen. Not known from the other Sondaic islands. An arboreal insect, widely but sparingly distributed, chiefly in low country. Since the ♂♂ occur only rarely in the neighbourhood of water except on emergence, they are only occasionally come across, dispersing inland for long distances and resting among shrubbery or high up in trees. Breeds in sluggish streams, in sandy brooks flowing through marshes, and possibly also in canals. The larva might be found buried in the mud at the border of some stream. Its abdomen is very long and cylindrical, the end segments being produced into a siphon-like structure. This tubular organ projects from the mud or sand whilst the rest of the body is submersed and thus enables the insect to carry on rectal breathing without exposing its body (FRASER).

¹⁾ This species will soon be described in "Tropische Binnengewässer", Bd. V (Arch. Hydrobiol. Suppl.-Bd. XIII).

West Java: One ♀, Tjarita, Oct. 4, 1930, along brook in coastal swamp, TOXOPEUS; one ♂ (three others seen), Malimping, April 24, 1933, in secondary growth, AUTHOR (I) One ♀, Batavia, June 1908, JACOBSON, one ♀, Batavia, both in Mus. Leiden (II) Two ♀♀, W. Java, PIEPERS, in Mus. Leiden; three ♂♂, three ♀♀, Java mer., FRUHSTORFER, in Mus. Brussels; one ♀, Buitenzorg, June 26, 1930, "in laboratory", J. VAN DER VECHT; one ♀, Buitenzorg, Batoetoelis, April 17, 1934, native coll.; one ♀, Wijnkoops Bay, in coll. FÖRSTER (III).

Mid Java: Three ♂♂, three ♀♀, Mt. Slamet, Batoerraden, 850 m, Nov. 24, 1928, Febr. 18-19 and Aug. 4, 1929, DRESCHER (VII) One ♂, Samarang, hilly country, March 22, 1931 "at lamp, 9.30 p.m.", DRESCHER (IX). One ♀, Japara, July 1917, ROEPKE (XII).

East Java: One ♀, Java or., MULIÉ, in Mus. Leiden; one ♂, Soerabaia, Nov. 1909, P. BUITENDIJK, in Mus. Leiden (XVII) One ♀, Tjepoe, 40 m, March 26, 1926, VERBEEK (XV) One ♀, Malang, 700 m, April-May, 1929, OVERDIJKINK (XVIII).

125. *Leptogomphus lansbergei lansbergei* (SELYS, 101) FÖRSTER (23, sub *M. semiteres*) LAIDLAW (58, 60) FRASER (31, 33) RIS (91).

The type is a ♀ in the Brussels Museum, labelled 'Batavia, LANSBERGE'. Besides this, I have examined several other ♀♀ taken by FRUHSTORFER in Java. RIS's ♂ from 'Soekaboemi' came from Mt. Tjisoeroe.

Found all the year round in hilly and low mountainous regions, distributed over the entire island. It is perhaps the least rare among regional Epigomphines. Like most of the others, it has rheophilous habitats, the adults after emergence from a forest stream flying straight on to the jungle and may be found in great numbers sitting on leaves or prominent twigs on the tops of trees. Their flight is low and trailing and in the gloominess of their damp retreats the alternated colour-pattern of black and greenish yellow renders them remarkably inconspicuous. Near Leuwiliang I once caught a ♀ basking in the sunshine on the leaves of a low tree, some hundred feet above the bed of a small stream. On account of the damp situations in which it usually occurs, *lansbergei* requires a long time for the hardening of its body and wing-membrane, teneral predominating far over the adult specimens.

The ♀ deposits her eggs in shady leaf-bottomed forest-brooks, or in small streams with large stones in the bed. *Malayogomphus semiteres*, FÖRSTER, from the Wijnkoops Bay (Palaboean Ratoe) in S.W. Java is synonymous with our species.

West Java: "Batavia, LANSBERGE" (II) Leuwiliang near Buitenzorg, 800 m; Wijnkoops Bay; Mt. Tjisoeroe, Djampang Tengah, 600 m, common (III) Koleberes, southern slopes of Mt. Patoeha, 700 m; Radjamandala, 350 m, virgin forest; 15 km north of Pameungpeuk, 400 m (IV).

Mid Java: Mt. Slamet, Batoerraden, 850 m, common (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, throughout the year (XX).

126. **Microgomphus chelifer thelyphonus** LIEFTINCK (66) LAIDLAW (60).

Described and figured from two ♂♂ and one ♀ collected by FRUHSTORFER in southwest Java. Since then I received a ♂ of this race from the southern extremity of Sumatra, and a second ♂ was caught by Mr. DRESCHER on the thickly forested isle of Noesa Kambangan, in S. Banjoemas (Mid Java), April 21, 1930. Possibly distributed throughout the island at low elevations, but evidently a very scarce species.

Heretofore considered by me as specifically distinct from *chelifer*, but now placed in the same formenkreis as a subspecies. The Indian representatives, according to FRASER, are arboreal by nature, but they often descend to settle on rocks in the bed of their parent streams, from which — when disturbed — they rise to the branches of trees high overhead. Settled in such situations, their shagreen colour renders them almost invisible. Flight short and swift.

127. **Heliogomphus drescheri** LIEFTINCK (66) LAIDLAW (60).

Originally described from Mt. Slamet, from where I have seen many specimens, captured in all months of the year. Subsequently discovered also in the extreme eastern part of the island. In the Brussels Museum is a single unidentified ♂ collected in southwest Java by FRUHSTORFER as early as in 1893. Occurs also in South Sumatra.

Evidently a rare species, found in similar situations as *L. lansbergei* and often taken along with it in the same place. I have described the larva of *H. kelantanensis* (LAID.), which by the curious flattening of the body is adapted to a life in very shallow water.

Mid Java: Mt. Slamet, Batoerraden, 850 m, locally fairly common throughout the year, DRESCHER (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, Jan. and April-May, LUCHT; Djember, Jan. 1933, LUCHT (XX).

Messrs DRESCHER and TOXOPEUS have taken this species, along with several other Epigomphines, in the primeval forests of the Lampong district in South Sumatra (Talangpadang and environs). These Sumatran specimens differ in no way from our typical series. *H. gracilis* (KRÜGER) is a second Sumatran species.

Fam. AESCHNIDAE.

128. **Amphiaeschna ampla** (RAMB., 82) (HAGEN, 41) KARSCH (46) MARTIN (80) FRASER (31).

RAMBUR's type is a ♀ in the Brussels Museum in very poor condition, lacking most of the abdominal segments. FRUHSTORFER collected five ♂♂ and six ♀♀ in Java which are placed in the same collection. Terra typica unknown, but very probably Java and so far not recorded outside the island, though MARTIN gives Tonkin as a further habitat; his wing-photograph of a ♀ is taken from this species, not from *grubaueri* (= *perampla*). The figures of the ♀ ter-

minal appendages in FRASER's account on the two species should be transposed, and the indication 'Buitenzorg' as a habitation of *A. ampla* is erroneous.

Moderately common in densely forested, mountainous areas and distributed over the entire island. It is a very local species and apparently quite abundant in suitable places. So far as I know all specimens were beaten up during the day from beneath dense shade at the bottom of deep narrow ravines where both sexes may be found hanging on branches among the foliage, or sitting against the bark of a tree, often in considerable numbers. It is never seen on the wing by day and may have particularly crepuscular or nocturnal habits. The breeding-places are unknown, but the larvae may reasonably be expected to live in small muddy pools at the edge of a stream.

West Java: Mt. Gedeh, Tjiboenar Est. (Perbawatie) 1000 m; Mt. Halimoen, 600 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III) Mt. Tangkoeban Prahoe, 14-1600 m, throughout the year (IV).

Mid Java: Mt. Slamet, Batoerraden, 850 m, all the year round (VII).

East Java: Mt. Raeng, Bajoekidoel Est., 500 m, Jan. 1932 (XX).

129. *Indaeschna grubaueri* (FÖRSTER, 21) (MARTIN, 80) FRASER (31).

For the reception of this species FRASER has proposed the generic name *Indaeschna*, and although *A. ampla* resembles *grubaueri* in many essential points, I think we are right following him. FÖRSTER described the ♂ from the Malay States, MARTIN gave a diagnosis of both sexes under the name *perampla*, and FRASER described a ♀ from Sumatra, erroneously stated to come from Java.

The only specimen known as having been collected in Java is a male (head wanting) in the Leiden Museum, labelled "MÜLLER, Java"; it was identified by R. MARTIN as '*Amphiaeschna perampla* SELYS'. I have also examined MARTIN's type of *perampla* from 'Malaisie', which is identical with *grubaueri* FÖRST. Several specimens from Sumatra and Borneo have since come under my notice. Habits and life-history unknown.

130. *Tetracanthagyna brunnea* McLACHLAN ¹⁾ (? = *degorsi* MARTIN).

One of the latest, and at the same time most striking additions to the Javan Aeschnid fauna. *T. brunnea* was described from North Borneo by McLACHLAN and KRÜGER; the male is unknown. MARTIN's *degorsi*, founded on a single male from Nias, and also reported from Borneo, might be identical with *brunnea*, and in that case the latter becomes a synonym of *degorsi*.

Species of this genus have nocturnal habits and are only occasionally found. So far known, they breed in forest marshes and deep pools, taking the shelter of dense foliage.

Dr. LAIDLAW once took a female of *brunnea* in Kelantan, northern Malay Peninsula, which was fluttering about the trunk of a large forest tree.

¹⁾ R. McLACHLAN, Considerations on the genus *Tetracanthagyna*. Trans. ent. Soc. London, 1898, pt. 4.

West Java: One ♀ (adult), Mt. Tjisoeroe, Djampang Tengah, ca 600 m alt., May 1934, M. E. WALSH misit. (III).

131. *Heliaeschna uninervulata* MARTIN (80).

New to Java. Originally described from Borneo and Enggano Is., off the west-coast of Sumatra. I have seen both sexes from Borneo and a ♂ from Sumatra. The ♀, which is as yet undescribed, has a three-pronged anal plate. The members of this genus have exclusively nocturnal habits. The larva is similar to *Gynacantha* but more robustly built. Hitherto only known from Mid and East Java, whence I have seen the following material.

Mid Java: Three ♂♂, one ♀, Ambarawa, LUDEKING, unidentified in Mus. Leiden (IX).

East Java: One ♂, Malang, HILLEBRAND, determined by RENÉ MARTIN in Mus. Leiden (XVIII).

132. *Gynacantha basiguttata* SELYS (114) KRÜGER (52) FRASER (31) LIEFTINCK (68).

Previously only reported from the island by KRÜGER and FRASER, I have examined the two ♂ types, labelled "Borneo W. K.", and the ♀ from Luzon, all in the Brussels Museum. The species has a wide distribution outside Java, but is a rare insect in our island. Inhabits damp primeval jungle in low country where it may be sought for during the whole year. Like other species of the genus it is nocturnal in habits. Breeds probably in forest pools. Larva unknown. Apparently common on Noesa Kambangan.

West Java: One ♀, Bajah, south-coast, 80 m, Sept. 1934, M. E. WALSH (I) One ♀ (ad.), Buitenzorg, March 22, 1920, TYPE of *G. javica* FRASER, in Mus. Buitenzorg; one ♂, one ♀, Mt. Tjisoeroe, Djampang Tengah, 600 m, Febr.-March, 1926 and May 1933, native coll.; one ♂, Wijnkoops Bay, Dec. 1932, idem (III).

Mid Java: Seven ♂♂, one ♀ (in cop., Jan. 17, 1928), isle Noesa Kambangan, sea-level, May, June, July, Dec. 1927, Jan. and Nov. 1928, DRESCHER (VII).

133. *Gynacantha bayadera* SELYS (p.p. 117) RIS (emend. 85, 89) KRÜGER (52) FRASER (31, sub *millardi*) LIEFTINCK (68).

Reported from Java by KRÜGER and RIS. MARTIN's figure of the ♂ anal apps., in the Monograph, was made after a different species (*ex* Palone, Birma). For synonymy see: RIS (89) and LIEFTINCK (68).

Fairly common and distributed all over the island in wooded districts, from sea-level upwards to about 1500 m. Chiefly found in mountainous areas. I have often come across this fine insect in thin forest, where it may be beaten up from its shelter among the leaves. Its delicate grass-green colours are highly cryptic in nature. *G. bayadera* has exclusively crepuscular habits, flying only at dusk. On Mt. Tangkoeban Prahoe, Mr. DRESCHER saw great numbers flying

in a cinchona plantation at about sunset. Males are attracted to light, and on various occasions it has been observed indoors and in verandahs at dusk. Breeding-places unknown.

West Java: Buitenzorg; Tjiampea; Tjiomas; Leuwiliang, 800 m; Mt. Salak, 800 m; Mt. Halimoen, 500 m; Mt. Gedeh, Tjisaroea Est., 1000 m; Mt. Tjimerang and Mt. Tjisoeroe, Djampang Tengah, 400-600 m; Wijnkoops Bay, Tjisolok (III) Mt. Tangkoeban Prahoe (IV).

Mid Java: Djeroklegi and isle Noesa Kambangan, sea-level; Mt. Slamet, Batoerraden, 850 m (VII).

East Java: Java or., FRUHSTORFER (RIS, l. c.); Idjen Plateau, Kendeng, 1200 m; Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

134. *Gynacantha dohrni* KRÜGER (52) MARTIN (80).

This is evidently a very scarce species in Java. For his description KRÜGER disposed of two ♂♂, from Sumatra and Java, and a small series from North Borneo. *G. dohrni* has often been confused with *G. basiguttata* by subsequent writers, a ♂ from southwest Java collected by FRUHSTORFER in the Selysian collection figuring also under that name. While going over the material in the Brussels Museum, I have convinced myself further of MARTIN's figure of the ♂ apps. of *basiguttata* being made from a specimen of *dohrni*, collected near Bukau in North Borneo. On Java, the island Noesa Kambangan is the only precise locality for this species.

Mid Java: One ♂, one ♀, isle Noesa Kambangan, June 1, 1927 and April 1, 1929, both captured by DRESCHER (VII).

135. *Gynacantha limbalis* KARSCH (46) MARTIN (80).

Originally described from Java, but never found back again. Of late, LAIDLAW has reported it from Borneo and, questionably, from Perak. Doubtlessly a very scarce species.

136. *Gynacantha musa* KARSCH (46) MARTIN (80).

Terra typica Java. Although seemingly not uncommon locally in low mountainous regions throughout the island, not yet found elsewhere. Closely related to *basiguttata*, yet easily distinguished in the male sex by the truncated apex of upper anal appendages. In the Brussels Museum I have seen three ♂♂ collected by FRUHSTORFER in southwest Java, and a ♂ from Flores taken by the same. These specimens have so far remained unidentified but were placed (evidently by MARTIN) under *basiguttata*.

Found throughout the year in wooded districts. On Mt. Karang I took a ♂ hovering over a small leaf-bottomed pool in second growth wood.

West Java: One ♂, Mt. Karang, Djoehoel, 400 m, May 26, 1931, AUTHOR (I) Many specimens, Mts. Tjisoeroe and Tjimerang, Djampang Tengah, 400-650 m, Jan.-July, native coll. (III).

Mid Java: One ♂, Tjilatjap, sea-level, Aug. 9, 1928 and numerous specimens, Mt. Slamet, Batoerraden, 850 m, Jan., April to Aug., DRESCHER (VII).

East Java: Two ♂♂, four ♀♀, Mt. Raoeng, Bajoekidoel Est., 500 m, May-June, Sept.-Oct. and Dec., LUCHT (XX).

137. *Gynacantha subinterrupta* (RAMB., 82) HAGEN (40) SELYS (116) KRÜGER (52) MARTIN (80) RIS (87, 89) KONINGSBERGER (50) FRASER (31).

RAMBUR's type, a ♂ in perfect condition, is in the Brussels Museum, but I have failed to recover his ♀ which is apparently lost. Described and figured by RIS from specimens of East Java (FRUHSTORFER). The thorax is olive-green and the pale abdominal spots of the adult male are blue and green in living examples, not brown as was repeatedly stated by RIS.

This is by far the commonest Javanese *Gynacantha*, occurring everywhere in plain country as well as in mountainous areas. Highest recorded altitude: Mt. T. Prahoe, ca. 1300 m (one ♀) and common on Mt. Slamet, 850 m. *G. subinterrupta* is in flight during the whole year and has nocturnal habits. The first individuals appear on the wing about half an hour before dusk falls, leaving their resting-places and commence a rapid skipping flight in the open. About thirty minutes before sundown, at 6.15 p.m. in the wet season, it may commonly be seen hunting for mosquitos in the darkened verandahs of bungalows, in forest-clearings, over road-side brooks, etc. As twilight comes the insects quickly augment to form small flocks and continue their flight in dark situations, e.g. muddy ditches and among pools under the banks of some small stream, where both sexes skim the surface of the ground, stuffing themselves with immense numbers of mosquitos. In such places, as night has set in for good, they may only be captured by watching for their silhouette.

The oviposition was observed by me in wet earth under the overhanging bank of a shallow pool near Tjisolok (Wijnkoops Bay); in the Karimoen Djawa islands, where this species is very abundant, I have watched several females ovipositing in the wet soil of a mangrove-pool, just before sunset. Few females are taken with the tiny anal appendages whole, these having been fractured off during the process of egg-laying, or are gnawed to pieces by the male during copulation. In a forest marsh near the Wijnkoops Bay, I caught two females in the act of transformation at 10 a.m., the exuviae hanging on semi-aquatic plants, few inches above water-level. Sometimes, however, the larvae form burrows or canals in the mud of a ditch or dry pool, and on emergence ascend a convenient reed-stem or stick. Obviously in sign of their forest-loving habits, specimens taken at light in the evening show the white threads of cobwebs attached to their wings, and numerous specimens beaten up from their shelter during the day bear equal witness of their escape from spider's webs. Mr. BENNER once took a pair in copulation in the verandah of his house in Tjilatjap, coming to light at 8 p.m.

138. *Gynacantha stenoptera* LIEFTINCK (75).

Described from a single ♂ in the Leiden Museum, collected in Java by some unknown explorer. It is most closely related to *G. subinterrupta*.

139. *Anaciaeschna jaspidea* (BURM., 9) SELYS (116) CALVERT (10) MARTIN (80) KONINGSBERGER (50) FRASER (31).

The type is one of a series of females, collected in Java.

Chiefly a species of low country, but observed upwards to as high a level as 1400 m above the sea. On account of its crepuscular habits, *A. jaspidea* is not often come across, though extremely abundant where found. It has a wide distribution throughout Java.

Although the females at least may have also diurnal habits, both sexes usually appear on the wing in the late afternoon and then assemble to large flocks which suddenly appear over rice-fields (s a w a h' s) and meadows, flying some 10 feet above the ground. Their flight is not so erratic as in *Gynacantha*, and at times the insects are an easy capture. Apparently, their flight is continued until long after dusk and obviously also during the night for many individuals have been captured in houses where they came to the lamp as late as 11 p.m. Mr. DRESCHER once took a series of 24 males and an equal number of females in a meadow near his house in Bandoeng (Aug. 27, 1928) and I have myself caught solitary specimens at light about 9 p.m. in Buitenzorg as well as on Mt. Gede, at an elevation of about 1000 meters. On Dec. 17, 1930, DRESCHER took a pair *in cop.*, coming to light in the verandah of his bungalow in Djeroeklegi (S. Banjoemas).

Jaspidea breeds in rice-fields and marshes. Transformation takes place during the night or in the early morning, and I found a few individuals emerging in a paddy field near Pasaoeran (W. Bantam) about 9 a.m. It is in flight during the whole year.

140. *Anaciaeschna montivagans* LIEFTINCK (71).

A mountain species, not occurring below 1200 m and even found at altitudes of over 2500 m. Widely but sparsely distributed throughout the higher mountain districts of West and Mid Java and a common insect in suitable places. It is on the wing in all seasons of the year, and, as is clearly demonstrated by my records of larvae and adult females captured during the act of oviposition, there appears to be a continuous succession of broods. In the peat-marsh Telagasaät (Poentjak-pass) larvae in all different stages of development may be found at any time of the year, the egg-laying females having been caught on March 30, April 19, May 18, June 19, Aug. 24, and Dec. 15 (West Java only).

A. montivagans breeds in mountain-swamps, forest-pools and marshes. On Mt. Papandajan the oviposition was observed by Mr. VAN STEENIS in partially submersed stems of *Juncus prismatocarpus*, at 1 p.m. (May 18, 1931). In the peat-marsh Telagasaät solitary females were observed by me ovipositing in

Polygonum javanicum, 10-11 a.m. (Dec. 15, 1929 and Aug. 24, 1930) and on Mt. Panggerango in the stems of *Araceae* and *Commelina*, about 12 a.m. (April 19, 1930 and June 19, 1932). It is proposed to give a detailed account on the life-history of this species in a separate memoir to be published elsewhere.

Although numerous males were bred from larvae kept alive in the laboratory at Buitenzorg, the adult male has never been discovered and its hiding places remain completely unknown. In a previous paper, I suggested that it might have crepuscular or nocturnal habits, a conjecture originally shared by FRASER, who neither succeeded in tracing the adult ♂ of the related Indian species *A. martini* (SEL.). Recently, however, FRASER told me in a letter that he had at long last secured two males of that species on two successive days, in the Annaimallai Hills (S. India). The one was flying high in the bed of a mountain river and the other along a mountain road at the upper margin of forests above pools and a lake in which he had taken the females ovipositing. The evidence thus brought forward of the insect being in flight during the day, affords great interest, although FRASER found it an extraordinary coincidence after searching everywhere for it for the past 12 years.

A. montivagans is most closely allied to *martini* (SEL.) and *moluccana* LIEFT., but differs from both by its sombre colours. The ♂ anal appendages are very similar to those of *martini*, but the brightly coloured stripes on each side of the thorax of the latter will serve to its easy recognition.

141. *Anax gibbosulus* (RAMB., 82) HAGEN (41) KRÜGER (52) RIS (83, 87; 91, sub *fumosus*) LIEFTINCK (73).

Terra typica Australia. Reported from Sumatra, Java and Soemba by KRÜGER, who has given a very clear explanation of the systematics of *gibbosulus*. RIS also gives Sumatra and Java as a habitat, but the specimens examined by him are unjustly referred to *fumosus* HAGEN, which is a distinct species. In his 1900 and 1913 papers, RIS has definitely ascertained the specific value of *gibbosulus* versus *guttatus*. His ♂ from 'Soekaboemi', mentioned in 1927, came from Mt. Tjisoeroe. *A. gibbosulus* and its races are at a glance distinguished from *guttatus* by the strongly pinched and much longer 3rd abdominal segment, by the presence of a T-mark on frons, the different anal apps. of the ♂, and by the absence of a middle spot alongside segm. 3-7 of abdomen. The races are distinguished from each other by differences found in the wing-venation, and the breadth of the hind wing, by the development of the frontal patch, the size and shape of the abdominal side-spots, and by their anal apps. A rich material is needed for the definition of a number of races, which may preliminarily be arranged as follows:

A. gibb. gibbosulus (RAMB.). — Australia, Kei Is., Aroe Is., Lesser Sunda Is., Ceram (?) New Guinea (?).

A. gibb. panybeus HAGEN. — Celebes.

A. gibb. subspec. — Sumatra and Java.

The last mentioned race, which I thought to be specifically distinct from *gibbosulus* (l. c., 1933), I now consider to belong within the formenkreis of that name.

Hitherto only known from West Java, where it seems to have a scattered distribution in wooded country. It is easily distinguished from *guttatus* in flight by its dark colouring.

I have first met with this insect early in May 1932, during a short holiday-trip to Tjipanas, some 15 miles west of Wijnkoops Bay. Tjipanas (lit't. hot river) at an elevation of ca. 50 meters, is reached by a forest path along the river of that name. The forest begins about half a mile north of the coastal village Tjisolok, and following the path, one reaches an open sunny space surrounded by dense original growth forest where the river takes up a smaller tributary. We arrived at Tjipanas early in the afternoon of May 1, and camped that night in a native bathing-house on the river bank. Here the streams enclose a grassy peninsula with much vegetation to and overhanging the gravel banks, and in the centre is a low swampy spot. In the afternoon several large *Anax* were seen flying back and forth over the bushes near our camp at too great a height for our nets. At about 4 p.m. they were seen patrolling the path along the river, but two hours later most of the *Anax* had apparently assembled in flocks, passing back and forth in pursuit of insects, very much after the manner of night hawks, over the grassy plain in front of the bathing house. As twilight came, between 6 and 6.30 p.m., they flew nearer and nearer the ground until shortly before dusk scores of them were seen very rapidly skimming the heads of low grass, and stuffing themselves with small diptera settling to the earth at sundown. Once, a male was seen capturing a stray Pierid and a second took a large *Melanitis* in flight, devouring all but its wings. On the morning of April 15, 1933, Dr. TOXOPEUS and myself made our camp again in the same locality and managed to secure eleven specimens of both sexes shortly after sunset. As distinguished from *Gynacantha*, which has truly nocturnal habits, our *gibbosulus* disappeared soon before night had set in for good. Early next morning a teneral female was taken at transformation in a small forest-pool at some distance of the river bank.

West Java: One pair, Bajah, south-coast, 80 m, Sept. 1934, M. E. WALSH and one ♂, one ♀, "Bantam", March 1933, WALSH misit. (I) Tjipanas (Wijnkoops Bay), May 1-2, 1932 and April 15-16, 1933, common, AUTHOR; one ♀, Tjoeroeg Goöng, Zand Bay, July 1929, DOCTERS VAN LEEUWEN; one ♂, one ♀, Mt. Tjisoeroe, Djampang Tengah, 5-600 m, May-June, 1932, native coll. (III).

142. *Anax guttatus* (BURM., 9) CALVERT (10) KARSCH (46) HAGEN (41) KRÜGER (52) NEEDHAM (81) FRASER (31) MARTIN (80) RIS (86) LIEFTINCK (67).

Terra typica Java. Widely and commonly distributed over the whole island, from sea-level upwards to considerable altitudes (Mt. Tangkoeban Prahoe, 1700 m, Mt. Gedeh, 1500 m). Our knowledge of the habits of this big species is

rather fragmentary, but it indicates that *guttatus* is very active during the day and is probably less crepuscular than *gibbosulus*. It breeds in small weedy ponds, marshes, lakes or 't a m b a k s' (fish ponds), round which the males are often to be seen hawking in bright sunshine, or restlessly searching for females. When flying over the water, the abdomen is held slightly in a curve, the bright blue eyes, green thorax and spotted abdomen making it quite conspicuous and easily recognizable from other large dragonflies.

In Java *guttatus* is on the wing during the whole year, but usually only solitary males are seen over the same pond. Sometimes a number of males may be seen soaring high and wide over dense jungle all day; capturing mayflies, small beetles and butterflies; in the late afternoon they all come down pursuing a flight over open country, lanes and forest-paths.

In the Karimoen Djawa islands the species was very abundant during November in small paddy-fields, pairing and oviposition taking place freely in the middle of the day; in the afternoon few specimens were seen over the forest, but just before sunset considerable numbers were again present, hawking very low to the ground on the skirts of the forest.

The larva is found among aquatic plants, i. e. *Ceratophyllum*, *Hydrilla* etc.; it has been described by NEEDHAM and myself. The young larvae grow rapidly and the entire life-history is completed within few months. Mr. DRESCHER once took a male of *guttatus* capturing a specimen of *Orthetrum sabina* in flight, and I have actually observed males preying upon white Pierids.

APPENDIX.

Doubtful records.

Vestalis amoena SELYS. — The type is a very old male from DE CHARPENTIER's collection, and is said to come from Java, but this is doubtlessly incorrect and probably due to a confusion of labels. See also SELYS (121), HAGEN (43), WILLIAMSON (126), and FRASER (35).

Anax papuensis (BURM.). — Only a single female, apparently collected by FRUHSTORFER, is recorded by KARSCH (46) from Java. I have omitted this Australian species from the list because of its strong migratory habit. It can only be a casual visitor of our island.

Species incertae sedis.

Caconeura lansbergei (SELYS, 115). — Described from a single male, collected by VAN LANSBERGE (?), possibly in Borneo. It is a black-and-blue species, and, according to SELYS, is allied to *C. dorsalis* (SELYS). A single female from Java, presumably referred to *lansbergei*, was described by FÖRSTER; the body is black with rich blue colouring on head, thorax and first abd.-segments (19). I am wholly unable to locate this species.

Parathemis metallica FRASER (31). — It is impossible to say, from the description alone, what this species exactly may be. *Parathemis* is said by its creator to be a close ally of *Pseudagrionoptera*, following that genus in the natural order. The male only has been made known, which is stated to be from Java. This is unlikely. Recently, Mr. D. E. KIMMINS (British Museum), informed me in a letter that the type is not in the B. M. collection. As no more dragonfly of that name is in the Buitenzorg Museum collection, the insect must be considered as lost.

Species delendae.

Vestalis lugens SELYS. — Erroneously recorded from Java by KONINGSBERGER (50). Should be *V. luctuosa* (BURM.).

Rhinocypha tincta (RAMB.) — Wrongly stated by FRASER to be a Javan insect (31). *Rhinocypha io* FRASER, described in the same paper from Sumatra, is synonymous with *R. selysi* KRÜGER.

Argiolestes karnyi FRASER (31). — Identical with *A. cincta* SELYS. FRASER's type is from Celebes and was wrongly given to be from Java.

Teinobasis gracillima FRASER (31). — Identical with *T. superba* (SELYS). FRASER's type comes from Celebes, not from Java.

Aciagrion occidentale LAIDLAW. — Erroneously stated by FRASER to occur in Java (31).

Nesozenia lineata SELYS. — Likewise erroneously reported from the island by the same author (31).

Lathrecista asiatica pectoralis (BRAUER). — Should be *L. a. asiatica* (F.). The subspecies *pectoralis* BRAUER occurs in the Moluccas (FRASER, 31).

Orthetrum leptura (BURM.) — Synonymous with *O. sabina* (DRURY). Both names figure in FRASER's list (31).

Orthetrum pruinosum schneideri FÖRSTER. — A male labelled "W. Java, Preanger 15-1600 m, SIJTHOFF" (in SNELLEN's handwriting), figuring under the name *O. p. clelia* SELYS in RIS's monograph, is evidently wrongly labelled. The specimen was very probably collected in Borneo, along with several other species not occurring in Java, which are placed in the Leiden Museum, all bearing the same wrong locality-label. These species are: — *Vestalis amoena* SEL., *Euphaea inequiptar* SEL., *E. subcostalis* SEL., *Rhinocypha humeralis* SEL., *Rhinagrion borneense* (SEL.), *Caconeura hyperythra* (SEL.), *Gomphidia* cf. *maclachlani* SEL., and *Leptogomphus coomansi* LAID. The Calopterygids (s. lat.) bear an identification-label in the handwriting of R. MARTIN.

Orthetrum triangulare melania SELYS. — This species has been reported from Palaboean (Wijnkoops) Bay in S. W. Java by FÖRSTER (23). The statement is certainly incorrect.

Rhyothemis resplendens SELYS. — Erroneously recorded from Java by FRASER (31). This species is restricted to the eastern part of the Archipelago.

Tramea limbata (DESJ.) and *euryale* SELYS. — These two species were held apart by FRASER in his list (31) and should be united under the name *T. limbata euryale* SELYS.

Procordulia karnyi FRASER (31). — As has been pointed out by me (68), *karnyi* is a synonym of *sumbawana* (FÖRST.).

Idionyx dohrni KRÜGER. — Erroneously stated by FRASER (31, 32) to occur in Java.

Gynacantha javica FRASER (31). — The type is a female, collected near Buitenzorg, March 22, 1930. It is in bad condition and should be classified as *G. basiguttata* SELYS (68).

Gynacantha millardi FRASER (26). — Also incorrectly listed as a Javan species by FRASER (31). Should be *G. bayadera* SEL.-RIS. *G. millardi* FRASER is an Indian species, not inhabiting Malaysia (68).

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A LIST OF THE ODONATA KNOWN FROM JAVA.

(An undulating line means that the species is known from Java but that exact localities are not recorded).

	Malaya	Sumatra	West	Mid	East	Borneo	Celebes	Less. S. Is.	Remarks ¹⁾
			Java						
Calopterygidae									
<i>Neurobasis chinensis</i> (L.)									3
<i>N.ch. florida</i> (Hag.)									3
<i>Vestalis luctuosa</i> (Burm.)									
Euphaeidae									
<i>Euphaea variegata</i> (Ramb.)									
<i>Dysphaea dimidiata</i> Selys.									(Incl. <i>D. lim- bata</i> Sel.)
Libellaginidae									
<i>Rhinocypha anisoptera</i> Selys.									
<i>Rhinocypha fenestrata</i> (Burm.)									
<i>Rhinocypha heterostigma</i> (Ramb.)									
<i>Rhinocypha selysi</i> Krüger.									
<i>Libellago lineata</i> (Burm.)									
<i>L.l. lineata</i> (Burm.)									
<i>Libellago sumatrana</i> (Selys)									
Lestidae									
<i>Platylestes heterostylus</i> Lieft.									
<i>Lestes concinnus</i> Selys.									Madoera Is.
<i>Lestes praemorsus</i> Selys.									
<i>L.p. praemorsus</i> Selys.									
Megapodagrionidae									
<i>Rhinagrion tricolor</i> (Krüger)									
Platystictidae									
<i>Drepanosticta gazella</i> Lieft.									
<i>Drepanosticta siebersi</i> Fraser.									
<i>Drepanosticta spatulifera</i> Lieft.									
<i>Drepanosticta sundana</i> (Krüger)									

¹⁾ Under "Remarks" the nearest locality to Java is given if the species is not known from one of the regions listed, or if the distribution is discontinuous.

	Malaya	Sumatra	West	Mid	East	Borneo	Celebes	Less. S. Is.	Remarks
			Java						
<i>Agriocnemis femina</i> (Brauer)									
<i>Agriocnemis minima</i> Selys.									
<i>Agriocnemis pygmaea</i> (Ramb.)									
<i>Mortonagrion falcatum</i> Lieft.									Karimoen Djawa
<i>Aciagrion aciculare</i> Lieft.									
<i>Aciagrion fasciculare</i> Lieft.									
<i>Enallagma malayanum</i> Selys.									India
Libellulidae									
Libellulinae									
<i>Tetrathemis irregularis</i> Brauer.									
<i>T.i. hyalina</i> Kirby.									
<i>Tetrathemis platyptera</i> Selys.									
<i>Orchithemis pulcherrima</i> Brauer.									
<i>Lyriothemis cleis</i> Brauer.									
<i>Lyriothemis magnificata</i> (Selys).									
<i>Agrionoptera insignis</i> (Ramb.)									
<i>A.i. insignis</i> (Ramb.)									
<i>Lathrecista asiatica</i> (F.)									
<i>L.a. asiatica</i> (F.)									
<i>Potamarcha obscura</i> (Ramb.)									
<i>Cratilla lineata</i> (Brauer)									
<i>Cratilla metallica</i> (Brauer)									
<i>Orthetrum chrysis</i> Selys.								?	
<i>Orthetrum glaucum</i> (Brauer)									
<i>Orthetrum luzonicum</i> (Brauer)									
<i>Orthetrum pruinosum</i> (Burm.)									
<i>O.p. pruinosum</i> (Burm.)									
<i>Orthetrum sabina</i> (Drury)									
<i>Orthetrum silvarum</i> Lieft.									
<i>Orthetrum testaceum</i> (Burm.)								?	
<i>O.t. testaceum</i> (Burm.)									
<i>Orthetrum triangulare</i> Selys.									
<i>O.t. triangulare</i> Selys.									
<i>Brachydiplax chalybea</i> Brauer.									
<i>B.c. chalybea</i> Brauer.									
<i>Raphismia bispina</i> (Hagen)									Karimoen Djawa

	Malaya	Sumatra	West	Mid	East	Borneo	Celebes	Less. S. Is.	Remarks
			Java						
<i>Acisoma panorpoides</i> (Ramb.)						?			
<i>Diplacodes nebulosa</i> (F.)									
<i>Diplacodes trivialis</i> (Ramb.)									
<i>Brachythemis contaminata</i> (F.)									
<i>Neurothemis fluctuans</i> (F.)									
<i>Neurothemis intermedia</i> (Ramb.)									India, Assam &c.
<i>N.i. excelsa</i> Lieft.									
<i>Neurothemis palliata</i> (Ramb.)									
<i>N.p. palliata</i> (Ramb.)									
<i>Neurothemis terminata</i> Ris.									
<i>N.t. terminata</i> Ris.									
<i>N.t. obscura</i> Fraser									} Karimoen Djawa Sebesi
<i>Neurothemis tullia</i> (Drury)									
<i>N.t. feralis</i> (Burm.)									
<i>Crocothemis servilia</i> (Drury)									
<i>Rhodothemis rufa</i> (Ramb.)									
<i>Trithemis aurora</i> (Burm.)									
<i>Trithemis festiva</i> (Ramb.)									
<i>Onychothemis abnormis</i> Selys.									
<i>Onychothemis culminicola</i> Förster.									
<i>O.c. culminicola</i> Förster.									
<i>Zygonyx ida</i> Selys.									
<i>Z.i. ida</i> Selys.									
<i>Zygomma obtusum</i> Selys.									
<i>Zygomma petiolatum</i> (Ramb.)									
<i>Tholymis tillarga</i> (F.)									
<i>Pantala flavescens</i> (F.)									
<i>Rhyothemis phyllis</i> (Sulzer)									
<i>R.p. phyllis</i> (Sulzer)									
<i>Rhyothemis triangularis</i> Kirby.									
<i>Hydrobasileus croceus</i> (Brauer)									
<i>Tramea limbata</i> (Desj.)									
<i>T.l. euryale</i> Selys.									
<i>Camacinia gigantea</i> (Brauer)									Kangean
<i>Macrodiplax cora</i> (Brauer)									
<i>Urothemis signata</i> (Ramb.)									
<i>U.s. bisignata</i> Brauer.									
<i>Aethriamanta aethra</i> Ris.		?							

