

THE DRAGONFLIES (ODONATA) OF NEW CALEDONIA AND THE LOYALTY ISLANDS

PART. 1. IMAGINES

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RÉSUMÉ

Le dernier recensement précis de la faune Odonatologique de la Nouvelle Calédonie effectué par H. CAMPION date de plus de cinquante années (1921); il fut suivi par la publication d'une liste faunistique provisoire due à E. SCHMIDT (1938). Depuis ces contributions, nos connaissances sur la faune de cette île se sont largement étendues grâce à deux expéditions hydrobiologiques récentes : l'une conduite en 1965 par M. le Prof. Dr. F. STAR-MUHLNER, de Vienne, la seconde, exécutée en 1972 par des spécialistes américains de l'Université de Floride à Tallahassee. Ces deux expéditions se sont appliquées spécialement à rassembler un assez grand nombre de larves d'un intérêt particulier. En outre des collaborateurs du Bishop Museum de Honolulu ont collecté des libellules adultes et étendu la prospection de la faune de cette île.

La première partie du travail que nous présentons a pour but une analyse critique, basée sur la vérification de l'identité des espèces déterminées antérieurement. Les caractères employés pour établir des clefs d'identification ont été vérifiés sur des spécimens types et dans diverses collections qui rassemblent la presque-totalité des espèces rencontrées à ce jour.

L'auteur traite particulièrement des formes endémiques, tandis qu'une large place est consacrée à l'origine et à la répartition géographique des espèces, par référence à la faune des îles voisines.

A l'heure actuelle, 40 espèces d'Odonates sont signalées avec certitude dans l'île de la Nouvelle Calédonie, 8 seulement ont été récoltées dans les îles Loyauté.

Cinq espèces et une sous-espèce sont décrites comme nouvelles, cinq autres déjà connues par ailleurs sont signalées pour la première fois.

Il est évident que de nouvelles recherches modifieront ces chiffres. Selon une estimation prudente le nombre total des espèces de libellules doit s'élever à une cinquantaine et dépassera probablement ce chiffre, car plusieurs espèces communes, très répandues dans les territoires voisins n'ont pas encore été observées dans les îles.

En outre, la Nouvelle Calédonie possède en propre, probablement, un certain nombre d'espèces encore à découvrir.

La deuxième partie de ce travail qui doit être achevée bientôt, est consacrée aux larves. Elle permettra de distinguer les formes les plus intéressantes parmi les espèces endémiques de la Nouvelle Calédonie.

INTRODUCTION

MATERIAL AND ACKNOWLEDGEMENTS

I wish to express my best thanks to all scientists who have assisted me in one way or other to make

the present review as complete as possible. In the list that follows, the names of these persons are bracketed behind those of the institutions. The symbols chosen for the latter indicate the ultimate disposition of the material studied and have been used also in the text under the heading of each species.

The preparation of this paper was initiated by Prof. Dr. Ferdinand STARMÜHLNER, of the First Zoologisches Institut der Universität Wien. In October 1968 he invited me to work out a collection of Odonate larvae made by him and Dr. A. KALTENBACH during a three month's stay on the island, from July to October, 1965. The elaborate reports on this Austrian expedition published already by STARMÜHLNER and WENINGER (1968), give a good impression of the topography and hydrography of New Caledonia. STARMÜHLNER's paper contains an annotated list of all localities where collections have been made, with summaries of the faunal elements met with in a great variety of aquatic habitats. The description of these collecting sites is important, especially with regard to the dragonfly larvae obtained. They are all numbered and prefixed FNK, a symbol that has been adopted in the text of the present paper as a reference to the various micro-habitats investigated.

The original object was to identify and put on record the above collection first. In July 1973, however, Dr. William L. PETERS offered me to deal with an even more substantial collection of dragonflies, comprising both larvae and adults, made from September to November 1972 by members of a party organized by the University of Florida, Tallahassee, indicated by the mark FAMU in the present account. (1) The partners on this field trip were Drs. W. M. BECK Jr., W. L. & Mrs. J. G. PETERS (all of FAMU), and G. F. EDMUNDS Jr., of the University of Utah, Salt Lake City. Detailed lists, similar to the above, of the FAMU collecting localities are in course of preparation. It will be seen that both expeditions have contributed in no small measure to our knowledge of the immature stages of the island's Odonate fauna.

Whereas, on the occasion of the field explorations just mentioned, the attention was focussed on the larvae, most of the imagines—which form the basis of this part of my work—were assembled during the past fifteen years or so by staff members of the Bishop Museum, Honolulu, under the direction of Dr. J. L. GRESSITT, to whom I am indebted for much friendly co-operation. My best thanks are due also to Dr. T. W. DONNELLY, of the Department of Geological Sciences, State University of New York at Binghamton, for the gift of duplicates of species collected by him on various islands in the Pacific. Dr. Heinz SCHRÖDER, of the Natur-Museum Senckenberg, Frankfurt a.M., sent me on loan some plate negatives of wing-photographs illustrating F. RIS's New Caledonia paper (1915) and gave his

permission to reproduce enlargements of these on page of this journal.

The immature stages and imagines collected by the FAMU expedition generously came to me by free gift and will be donated to the Leiden museum (ML). Upon the request of Drs. W. L. PETERS and Paul H. CARLSON duplicates of these, where available, will be sent to the Centre Forestier Tropical (CFT), at Nouméa.

- AMS — Australian Museum, Sydney (C. N. SMITHERS)
 BISH — Bernice P. Bishop Museum, Honolulu (J. L. GRESSITT & † Miss S. NAKATA)
 BM — British Museum (Nat. Hist.), London (Peter WARD)
 CFT — Centre Technique et Forestier Tropical, Nouméa, N.G. (Centre O.R.S.T.O.M., M. CORBASSON & P. COCHEREAU)
 F (N°) — Prefix of collecting numbers of the FAMU Expedition
 FAMU Exp. — Florida Agricultural and Mechanical University Expedition 1972, Tallahassee, Fla. (P. H. CARLSON)
 FNK (N°) — Prefix of collecting numbers of the Österreichische Neukaledonien Expedition 1965 (see NMW)
 IRSN — Institut royal des Sciences Naturelles, Bruxelles
 ML — Rijksmuseum van Natuurlijke Historie, Leiden
 MP — Muséum National d'Histoire Naturelle, Paris (M^{me} S. KELNER-PILLAULT)
 NMB — Naturhistorisches Museum, Basel († F. KEISER & S. SCHAMBÖCK)
 NMW — Naturhistorisches Museum, Wien (A. KALTENBACH & F. STARMÜHLNER)
 SAM — South Australian Museum, Melbourne (T. W. DONNELLY interpr.)
 SMF — Natur-Museum Senckenberg, Frankfurt a. M. (H. SCHRÖDER)

All figures of structural details illustrating this paper are reproductions of original camera lucida drawings.

Pour conclure, sans l'encouragement et l'aide précieuse de M. F. Starmühlner, de même que sans la bienveillance de la rédaction des Cahiers O.R.S.T.O.M., cet ouvrage n'aurait pas été entrepris et encore moins réalisé. Nous tenons à leur exprimer notre profonde reconnaissance.

Origin and composition of the insular Odonate fauna

The district of Southern Melanesia, as it was first defined by MAYR (1941), comprises New Caledonia, the Loyalty Islands, the New Hebrides (with Banks Is.), and the Santa Cruz group. It forms a unit which is somewhat different from the rest of Polynesia, at least as far as the bird

(1) The University party gratefully acknowledges the support granted by the National Geographic Society, Washington, D.C., by financing this expedition.

fauna is concerned. This region is here adopted for convenience' sake, as it applies roughly to the Odonata as well.

As to the origin and composition of the present-day fauna of Southern Melanesia, several zoologists have on various occasions put forward interesting facts and expressed opinions based on systematic inventories of a variety of animals. These have been summarized a.o. by MAYR (1941, 1958), GRESSITT (1956), WILLIAMS (1945), and others; the first two authors also published notes on the geological history of the islands since the Mesozoic era.

Geomorphological evidence indicates that, towards the end of the Mesozoic era, the old andesitic island cores of this part of Polynesia may have occupied a larger area than today. To the purpose of establishing biogeographical boundaries, the pre-Tertiary configuration of the islands is, however, of no concern and may be regarded merely as a geological feature of the remote past (1).

The arch-trench system of these southern Melanesian archipelagoes underwent considerable changes by volcanic activity, which must have taken place early or in the middle of the Tertiary. There is no evidence that the various island arcs were at one time connected with one another, although the links in the chains may have been larger and nearer together than they are at present.

New Caledonia emerged from the sea apparently during the Oligocene, some 40 million years ago. Most authors agree that since that period the island has probably never been in continental connection with Australia or Papua. As a consequence New Caledonia can not possibly have received its fauna by way of a land bridge.

To the zoogeographer it is of interest to visualize that the exchange of faunal elements probably began long before the Pleistocene period, during the turbulent Tertiary era, with its fluctuations of the sea level, alternating elevation and subsidence of the ocean bottom, and volcanic outbursts.

It seems certain that New Caledonia, the largest and highest island of the most westerly chain, has never become completely submerged since it made its appearance during the Oligocene (MAYR, 1941). Ultimately, the sedimentary deposits expelled through volcanic activity may have caused the island to increase markedly in size, so that it could form an important link in a chain of insular "stepping stones" for the earliest colonizers to settle. Chance

dispersal during this long period of time must have played an important role in the evolution of the autochthonous Odonata of New Caledonia. Of course, only creatures capable of transoceanic dispersal could have reached the island and secure a footing. The occurrence of a fair number of old elements in the present-day fauna can be explained only by assuming that the latter are the descendants of immigrants that have reached the island intermittently at irregular intervals during the Plio-Pleistocene, i.e. within, at most, the past 20 million years. After every wave of immigrants, at least some of these parental pioneers should have survived, established themselves, and remained isolated for long enough to differentiate into the endemic genera and species of today, thus giving them a distinctively New Caledonian facies.

Speciation and dispersal

In his discussion of the various factors governing insular speciation in the zygoterous dragonflies of the Hawaii Islands, ZIMMERMANN (1948) pointed out that it is not unlikely that a succession of immigrants come from different stock and geographically discontinuous areas, so that it is only natural to expect the progeny of the newcomers to develop into dissimilar species showing a variety of morphological characters. This would explain the remarkable diversity of structure exhibited by the endemic *Argiolestinae*, *Isostictidae*, and species of *Synthemis*, now inhabiting New Caledonia. It is exactly in these old endemic groups that we meet with a striking interspecific variation, which clearly points to their polyphyletic origin.

However, as there are neither whole endemic families or subfamilies in New Caledonia, nor any of the true palaeogenetic elements of the Australian continent (2), we may assume that even the autochthonous elements in the dragonfly fauna of New Caledonia, are of comparatively recent origin (see below).

It is generally understood that many organisms have an amazing ability to cross water-gaps of considerable extent. As far as the Odonata of today are concerned, there is abundant evidence that this applies with equal force to the active, strong-flying species, such as some of the larger *Aeshnidae*, or the so-called "gliders" (e.g. *Pantala*, *Tramea* and *Rhyothemis*, among the Libellulids) and many

(1) A brief though clear picture of the palaeogeographical reconstruction of Australia with particular reference to the entomofauna of Queensland, has recently been given by MACKERRAS & MARKS (1974). See also LEGENDRE *et al.* (1967).

(2) Examples of these discontinuously distributed Mesozoic relics are the amphipterygoid genus *Diphlebia* and the *Chlorolestidae* among the Zygoptera, as well as the *Petaluridae* and the more primitive aeshnoids, like the *Neopetalidiidae*, among the Anisoptera.

TABLE I

List of the Odonata of New Caledonia and the Loyalty Islands, showing endemism (marked E), further distribution and occurrences on surrounding islands and continents

	New Caledonia	Loyalty Is.	New Hebrides	Australia	Papuan Region	Solomon Is.	Santa Cruz	Fiji Is.	Distribution
LESTIDAE									
<i>Leses (Leses) concinnus</i> Hagen & Selys.....	+								IA
<i>Leses (Indolestes) cheesmanae</i> Kimmins.....	+			+					SM
MEGAPODAGRIONIDAE									
Argiolestinae									
<i>Argiolestes ochraceus</i> (Montrouzier).....	E								AP
<i>Caledopteryx sarasini</i> (Ris).....	E								AP
<i>Caledargiolestes uniseries</i> (Ris).....	E								AP
<i>Caledargiolestes janiceae</i> spec. nov.....	+		+						AP
<i>Trineuragrion percostale</i> Ris.....									SM
ISOSTICTIDAE									
<i>Isosticta spinipes</i> Selys.....	(E)	(E)							A
<i>Isosticta tillyardi</i> Campion.....	E	(E)							A
<i>Isosticta robustior</i> Ris.....	(E)	(E)							A
<i>Isosticta gracilior</i> spec. nov.....	E								A
<i>Isosticta humilior</i> spec. nov.....	E								A
COENAGRIONIDAE									
<i>Xanthagrion erythroneurum</i> Selys.....	+								A
<i>Ischnura aurora aurora</i> Brauer.....	+								IP
<i>Ischnura heterosticta</i> (Burmeister).....	+								A
<i>Ischnura torresiana</i> Tillyard.....	+								AP
<i>Xiphagrion cyanomelas</i> Selys.....									IA
<i>Agrionemis exsudans exsudans</i> Selys.....	+								SM
AESHNIDAE									
<i>Gynacantha rosenbergi</i> Brauer.....	+								AP
<i>Aeshna brevistyla</i> Rambur.....	+								A
<i>Anax gibbosulus</i> Rambur.....	+								AP
CORDULIIDAE									
Corduliinae									
<i>Hemicordulia hilaris</i> spec. nov.....	+								?
<i>Hemicordulia fidelis</i> MacLachlan.....	+								SM
<i>Metaphya elongata</i> Campion.....	E								SM
Synthemistinae									AP
<i>Synthemis miranda</i> Selys.....	E								AP
<i>Synthemis flexicauda</i> Campion.....	E								AP
<i>Synthemis montaguei</i> Campion.....	E								AP
<i>Synthemis campioni</i> Lieftinck.....	E								AP
<i>Synthemis fenella</i> Campion.....	E								AP
<i>Synthemis ariadne</i> spec. nov.....	E								AP
LIBELLULIDAE									
<i>Agrionoptera papuensis lifuana</i> Kimmins.....	+								SM
<i>Lathrecista asiatica festa</i> (Selys).....	+								AP
<i>Oriethetrum caledonicum</i> (Brauer).....	+								AP
<i>Diplacodes bipunctata</i> (Brauer).....	+								AP
<i>Diplacodes haematodes</i> (Burmeister).....	+								AP
<i>Rhyothemis graphiptera</i> (Rambur).....	+								A
<i>Rhyothemis phyllis apicalis</i> Kirby.....	+								SM
<i>Pantala flavescens</i> (F.).....	+								O
<i>Tramea loewii</i> Brauer.....	+								AP
<i>Tramea transmarina intersecta</i> subsp. nov.....	+								SM
<i>Tramea liberata liberata</i> Lieftinck.....	+								AP
Total.....	40	8	14	15	12	6	2	8	

TABLE I.—A = Australian; AP = Australo-Papuan; E = Endemic; (E) = Endemic + Loyalties; IA = Indo-Australian; IP = Indo-Pacific; O = Universal; SM = Southern Melanesian.

of the weaker wind-borne forms, which are transported passively over great distances by air currents and storms. (1)

Topography, climate and ecological data of New Caledonia

In the next paragraphs I have summarized the most distinctive features of New Caledonia by making free use of the wealth of information as contained in the two publications cited.

New Caledonia is a geographically isolated tropical island in the South-west Pacific and may be assigned to the subdivision Southern Melanesia within the Polynesian Subregion (E. MAYR, 1941). It is of volcanic origin and by far the largest and highest of all land-masses in the Pacific Ocean, the islands of the nearby Loyalty group being considerably smaller and almost flat. The main island has a remarkable elongate form, its long axis extending almost in a straight SE-NW direction. It is situated between Lat. 20°10' and 22°30' S, roughly 400 km long and about 50 km broad, occupying an area of ca 16.100 sq. km. In a northeastern direction the New Caledonia group is closest to the chain of islands formed by the New Hebrides (ca 9.800 sq.km), the most southerly of these (Porta Villa) being less than 300 km away from the Loyalties. However, New Caledonia lies far distant from the nearest big "continents", i.e. Australia, the eastcoast of which is almost 1300 km to the west and New Zealand, even more remote, with its North Cape approximately 1500 km toward the south, the isolated Norfolk Island being situated about midway between the last.

There is a densely forested, interrupted NW-SE submontane central range (highest point, on summit of Mt. Panié, 1628 m alt.), with much rain in all seasons. Owing to the prevailing SW and N winds, the average annual rainfall at the south- and westcoasts differs greatly from that on the steep eastern mountain slopes (i.e. from ca. 900-3300 mm), with heaviest rain in the north-west, though only

above 800 m alt. There are few big rivers but numerous fast, clear and well-oxygenated forest streams, which come down from steep slopes in cascades. Because of the precipitous nature of the country most streams are short and their upper reaches are usually fed by springs and a network of small brooks. The driest time of the year is from September to November, the wettest months with heaviest rainfall are February-March, while the main annual temperature at Nouméa (in the South) is 23.6° C. (26.6° in January, 20.3° in August).

The lower reaches of the rivers, especially at the westcoast, find their way through mangrove forest, while the short streams entering the sea at the eastern shore of the island flow through zones of brackish waters. There are fish ponds as well as extensive freshwater lakes; the shallow spring-fed marshes of the Plaine des Lacs in the southeast part of the island are, however, apparently on a high, very wet plateau, but with poor vegetation. (STARMÜHLNER and WENINGER, 1968).

Analysis of the Odonate fauna

The most recent survey of the Odonata of Oceania is the useful publication by Erich SCHMIDT (1938). In this paper are listed all described taxa and insular records available in the literature, with notes on the synonymy and full references. The area comprises the Pacific as a whole, from Micronesia and the Bismarck Archipelago in the West to the Galapagos Islands in the East (2).

It is of interest to make a more detailed analysis of the New Caledonian Odonata. The results are demonstrated in the tabulation (Table I), which lists all taxa so far known from the island. Species marked E are endemic only in New Caledonia, while (E) indicates those restricted to both island groups. The Loyalty Islands will not concern us any longer, because since KIMMINS (1958) added 3 species to the 5 already listed by SCHMIDT, apparently no further collecting has been done in the Loyalties. The other symbols in the last column

(1) Speaking of the similarity between species of the platycnemidid genus *Copera* living in East Africa and southern India, and of their distribution capacities, FRASER once wrote: "These small zygopterans when emerging, rise straight into the air. I have watched them ascend to vast heights, until finally lost to sight. No doubt, in spite of the enormous distance to be covered, these insects rely on air currents for distribution, their very weakness, their gossamer-like lightness, being their strength." (*Trans. Ent. Soc. Lond.*, 76 : 128, 1928). Observations like these have been made by others, including myself, in various countries in the Orient and Pacific.

(2) MUMFORD (1941), speaking of the insect fauna of the South Pacific islands, repeats a former statement made by him on a previous page (p. 241) of the same journal, by referring to a paper written by himself:—"As the dragonflies (Odonata) have already been dealt with at length [sic] in Mr. MUMFORD's memorandum on the "Insects of the southern islands of the Pacific in relation to Pacific island distribution", I shall not repeat here, except to say that this Order would seem to include an important endemic element in all the high islands of Polynesia that have been explored to date." As the publication of such a memorandum does not appear to have ever been materialized, we shall have to be content with the author's elaborate title and good intentions.

of the tabulation give a general impression of the possible origin and principal range of the species.

Any analysis of New Caledonia is much impeded by two factors, viz. (1), because no expert collecting has yet been done in the islands, many species actually occurring having undoubtedly remained unnoticed; and (2), it is still too early to make adequate comparisons with other islands in Southern Melanesia, because the dragonflies of these are even less known, particularly those of the New Hebrides.

New Caledonia is generally believed to have an impoverished entomofauna (see, however, GRESSITT, 1956, concerning some beetle families), but we will probably have to alter this view regarding the Odonata.

While SCHMIDT reported 27 species and subspecies from the island, the present list contains 40, of which 6 taxa are described as new and 5 already known are here recorded for the first time.

ENDERISM

As far as we know at present, there is a fairly high percentage of endemic forms in New Caledonia, most of them showing peculiarities of their own. It is of interest to note that they are characterized by a high degree of speciation. There are three very different archaic complexes deserving special attention in this respect, viz. (1), the megapodagrionid subfamily *Argiolestinae* with three endemic genera, which are just enough differentiated to warrant generic distinction; (2), the genus *Isosticta*, of the family of that name, with several precinctive species; and (3), the genera *Metaphya* and *Synthemis*, of the corduliid subfamilies *Corduliinae* and *Synthemistinae*, respectively.

(1). Leaving aside one supposedly terrestrial larva of unknown status, which almost certainly also belongs here (see p. 143), four *Argiolestinae* are peculiar to New Caledonia, while a fifth, the monotypic *Trineuragrion percostale*, also occurs in the New Hebrides. As to the affinity of this group, nothing definite can be said, as they differ interspecifically and possess characters shared by Australian and Papuan members in about equal proportion.

(2). *Isosticta* is closely related to a number of small Australian genera, all of which are peculiar to that continent. The genus is not strictly endemic, for two of its members occur also in the Loyalty Islands, and there are two other species in Australia. *Isosticta* is not known from the Papuan region, where it is replaced by the allied *Selysioneura* and *Tanymecosticta*, each with many species.

(3). The peculiar corduliine, *Metaphya elongata*, known only from a single female, may ultimately require a separate genus to hold it; *Metaphya* has a discontinuous distribution, occurring only in North Borneo, New Guinea, and North Australia, each country having its own species. All are similar and closely interrelated, whereas the New Caledonian insect differs markedly from the others. Lastly, the archaic genus *Synthemis* is well represented in both New Guinea and Australia, with a few outlying species in surrounding islands, including one in Fiji. As to their affinity, the regional species show characters most closely resembling those of certain Australian forms, suggesting an origin from that continent. They include a number of conspicuously coloured dragonflies of large size. For a discussion of the latter, see CAMPION (1921), LIEFTINCK (1971), and elsewhere in the text.

As far as the species and subspecies are concerned, the analysis shows us the following.

Of a total of 40 taxa, 14 (or 35 per cent) are precinctive to New Caledonia alone, while 16 of the total (or 40 per cent) occur in both New Caledonia and the Loyalties. In addition to the latter, 8 species and/or subspecies (marked SM in the Table), (or 60 per cent of the total), are restricted to New Caledonia (with or without the Loyalties) together with the New Hebrides. However, the following considerations will, I think, place the composition of the regional fauna in its true perspective.

NEGATIVE CHARACTERS OF THE FAUNA

The position of New Caledonia is remarkable for the absence of not less than 5 zygoterous families, all of western origin, which have a fairly rich representation in the Papuan region as well. These are: the *Chlorocyphidae*, *Calopterygidae*, *Platystictidae*, *Platycnemididae*, and *Protoneuridae*. Except the first two (each with a single species) and the last (with more numerous representatives), these are lacking also from the Australian continent. Eastern (Pacific) elements are almost absent, for example, the coenagrionid genus *Nesobasis*, with numerous (about 20) endemic species in Fiji and two others which have reached the New Hebrides. Thus a Polynesian influence (except, perhaps, *Hemicordulia*), is quite unapparent.

Other negative characters have reference to some 15 or more common and widely spread species, most of which might have been expected to occur in the islands. Noteworthy absentees are (1), *Pseudagrion microcephalum* (Ramb.) with immediate allies, and *Xiphagrion cyanomelas* Selys (known only from the Loyalties), among the *Coenagrionidae*; (2), *Anax guttatus* (Burm.) and *Anaciaeschna jaspidea*

(Burm.), of the *Aeshnidae*, both excellent fliers showing great migratory tendencies; and (3), a good few *Libellulidae*, i.e. *Orthetrum sabina* (Drury), one or two species of *Brachydiplax*, *Diplacodes trivialis* (Ramb.), *Raphismia bispina* (Hagen), *Neurothemis stigmatizans* subspec., one or two *Zyxomma*, *Tholymis tillarga* (F.), *Hydrobasileus brevistylus* (Brauer), *Camacinia othello* Till., one or two more *Rhyothemis*, and *Macrodiplax cora* (Brauer). These species are well known in the lowlands of the Australo-Papuan region, occurring chiefly near the coast. Several breed in ponds, or frequent sago marshes and mangrove swamps. Most of them have great adaptive and dispersal faculties, the only limiting factor in their establishment would seem to be the availability of stagnant or slightly brackish water, either temporary or permanent. Others, like *Zyxomma* and *Tholymis*, are apt to be overlooked on account of their crepuscular habits.

So, there is every reason to believe that the spread of species has been going on and still continues at this time. Consequently, we may add up some 15 wide-ranging dragonflies to the total presently recorded for the island. At that rate New Caledonia would show a much less marked individuality, about 25 per cent of precinctive species then being left of the approximately 55 anticipated.

RELATIONS WITH NEW ZEALAND

No mention has yet been made of the relations with New Zealand, which is well-known for the extreme poverty of its dragonfly fauna, in spite of the abundance of running waters and other suitable breeding places in the forest. A comparison reveals the following. Only 13 species (including one subspecies) have been at all recorded, no less than 7 [including the subspecies of *Uropetala carovei* (White)] being peculiar to the islands. The remaining 6 are more widely distributed, but only 4 occur in New Caledonia as well. Remarkably enough, neither the widespread tropical species *Hemicordulia australiae* (Ramb.), common also in Norfolk and the Kermadecs, nor *Hemianax papuensis* (Burm.), have turned up in New Caledonia. The reason why there are no true New Zealand genera and species in New Caledonia seems to be primarily a climatic one, all precinctive species being typically elements of a temperate climate. On the other hand, tropical species with a wide distribution in the more northern Pacific islands, are scarce in New Zealand, even the ubiquitous libellulid *Pantala flavescens* (F.) has not succeeded to penetrate further south than the northern extremity of North Island. (Dr. E. G. TURBOTT, of the Canterbury Museum, Christchurch, informed me in a letter, dated Oct. 5, 1950, that *P. flavescens* was first observed in New Zealand about

August, 1950, on a trip to North Auckland, made by him in company with Dr. E. B. MONTGOMERY, who collected the species).

IMMATURE STAGES

Unfortunately, there is only a single case in the present collections where an imago was found emerging (i.e. of the genus *Isosticta*), and no exuviae to show that such a happening was observed at any time. Unless the imagines are found in the act of transformation and the exuviae collected with them, there is often no means of determination open, even to the specialist. In the present case this applies to those genera which contain a number of nearly related species (*Isosticta*, some *Argiolestinae*, and *Synthemis*), whose larvae are very homogeneous. It has been one of the reasons why it was thought best to deal with adults and larvae separately, and to publish first all information at present available on the perfect insects.

In the notes that follow, the only exceptions are formed by a few *Argiolestinae* of special interest, the larval identity of which could be definitely established. The localities of the latter are, therefore, included in separate paragraphs which follow those given for the imagines. These larvae will be described and figured in Part 2 of this memoir.

ZYGOPTERA

Fam. LESTIDAE

Lestes (Lestes) concinnus Hagen & Selys

Lestes concinna Hagen & Selys, 1862 : 321 (♀ Manila, P.I.).

Material (imagines).—New Caledonia: 13 ♂ & ♀, Yahoué, 11.9.1940, Nouméa, 23.9.1940, and St. Louis, 29.10.1940, the latter with collector's note "nearly dry grassy pool", F. X. WILLIAMS (BISH).

A rather surprising discovery of an uniformly coloured species lacking metallic markings. Widely but scatteredly distributed from India to Australia and New Caledonia.

Austrolestes paludosus Tillyard, from North Australia, is synonymous. *Lestes (L.) umbrinus* Selys is a distinct, though closely allied, member of the same group, the differences between the two having been expounded by LIEFTINCK (1960a), and the larval structures of *concinus* are figured in a second paper on lestids (LIEFTINCK, 1960b).

Lestes (Indolestes) cheesmanae (Kimmings)

Austrolestes cheesmanae Kimmings, 1936 : 69-70, fig. 1-4 (struct. ♂ New Hebrides, Erromanga and Banks I.); KIMMINGS, 1953: 242 (addit. descr., New Caledonia); KIMMINGS, 1958: 247 (list).

Lestes (Indolestes) cheesmanae: LIEFTINCK, 1960 : 169, fig. 50-51 (larval labium, New Hebrides).

Material (imagines).—New Caledonia: 2 ♂ 4 ♀, Saint Louis, 14.10.1940, F. X. WILLIAMS, and Thi River valley, 6.11.1940, same coll. (BISH). 1 ♂ 1 ♀ (adult), Mt. Koghi, 450-600 m, 4-6.10.1967, J. SEDLACEK (ML).—Additional material (imagines). New Hebrides: 1 ♂ (adult), with type-written label "S. W. Sauto Tsaraepae-Tsarapara Au 31 57 N.H.G. mise" [Esprito Santo] (BISH).

Material (larvae).—Österr. Neukaledonien Exp. 1965: 2 young ex., FNK 44.2, 28.7.1965 (NMW). New Hebrides: the ultimate instar larva from Tutuba I., described and figured by me in 1960.

This is a true *Indolestes*, most nearly resembling *L. (I.) tenuissimus* Till. and immediate allies occurring in N. Australia and the Papuan region. Of the material listed above, one pair from New Caledonia and the male from the New Hebrides are still before me. Structurally, these specimens are absolutely identical, but, as observed also by KIMMINS, the former average a little smaller in size than New Hebridean examples; they also have a shorter, almost black (not brown) pterostigma and the thoracic black markings are a little more extensive.

Some measurements are: ♂ abd.+app. 34.3—37.0, hind wing 21.2—22.5 mm, pterostigma 1.1 mm (New Hebrides); 27.0—31.0 mm and 17.0—18.2 mm and 0.9 mm, respectively (New Caledonia); ♀ 25.6—26.0, 18.0—20.0 and 1.0 mm, respectively (New Caledonia). There are 10—11 postnodals in both fore and hind wings (♂ New Hebrides), only 8—9 (♂♀ New Caledonia).

Fam. MEGAPODAGRIONIDAE

Subfam. Argiolestinae

All members of the family occurring in New Caledonia and the Loyalty Islands belong to the Australo-Papuan complex of forms amalgamated under the subfamily name Argiolestinae in FRASER's "Reclassification" (1957). The monotypic genus *Caledopteryx* Kennedy, though undoubtedly also belonging here, was omitted and probably overlooked in this classification. Of the many other genera included in this subfamily, I believe to have shown that some at least, i.e. *Rhinagrion* Calvert, *Heteragrion* Selys and *Oxystigma* Williamson, should be removed therefrom mainly on the basis of their larval characters, albeit that a proper allocation of these was left undecided (LIEFTINCK, 1956). Much information on the history, morphology and nomenclature of the Indo-Australian assemblage of forms can be found in three of the writer's publications dealing with the family (LIEFTINCK, 1935, 1938 and 1956). These memoirs contain a number of wing photographs, including those of

typical *Argiolestes* (with "*Wahnesia*" and "*Metagrion*"), as well as many drawings of other significant structures of both adults and larvae. This was done mainly to demonstrate clearly the astonishing variation exhibited by these insects in details of their venation and other organs, and also to emphasize the difficulty of singling out criteria for generic distinction in this particular group.

In order to clarify the classification as much as possible, it was thought best to follow a similar course with regard to the taxonomy of the insular forms presently discussed.

The New Caledonian group comprises five species; and though all of them are unmistakable *Argiolestes* in a broad sense, three have been placed successively in separate genera, only *A. ochraceus* remaining. These species are: (1) *sarasini* Ris, the type species of *Caledopteryx* Kennedy, (2) *percostale* Ris, set apart already by its describer and placed in *Trineuragrion* Ris; and (3) *uniseries* Ris, the type species of *Caledargiolestes* Kennedy, to which *C. janiceae* spec. nov., can now be added as a second member. As will appear from the descriptive key and illustrations below, the regional taxa have so many features in common that a fairly close relationship can hardly be called in question in spite of some peculiar diversities in certain respects. Although I am inclined, therefore, to keep them together and consider the characters employed by KENNEDY to define *Caledopteryx* and *Caledargiolestes* as of subgeneric importance only, I have, for the present at all events, retained *Trineuragrion* Ris as a distinct genus and given equal rank to the other two, the more so as *Caledargiolestes*, with the discovery of a second species, no longer figures as a monotypic genus. Further details on the relationships are explained in some cases under the heading of each genus.

Incidentally, mention should be made of a new attempt to a taxonomic grouping of the Megapodagrionidae, viz. in a paper by RACENIS (1959), who "por conveniencia taxonomica" ventured an entirely arbitrary classification of the whole family. Overlooking all recent advances in our knowledge, the author introduced a rather whimsical system, which is based merely on one or two reputedly unstable venational characters, i.e. (1) the presence of one or more cell-rows in the area posterior to Cu₂, and (2) the amount of petiolation of the wing determined by the point where Ab meets the wing margin. I am of the opinion that these features, if not taken in combination with more stable characters, are useless. To demonstrate the incongruity of this simplified classification, the New Caledonian species-group may be taken as an example. In RACENIS' system *Trineuragrion* and *Caledargio-*

lestes are placed not only away from the others in the subfamily Megapodagrioninae, but also in different tribes, the former in the Megapodagrionini, the latter in a tribe called Philogeniini. *Argiolestes* and *Caledopteryx*, on the other hand, remain in the Argiolestinae, but are placed in a new tribe, Argiolestini, away from the Australian *Austroargiolestes*, for which another new tribal name is created, viz. "Austroargiolestini".

IMMATURE STAGES

At present only the larvae of *Caledopteryx sarasini* and *Argiolestes ochraceus* could be recognized and identified with absolute certainty; the correct associations of two other forms remain to be established, viz. one larva which should be referred to either of the three species *Caledargiolestes uniseries*, *C. janiceae* spec. nov., or *Trineuragrion percostale*, and a second, the enigmatic "terrestrial" kind, of which we do not even possess a full-grown example. This leaves us with at least three (probably four) of the five (or six) New Caledonian species whose immature stages are still unknown. A detailed account of all argiolestine larvae accumulated by the various expeditions is in course of preparation. Pending the publication of this report I have listed, for the sake of completeness, all localities and totals of collected specimens belonging to the two species just mentioned. These are enumerated under the heading "material", following the list of adults recorded.

The imagoes of the regional species can be distinguished from one another by means of the next

DESCRIPTIVE KEY TO THE SPECIES

1. Neuration dense: more than 20 postnodal cross-veins. Area posterior to Cu_2 with two or more cell rows, or at least fore wing with several duplicated cells; at least four postquadrangular antenodal cells. Ac situated nearer to Ax_1 than Ax_2 , placed far away from Ab. Three to six cells between origin of veins M_2 and M_{1a} . Large species: ♂ abd.+app. 39-48 mm, hind wing 28.5-40 mm; ♀ 36-45 and 29-42 mm, respectively..... 2
2. Neuration more open: less than 20 postnodal cross-veins. Area posterior to Cu_2 with a single row of cells and only two to three postquadrangular antenodal cells. Position of Ac variable. Two to three cells between origin of veins M_2 and M_{1a} . Apex of second segment of ligula (penile organ) bilobate. Smaller species: ♂ abd.+app. 23.5-33.5 mm, hind wing 18-25 mm; ♀ 23.5-29 and 21-25 mm, respectively..... 3
2. Labrum (except anterior border) and face wholly blue; summit of head, in addition to minute ochreous antenniferous spots, with large, oval or subtriangular blue dot between orbit and lateral ocellus; these blue head marks in aged examples frequently so much obscured as to become obsolete. Labium black, as in fig. 1. Light thoracic markings dull yellow. A pair of yellow juxtahumeral mesepisternal spots or stripes present, though variable and incomplete above. Legs black; tarsal claws with vestigial interior subapical tooth. Wings (pl. I fig. 1); petiole hyaline; pterostigma brownish black or black. Abdomen predominantly metallic black; segm. 1-2 clothed with longish raised hairs; 2-8 frequently with yellow basal rings, these spots finely divided into two by a transverse subbasal black line (juv.-semiad.), or abdomen wholly obscured except whole middorsum of tergites 9-10 and very broad intersegmental membranes of 7-9, which are conspicuously blue above (adult). Sides and ventral surface of thorax segments, as well as basal and terminal abdominal segments partly, pruinescent blue-grey. Ligula (penile organ) as in fig. 2; apex of second segment bilobate. Male inferior anal appendages only little shorter than superior pair, the former approximated and broad at base, their distal portion cylindrical, very slender. ♂ abd.+app. 41.0-48.0 mm, hind wing 33.5-40.0 mm; ♀ 40.0-45.0 and 37.5-42.0 mm, respectively. *Caledopteryx sarasini*
- Labrum black, face reddish brown to black (♂), or genae and clypeus partly bright chrome (♀); a yellow or ochreous spot between base of antenna and lateral ocellus. Labium as in fig. 4, black, its base yellow; median lobe more widely and deeply emarginate than in all other regional species. Light thoracic and abdominal markings extensive, brilliant orange. Pro- and synthorax deep black with bright orange markings: a complete dorsolateral band on each side of prothorax (♂♀), and very broad mesepisternal patches, almost attaining ante-alar triangles, on either side of a black middorsal stripe (♂); or much narrower, lighter coloured juxtahumeral bands, abbreviated dorsally (♀); sides and ventral surface of thorax also profusely marked with orange-yellow (♂♀). Legs with coxae and trochanters bright yellow, femora dirty yellow with two fairly defined brown rings and outer faces also obscured, tibiae and tarsi blackish; tarsal claws with distinct though small interior subapical tooth. Wings less richly veined (pl. I fig. 2); petiole golden yellow; pterostigma deep black (♂) or bright yellow (♀). Abdomen with segm. 1-6 brilliant orange, except 1-2 marked with brown, intersegmental rings of 1-6 black; 7-10 black, but intersegmental membranes as well as whole dorsal surface of 9-10, bright blue (♂); or abdomen dark yellowish orange marked indistinctly with brown dorsally and at end of all segments, apex of segm. 1 moreover with transverse dorsal streak of clear yellow (♀). No blue pruinescence. Ligula as in fig. 5; apex of second segment convex, evenly rounded. Male inferior anal appendages reduced in size, superior pair robust, more or less forcipate, apices blunt. ♂ abd.+app. 39.0-43.0 mm, hind wing 28.5-31.5 mm; ♀ 36.0-39.5 and 29.0-31.5, respectively..... *Argiolestes ochraceus*
3. Only two normal antenodal cross-veins. Position of nervure Ac unstable but usually much nearer Ax_1 than Ax_2 , though frequently placed about midway between; Ab entering wing margin a long distance away from Ac, always well distal to level of proximal side of quadrilateral. Medio-anal link straight or, rarely, slightly fractured. Arc at or a little distal to Ax_2 , the distal position especially evident in fore wing. Origin of M_3 and Rs variable, Rs occasionally arising somewhat distal to subnodus. Wings relatively broad, with bluntly rounded tips; pterostigma black, inflated, moderately oblique or almost square. Labium

- as in fig. 6. Body bronze-black. Labrum, face, whole dorsum of prothorax, and an oblique dorsolateral band on mesothorax, all blue; sides of thorax as well as basal and terminal segments of abdomen partly pruinescent blue (*C. janiceae* immature). Abdomen dark bronze-brown or black, segments 3-8 with at least basal yellow rings and dorsum of 1 and 2 partly yellow or blue. Ligula as in fig. 7. Male superior anal appendages only little longer than inferior pair. *Caledargiolestes* 4
- A third, incomplete (costal), antenodal cross-vein present almost regularly, but occasionally lacking in one or two of the wings. Nervure Ac nearer Ax_2 than Ax_1 , placed well in advance of level of proximal side of quadrilateral. Ab entering wing margin either slightly distal or even proximal to Ac , or both veins coincident at wing border. Medio-anal link distinctly fractured. Ac at Ax_2 . Origin of M_3 and Rs invariably as shown in pl. I fig. 4, the antenodal fragment of M , relatively long. Wings narrower, more pointed, and the dark brown or black pterostigma longer and more oblique, than in preceding species. Labium as in fig. 8. Body black with strong metallic green, bronze or coppery reflections. Labrum and face light blue, postclypeus at least partly metallic green (δ); or only mandibles and genal area chrome (φ). Pro- and synthorax metallic black, only sides of prothorax, a small juxtahumeral spot on either side low down on mesepisterna, and two lateral stripes of unequal breadth at sides of thorax, bright ochreous; rear of head, sides and venter of thorax, as well as basal and dorsum of terminal segments of abdomen, pruinescent light blue to chalky white. Legs black, the coxae posteriorly and trochanters anteriorly, chrome; tarsi with distinct inferior subapical tooth. Abdomen metallic black, unmarked, save for an ochreous spot at sides of 1, and vestige of yellow at lower margin of 2. Ligula as in fig. 9. Male anal appendages black, superior pair forcipate, inferiors about two-thirds length of superior pair, at first broad, then very slender with pointed, upturned tips. δ abd.+app. 27.5+32.0 mm, hind wing 21.5-24.0 mm; φ 23.5-26.0 and 21.0-23.5 mm, respectively. *Trineuragrion percostale*
4. Size medium: δ abd.+app. 31.0-33.5 mm, hind wing 23.0-25.5 mm; φ 29.0 and 25.0 mm, respectively. Body pubescence normal, face, thorax and basal abdominal segments lacking long raised hairs. Blue colour on either side of frons band-like, leaving off abruptly at level of posterior ocelli. Wings (pl. I fig. 3) moderately broad, petiole relatively long, disk not abruptly widened; pterostigma dark brown or deep black, short and rather inflated, but distinctly oblique, not squarish. Postnodals 14-16 in fore wing, 13-14 in hinder pair (δ); or 16 and 15-16, respectively (φ). Ac frequently a little distal to Ax_2 , nervure Ac much nearer Ax_1 than Ax_2 ; veins M_2 and M_{1a} approximated, 1-4 (usually 2) cells apart at their origin. Quadrilateral long, e.g. costal side in hind wing at least twice as long as distal side. Femora palest ochreous or fawn-colour, darker externally, distal one-fourth to one-sixth of each definitely deep black; outer faces of mid and hind tibiae also pale; tarsal claws yellow, with distinct inferior subapical tooth. Abdominal segments 3-7 or 3-8 with basal yellow rings only, otherwise black. Ligula as in fig. 7. Male anal appendages (fig. 10-12) black, the approximated swollen basal ridges and apices of inferiors partly yellowish; superior pair at first strongly outbent then twisted and incurved, the broadened distal portion with distinct, bluntly triangular, inferior tooth; apex of inferior appendages much swollen, unmodified, with tuft of longish pale hairs on the inside..... *C. uniseries*
- Size smaller: δ abd.+app. 23.5 mm, hind wing 18.0 mm, φ unknown. Body covered with long raised whitish hairs especially developed on the face, thorax and first two abdominal segments. Blue colour on either side of frons less extensive, forming a stripe along inner orbits, which tapers to a point and ceases at level of anterior ocellus. Wings broader, shortly petiolated, disk more abruptly widened and tips obtusely rounded; pterostigma squarish. Postnodals 15 in fore wings, 14-15 in hinder pair. Ac at Ax_2 , nervure Ac about midway between Ax_1 and Ax_2 . Veins M_2 and M_{1a} more widely separated, 4-5 cells apart at their origin. Quadrilateral shorter, e.g. costal side in hind wing less than two times as long as distal side. Femora light brown, each with two indistinct darker brown rings and a narrow black annule also at apex; tarsal claws black, inferior tooth unapparent. Abdominal segments 3-7 with basal as well as subapical yellow rings terminal segments apparently unmarked. Ligula not studied. Male anal appendages (fig. 13-16) black; superior pair with broadened distal portion sulcate, the expanded inner projection obtuse-angulate, lacking a tooth; inferior appendages modified, the apical portion of each deeply emarginate and of intricate structure, the whole very bristly, but apex devoid of conspicuous tuft of longish hairs..... *C. janiceae*

The ligula, here shown for all but one species (fig. 2, 5, 7 and 9), is built according to the same plan in all regional species, differing only in details (see also KENNEDY, 1920, for *Argiolestes*). All agree in having a well-developed, transverse and plate-shaped lamina interna, the side portions of which are conspicuous, divergent and markedly sclerotised, while the apical lobes of the last segment are frequently beset with extremely minute microsetae.

Caledopteryx Kennedy, 1925

The generic diagnosis supplied by KENNEDY is based entirely on Ris's very complete description and wing photograph of the only known type species, *Argiolestes sarasini* Ris. This is a conspicuous dark-coloured dragonfly, the largest of the New Caledonian group, recalling the Australo-Papuan *Podopteryx* Foerster in general appearance and size. Ris (1915), upon comparing the wing venation of the two, suggests a near relationship, saying of *Caledopteryx* that it bridges the gap in some ways between *Argiolestes* and *Podopteryx*. Yet on comparing *Caledopteryx* with *Podopteryx*, some dissimilarities of structure are decidedly striking and seem to preclude a close affinity. *Podopteryx* is a still larger and less hairy insect, with more expanded wings; moreover, the shape of the ligula of male *Caledopteryx*,

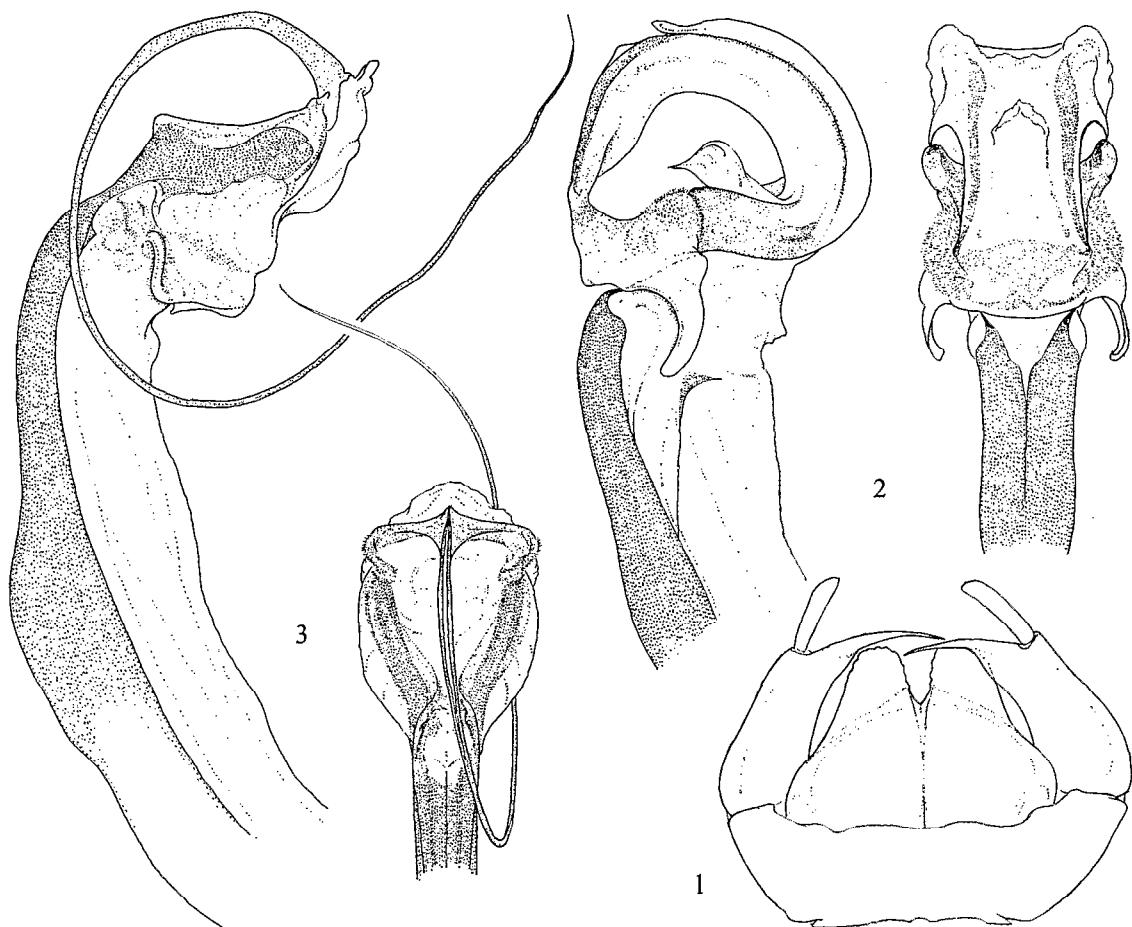


Fig. 1-2. — *Caledopteryx sarasini* (Ris), male, Mt. Pouédihi, N 50. Labium, dorsal view (1) and ligula, lateral and ventral view (2). — Fig. 3. *Podopteryx selysi* (Foerster), male, Hollandia, N. New Guinea. Ligula, lateral and ventral view. Corresponding figures on the same scale (fig. 1 same to 4, 6 and 8).

figured also by KENNEDY (1920) for *P. roseonotata* (Selys), is entirely different from that of *P. selysi* Foerster (fig. 1), the form of this organ resembling that of the remaining New Caledonian species much more closely (fig. 5, 7 and 9). The curved hairy ridge at the base of the apical incision of the labium of *Caledopteryx* (fig. 1), is non-existent in *Podopteryx*, the emargination itself being less deep, more U-shaped, than it is in all New Caledonian species (fig. 1, 4, 6 and 8).

Both sexes of *C. sarasini* have most of the face and terminal abdominal segments marked with blue, a colour which is much obscured in aged individuals. The insect exhibits a great deal of variation in many details, especially in the venation. Apart from the varying number of cell-rows in the area posterior to Cu_2 , as observed already by Ris (1915), the position of the arculus is unstable,

changing from a little before to slightly after Ax_2 ; the nervure Rs frequently arises somewhat distal to, instead of at, the subnodus; Ac is often placed further distad than shown in pl. I fig. 1, and in some specimens Ab reaches the wing margin at, or even a little proximal to, the level of the arculus! The medio-anal link is either straight or slightly fractured; the length of the quadrilateral also varies, being often shorter (so as to appear more strongly widened) than in the specimen photographed. Lastly, there are occasionally one or more supernumerary cross-veins in the space between Ab and the margin proximal to the medio-anal link, which is very unusual. Other discrepancies worth attention are found in the colour pattern of thorax and abdomen. Males, apparently full-grown and overlaid with pruinescence, may differ among themselves by having all lateral thoracic marks

either large and confluent, or reduced in size and broken up into a number of spots and lines, while some of the darkest males show no sign of light-coloured basal spots on segments 3-7, so conspicuously present in lighter individuals. Another peculiarity of the male not found elsewhere is found on the terminal segments, which are separated by unusually broad, sometimes rather deeply impressed, inter-segmental membranes, in contrast with the upturned hind margins of tergites 8 and 9.

Considering all above facts, I believe *Caledopteryx* to be more nearly related to *Caledargiolestes* and *Trineuragrion*, than to *Argiolestes* s. str. or *Podopteryx*.

***Caledopteryx sarasini* (Ris). Fig. 1-2, pl. I fig. 1**

Argiolestes sarasini Ris, 1915 : 58-60 (♂♀), fig. 1-2 (♂ wings & anal apps., New Caledonia). CAMPION, 1921 : 35 (♂♀ size variation). SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 247 (list).

Caledopteryx sarasini: KENNEDY, 1925: 295, 301 (gen. nov.).

Material (imagines).—New Caledonia FAMU Exp. 1972: 13 ♂ 4 ♀, N 37, N 42, N 46, N 47, N 50 (CTFT, ML). 3 ♂, Mont. des Sources, 500 m, 30.12.1963, R. STRAATMAN; 1 ♂, Col d'Amieu, 500 m, 22.12.1963, R. STRAATMAN; 1 ♂ 2 ♀, Pouébo and 10 km S of Pouébo, 250-600 m, 12-24.1.1964, R. STRAATMAN; 1 ♂ 1 ♀, Forêt de Thi, 1.10.1967, J. & M. SEDLACEK; 1 ♂ 1 ♀, Col d'Amieu, 21.3.1968, J. L. GRESSITT & T. C. MAA; 2 ♂ 1 ♀, between Mokoue & Dothio, 22.3.1968, T. C. MAA; 1 ♀, DOGNY, 29.3.1968, J. L. GRESSITT & T. C. MAA; 1 ♀, near Plum, 24.3.1968, same colls.; 1 ♂, La Crouen, 21.3.1968, J. L. GRESSITT; 2 ♂ 1 ♀, Mts. de Koghis, 4-600 m, 1.1969, N. L. H. KRAUSS (all BISH & ML).

Material (larvae).—Österr. Neukaledonien Exp. 1965: 5 ex. ult, 3 ex. penult, 2 ex. younger stages (both sexes), FNK 8/2, FNK 26, FNK 29, FNK 39, FNK 97, FNK 104 (NMW, ML). New Caledonia FAMU Exp. 1972: ca. 30 ex. ult, 6 ex. penult, ca. 20 ex. younger stages (both sexes), N 22, N 25e, N 27, N 27e, N 50, and N 52 (CTFT, ML).

***Argiolestes ochraceus* (Montrouzier). Fig. 4-5, pl. I fig. 2**

Sympetrum ochraceum Montrouzier, 1865: 247 (♂ New Caledonia). *Argiolestes rouxi* Ris, 1915: 60-61 (♂♀), fig. 3-4 (♂ wings & anal apps., New Caledonia). KENNEDY, 1925: 294, 301.

Argiolestes ochraceus: CAMPION, 1921: 35-36 (descri. notes, synonymy, New Caledonia). SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 247 (list).

Material (imagines).—New Caledonia FAMU Exp. 1972: 7 ♂ 7 ♀, N 42, N 46, N 47, N 54 and N 55 (CTFT, ML). 3 ♂ 1 ♀, Pouébo, 10 and 15 km south, 400-480 m, 12 and 22-24.1.1964, R. STRAATMAN; 2 ♂, Col d'Amieu, 21.3.1968, J. L. GRESSITT & T. C. MAA; 1 ♀, Yiambe, 0-550 m, 11-16.10.1967, J. & M. SEDLACEK (all BISH & ML).

Material (larvae).—Österr. Neukaledonien Exp. 1965: 1 ex. penult FNK 105/1 (NMW). New Caledonia FAMU Exp. 1972: 1 ♂ ult, N 16b, 1 ex. 3-ult, and 5 ex. younger

stages (both sexes), N 15b, N 19e, N 20, N 35, N 37 and N 55 (CTFT, ML).

For structural details of this very handsome species the key should be consulted. *A. ochraceus* is chiefly remarkable for its slender forms, brightly coloured body, narrow wings and open venation. In the neural characters it takes a position intermediate between representatives of the (typical) *A. australis* (Ramb.) group, and the narrower-winged forms such as *tenuispina* Lieft. and *microstigma* Lieft., all from continental New Guinea. From the first mentioned species *ochraceus* differs in its more slender build, narrow wings and much shorter quadrilateral, from the latter it can be immediately distinguished by the more proximal position of the veins M_3 and Rs , the duplicated cells in the Cu_2 area, etc. Ris's wing photograph is reproduced in pl. I fig. 2.

***Caledargiolestes uniseries* (Ris). Fig. 6-7, 10-12, pl. I fig. 3**

Argiolestes uniseries Ris, 1915: 62-63 (♂), fig. 5-6 (wings & anal apps., New Caledonia). SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 247 (list).

Caledargiolestes uniseries: KENNEDY, 1925: 293-294, 298 (nov. gen.), pl. I fig. 3 (wings, sec. Ris).

Material (imagines).—New Caledonia: 1 ♂, Mont. des Sources, 550 m, 30.12.1963, R. STRAATMAN (ML); 1 ♀, Col d'Amieu, 500 m, 22.12.1963, R. STRAATMAN (BISH); 1 ♂, Pouébo, 200 m, 25.1.1964, R. STRAATMAN (BISH); 1 ♂, Col des Roussettes, 29.1.1969, N. L. H. KRAUSS (ML); 2 ♂ 1 ♀, Col des Pirogues, 23.1.1962 and 14.11.1963, N. L. H. KRAUSS (ML, BISH).

[The following larvae, all of a single species, are only tentatively referred to this genus and species. The basal wing venation could not clearly be made out in any of the full-grown dissected specimens, so that they could belong to *Trineuragrion* as well. Descriptions and illustrations will follow in the second part of this account.]

Material (larvae).—Österr. Neukaledonien Exp. 1965: 1 ex. ult, FNK 59 (NMW). New Caledonia FAMU Exp. 1972: 6 ex. ult, 2 ex. penult, 1 ex. 3-ult, 2 ex. younger stages, N 15, N 22, N 25, N 27, N 27b, N 34, N 46, N 47 (CTFT, ML).

The original description and figures were taken from a single immature and shrivelled individual, the type male (in NMB?) being the only specimen so far known. We now have full-coloured males as well as a female, hitherto undescribed, which amplify our knowledge of the species.

Male (adult).—Labium and rear of the head deep black, labium as in fig. 6. Mandible-bases bright ochreous; labrum, genae, clypeus and frons on

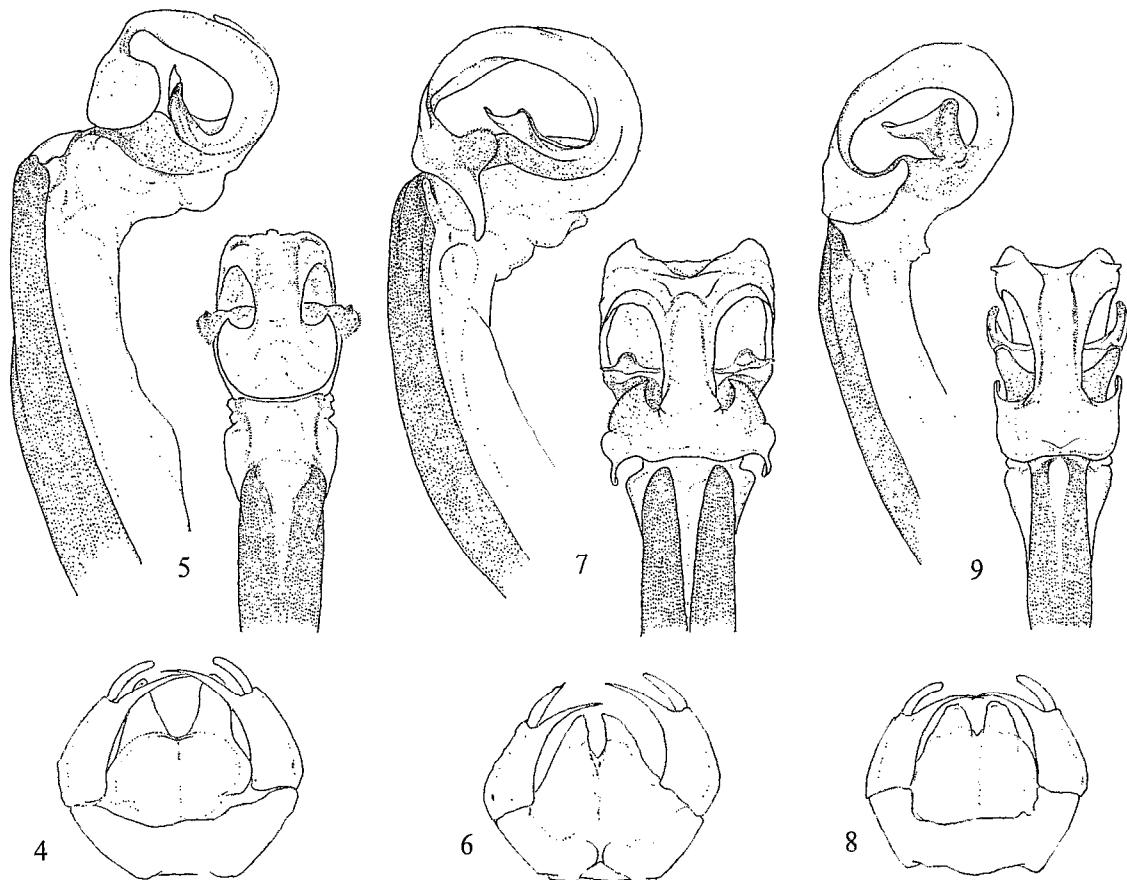


Fig. 4-5. — *Argiolestes ochraceus* (Montr.), male, Mt. Gaata, N 42. Labium, dorsal view (4) and ligula, lateral and ventral view (5). — Fig. 6-7. *Caledargiolestes uniseries* (Ris), male, Mt. des Sources. Labium, dorsal view (6) and ligula, lateral and ventral view (7). — Fig. 8-9. *Trineuragrion percostale* Ris, male, Paita, N 54. Labium, dorsal view (8) and ligula, lateral and ventral view (9).

Corresponding figures on the same scale.

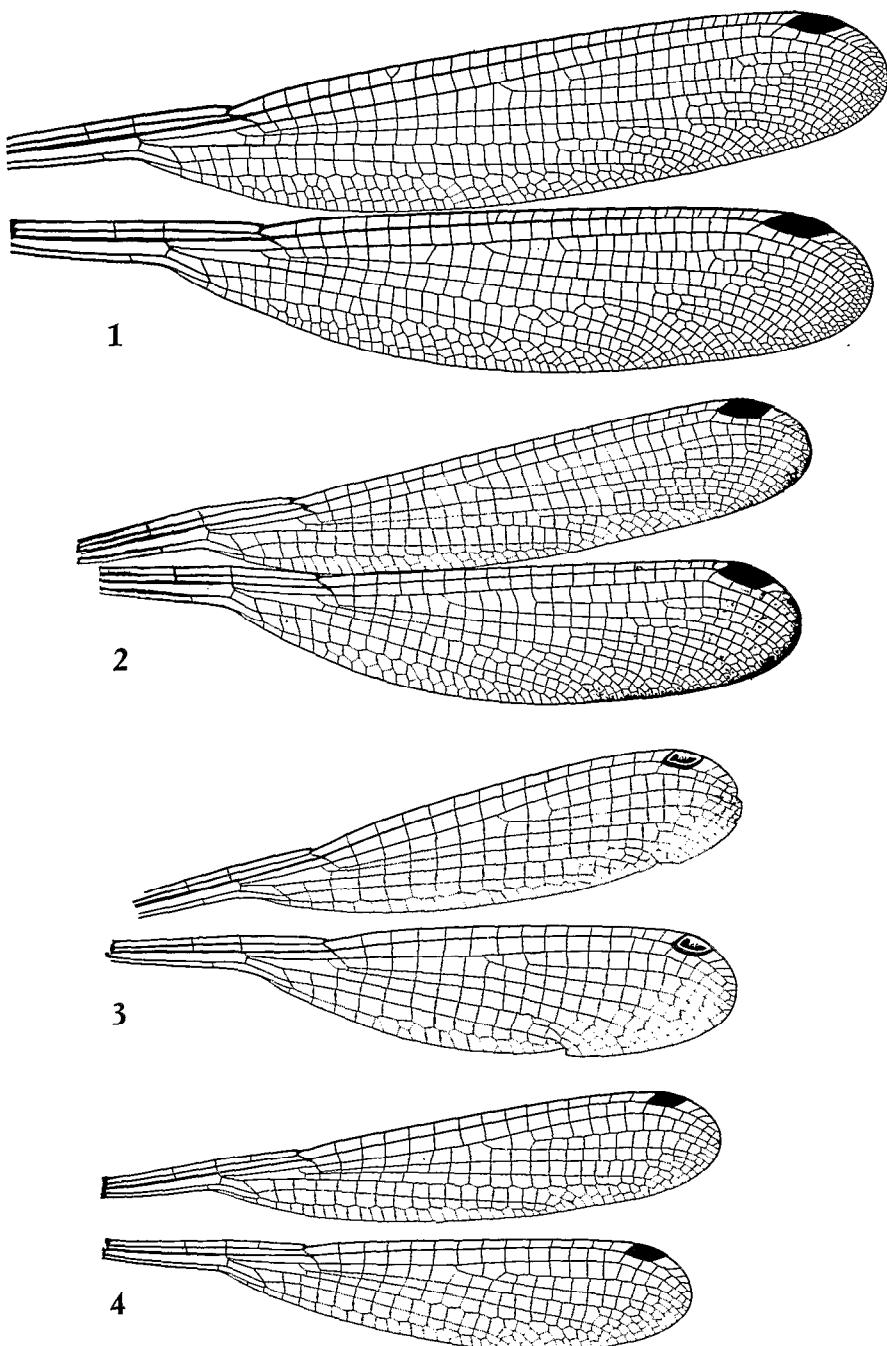
either side of the middle, light blue, the transverse frontal patches broadly contiguous with a thick stripe bordering the inner orbits, the latter extending upward on each side as far as the level of lateral ocelli, where it curves a little inward, the apex of the spot being rounded off; rest of head, including the antennal sockets, dull black, save for a pair of diffuse dark reddish streaks, one each between antenna and lateral ocellus, and an indistinct stripe upon middle of occipital border. Antenna black, the first segment and basal half of second yellow anteriorly. (In very old males the light face marks are much obscured).

Prothorax above, the mesostigmal lamina and mesoprescutum, cream colour (obscured and pruinescent blue in aged specimens); propleurae deep black. Light markings on dorsum and sides of synthorax as described by Ris, all pale chrome,

but frequently obscured, the sides and black ventral surface coarsely pruinescent blue. Legs as described in the key.

Wing membrane subhyaline, distinctly grey-yellow in aged males. Arculus invariably a little distal to subnodus and Ac always nearer Ax_1 than Ax_2 . Pterostigma short and thick though longer than wide, parallel-sided, deep black between black nervures.

Abdomen relatively short, very slender, basal and terminal segments moderately inflated, segm. 9 about one and one-third as long as broad, 10 about one-third length of 9 and a little less than half as long as its breadth, the tergites of both segments unmodified. Colour brownish black, 1-2 with low bronze reflections, unmarked save for a diffuse yellowish stripe bordering the tergites laterally; 3-8 each with small yellow basal annules,



Pl. I. — Wings of New Caledonian Argiolestinae (after Ris, 1915). — Fig. 1. *Caledopteryx sarasini* (Ris), male, Canala. — Fig. 2. *Argiolestes ochraceus* (Montr.), male, Oubatche. — Fig. 3. *Caledargiolestes uniseries* (Ris), holotype male, Canala. — Fig. 4. *Trineuragrion percostale* Ris, male, Canala.

indistinct and subinterrupted dorsally, very small and crescent-shaped on 3 and 7-8, larger (0.5-0.7 mm) and more or less oval in side view on 4-6.

Ligula (fig. 7) rather similar in form to that of *Trineuragrion* (fig. 9), but also shaped much as in *Argiolestes ("Wahnesia") montivagans* (Foerster), from New Guinea, and *Neurolestes trinervis* Selys, from West Africa, figured by KENNEDY (1920, pl. 3 fig. 103-104 and 107-108). The recurved apical segment is cleft and bilobed, each of the latter ending in a broad divaricate flap, the outermost one being longest and attenuated, the inner short, rounded, and covered densely with microsetae; lamina interna conspicuous, broad and more or less plate-shaped, carrying a sclerotised subapical boss at either side.

Anal appendages black, superior pair as long as segment 9, the broadened distal portion of each with a robust, bluntly triangular, subapical tubercle on the inside; inferior pair only little shorter than the superiors, almost straight, the apical portions broadened, more or less spatulate in side view, hollowed out within (fig. 10-12).

Female (adult, first description). — Resembles the male in most respects. Labium jet black; mandible-bases and genal area ochreous, labrum dusky brown, clypeus blackish brown, the post-clypeus shining, with dark purplish reflex. Frons and upper surface of head dull bronze-black, epicranial light streaks as in male but occipital plate unmarked. Antennae obscured.

Dorsum of prothorax yellowish brown, pronotal tubercles raised, forming bluntly conical processes, posterior lobe depressed, border entire, slightly thickened, evenly rounded; propleurae deep black. Synthorax and legs coloured as in male; in addition to the broad oblique band traversing the humeral suture and filling out the dorsal edges of the metepisterna, the latter space is marked with a yellow streak that runs down for some distance from the metaspiracle; metepimerum with two elongate spots of the same colour; venter black.

Abdomen considerably more robust than in male, gradually broadened from base to apex; segm. 8 only little longer than 9, which is more than four times as long as the short and annular 10th segment; hind margin of the latter somewhat raised and pinched. Anal appendages only slightly longer than 10, conical, tips acuminate. Valves robust, inner pair scarcely surpassing tuberculum supra-anale, distal portion of outer valves microscopically serrulate.

Colour design of abdomen exactly as in male, segm. 9-10, outer valves and appendages dull blackish brown, tips of inner valves yellow-brown.

Abdomen 29.0 mm, hind wing 25.0 mm.

This darkish little species is somewhat larger and more slenderly built than *T. percostale*, differing in particular from this and other members of the group (except the one described hereafter) by having broader wings in comparison with the open venation and shortness of the intercalated sectors.

Evidently an easily overlooked insect of scarcer occurrence than the equally inconspicuous *T. percostale*, possibly distinguished from the latter also in habitat preference and behaviour.

Caledargiolestes janiceae spec. nov. Fig. 13-16

Material (imagines).—New Caledonia, FAMU Exp. 1972: 1 ♂ (semiaadult), stream on Mt. Pouédihi, 15 km W of Ouénarou Forest Station, on Eaux et Forêts road, 153 m, 5.11.1972 (N 50), W. L. & Mrs. Janice G. PETERS. The specimen is the holotype (ML).

Male (holotype). — Labium shaped similarly to that of *uniseries*, colour dark brown, submentum and squamae paler; median emargination of midlobe oval, its depth about one-third total length of lobe; whole surface of labium clothed with long whitish hairs. Mandible-bases, an indistinct line bordering the labrum, and genal area, pale bluish yellow, this colour extending upward along margin of compound eye as a diffuse pale stripe tapering to a point at level of anterior ocellus. Clypeus bronze-brown, the anteclypeus somewhat lighter, the postclypeus slightly pruinescent blue. Antennal sockets yellow anteriorly, antennae brownish black, the second segment reddish brown apically. Head otherwise bronze-black with traces of an oblique brownish spot on each side between base of antenna and lateral ocellus; occipital border also faintly yellowish medially. Frons anteriorly pruinescent light blue, whole surface clothed with very long raised white hairs, a few of these also in front of the lateral ocelli; occipital border likewise fringed with long white hairs. Rear of the head bronze-black, thinly pruinescent blue.

Prothorax middorsally, and central portion of posterior lobe narrowly, dark brown, for the rest pale bluish yellow; sides sharply defined deep black; pronotal tubercles evenly rounded, less elevated than in *uniseries*. Colour pattern of synthorax not fully developed: mesepisterna with indistinct humeral stripes; mesepinera and mesinfraepisterna brownish black, the former with an isolated yellow spot at some distance from upper margin bordering the humeral suture; metepisterna dark brown with a yellowish band, subinterrupted on either side of the metaspiracle and widest above; metepimera bronze-black, except a diffuse stripe along the second suture, which curves back ventrally to join a broader stripe occupying almost the lower

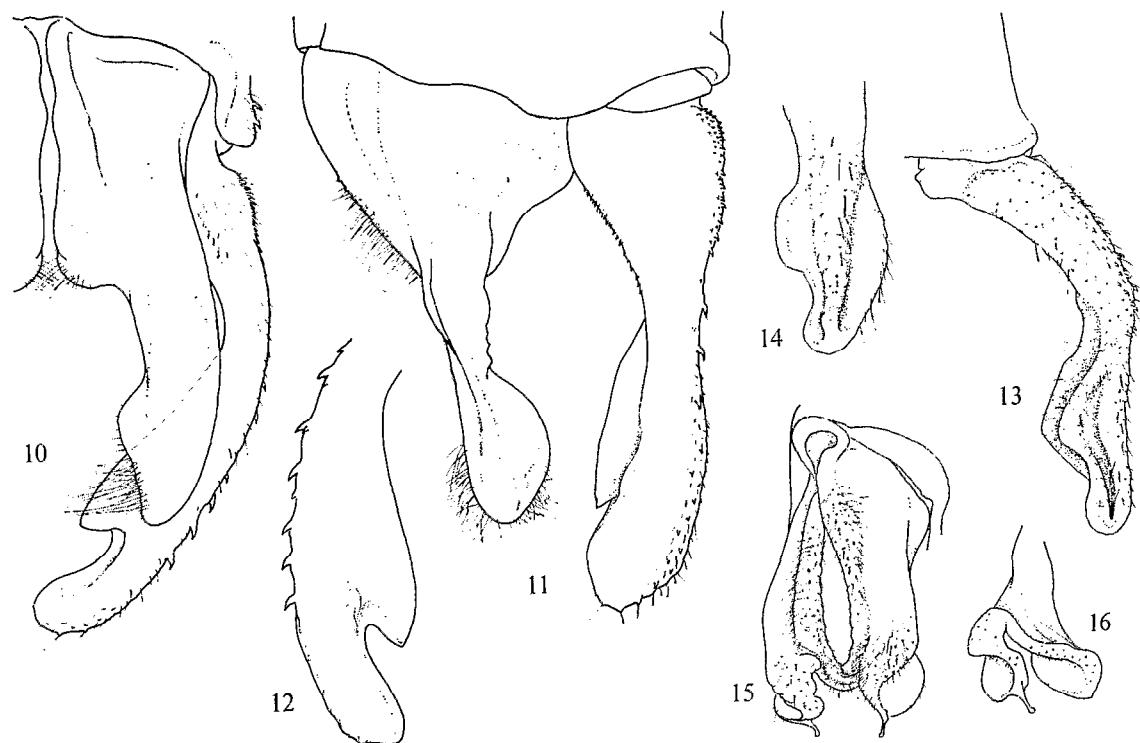


Fig. 10-12. — *Caledargiolestes uniseries* (Ris), male, Col des Pirogues. Anal appendages, partial ventral view (10), left lateral view (11), and apex of sup. app., from within (12). — Fig. 13-16. *C. janiceae* spec. nov., holotype, Mt. Pouédihi, N50. Anal appendages, right sup. app., dorsal view (13), apex of right sup. app., extero-lateral view (14), and inf. app., oblique ventral view (15), and apex of same, caudal view; long bristles omitted (16).

half of the space; upper portion of metinfraepisterna also yellowish. Ventral surface brown, with pair of yellowish lateral stripes. All thoracic segments clothed rather densely with conspicuous, long, raised white hairs.

Legs with all coxae and trochanters obscured; inner faces of fore and mid femora yellow-brown, the outer ones as well as the tibiae and tarsi brownish black; hind femora and tibiae yellow-brown, a subapical annule and tips of hind femora dark brown; tarsi including the claws and all bristles black; interior subapical tooth of tarsal claws obsolete (vestigial).

Wings broader than in *uniseries*, ceasing to be petiolated only little distal to level of Ax_2 ; disk rather abruptly widened and tips bluntly rounded. Ab entering the margin slightly beyond proximal side of quadrangle but well distal to Ac, which is placed exactly midway between Ax_1 and Ax_2 in all wings. Arculus at Ax_2 in all wings. Quadrangle relatively shorter than in *uniseries* and more distinctly broadened distally. Two postquadrangular antenodal cells. M_3 arises before the subnodus for a distance

distinctly less than one cell, Rs at the subnodus; M_2 at Px_6 in fore wing, at Px_5 in hind wing; M_{1a} 4-5 cells further distad on both fore and hind wings. All supplementary sectors very short, as in *uniseries*. Distal courses of veins M_4 (MA) and Cu_2 (IA) more distinctly zigzag than in *uniseries*, the broken course of M_4 already beginning at level of origin of M_2 (in hind wing even a little more proximal). Postnodals of first series 15 in fore wings, 14-15 in hind wings. Pterostigma shorter and less oblique than in *uniseries*, only little longer than high, the costal side the longest, anal and distal sides more distinctly angulated than in the allied species, in which the angle is almost rounded (pl. I fig. 3); colour sepia between black veins.

Abdomen bronze-brown, almost black; distal portion of tergite 1 raised and convex in profile, colour dark brown, sides with large, light blue, subtriangular mark occupying at least half of the sides; 2 blackish brown with pair of diffuse basodorsal spots and a much larger yellowish triangle upon middle of sides; segments 3-7 each with well defined basal and subterminal yellow rings, the former

about half the size of the latter and subinterrupted in the median line, the subterminal rings diffuse anteriorly, straight-lined and well defined posteriorly, each of the latter about equal in length to the black apical rings; 8-10 blackish, 8 with pair of small basodorsal light spots, the remainder unmarked. First two abdominal segments and basal portion of tergite 3 clothed with long, erect white hairs most conspicuous and tufty on dorsum and sides of first tergite.

Anal appendages as in fig. 13-16; superior pair black, shorter than segm. 8 and about equal in length to 9; inferiors also obscured, but apices yellowish on the inside.

Measurements: abd.+app. 23.5 mm, hind wing 18.0 mm, pterostigma 0.7 mm.

Female unknown.

This little new species, the smallest of all regional argiolestines, is undoubtedly a near ally of *C. uniseries* Ris, sharing with it the important generic characters of the wings, viz. (1), open neuration and presence of only a single row of cells between Cu₂ and the anal margin, and (2), the proximal position of the main veins, Rs originating at the subnodus, M₃ proximal to that level.

Gratefully dedicated to Mrs. Janice G. PETERS, who collected many aquatic insects during the FAMU expedition.

Trineuragrion percostale Ris. Fig. 8-9, pl. I fig. 4

Trineuragrion percostale Ris, 1915: 63-64 (♂), fig. 7-8 (♂ Wings & anal apps., New Caledonia). MUNZ, 1919, pl. 9 fig. 54 (Wings, after Ris). KIMMINS, 1936 (10) 18: 70 (♂ Banks I., New Hebrides). SCHMIDT, 1938: 324 (cat.). KIMMINS 1953: 242 (♂♀ New Caledonia, no descr.); KIMMINS, 1958: 247 (list).

Material (imagines).—Österr. Neukaledonien Exp. 1965: 1 ♂, FNK 107, Tiari Fluss, Uferregion, 17.9.1965 (NMW). New Caledonia FAMU Exp. 1972: 1 ♂, N 54, Tributary of Karionan River, 5 km NW of Paita, 122 m, 14.11.1972, W. L. & J. G. PETERS (ML). 2 ♂, Mokoue to Dothio, 100-350 m, 22.3.1968, J. L. GRESSITT & T. G. MAA; 1 ♂ 2 ♀, Pouébo, 100-200 m, 27.1.19 & 25.1.1964, R. STRAATMAN; 1 ♀, Mt. Koghi, 500 m, 6.12.1963, R. STRAATMAN; 1 ♂ 1 ♀, Forêt de Thi, 1.11.1967, J. & M. SEDLACEK; 2 ♂, Mts. de Koghi, 4-600 m, 1.1969, N. L. H. KRAUSS (all BISH & ML).

Female (adult, first description).—Very similar to the male. Labium yellow, only tips of median lobe and palpi deep black. Labrum dark metallic green, rather shining, with tiny, oval, impressed midbasal yellow spot placed in the long axis; mandible-bases, genae and frons, as far upward as base of antennae, bright chrome, this colour continued upward along inner orbits and tapering to a point almost at level of median ocellus; more inward this frontal mark ceases at the tubercles

and carries a tiny off-shoot pointing obliquely mesad. Front of anteclypeus with transverse yellow stripe, postclypeus laterally marked with pair of small spots of the same colour. Antennae and all remaining parts of the head dark metallic green; rear black, slightly pruinescent blue.

Pronotal tubercles raised and of large size, but evenly rounded above; posterior lobe short and broad with completely rounded side-angles, hind margin upturned, though slightly depressed at middle. Pro- and synthorax dark metallic bronze-green, rather shining, marked with bright chrome, as follows: propleuron almost entirely; a somewhat smaller, subtriangular, mesepisternal spot bordering mesinfraepisternum, and a triangular spot filling out the lower edge of same; an almost complete metepisternal stripe, widest ventrally, along first lateral suture, tapering to a point dorsally but excluding the spiracle; a small metinfraepisternal triangle; the metepimeron, with the exception only of an elongate, dark metallic band, incomplete ventrally, running along latero-ventral border. Thorax underneath light chrome with a few scattered blackish specks. Legs deep black, except all coxae and trochanters, which are conspicuously bright chrome, the former only striped diffusely with black externally; tarsal claws with distinct subapical inferior tooth.

Wings clear, neuration as in male; pterostigma dark brown with a rufous tinge.

Abdomen of the usual argiolestine form, shorter and much stouter than in male; segments cylindrical and gradually more expanded posteriorly; colour dark metallic green lacking pale markings, except sides of segm. 1, which carry a large subtriangular chrome yellow spot at either side. Segm. 10 short and annular, with distinct, blunt middorsal crest, the hind margin rather swollen, shallowly emarginate. Genital valves normal, black, outer pair only slightly surpassing hind margin of segm. 10, their lower margin finely serrulated, apex yellowish, bluntly triangular; styli curved, dark brown. Anal appendages black, a little longer than segm. 10, straight and awl-shaped, covered all over with sharp teeth, the tips very slender and acuminate. Sternites of abdominal segments and outer faces of genital valves slightly pruinescent in aged individuals.

This very peculiar species is darker and averages a little smaller in size than *C. uniseries* and can be easily distinguished therefrom by its much narrower and more pointed wings (pl. I fig. 4). In the form of the mouth-parts and ligula of the male, *percostale* does not differ much from other regional argiolestines (fig. 8-9). In respect of venation and structure, the

specimens in our series generally agree with the original description, although showing much variation in details not especially mentioned in the key, e.g. in the length of the quadrilateral on the wings. Even the additional costal antenodal cross-vein may be wanting occasionally: in two males and one female out of a total of eight and four, respectively, such a vein is missing in one or two of the wings (i.e., in 3 out of 12 individuals, or 25 per cent), usually asymmetrically so. Hence, in consequence of its instability, the presence of this vein can hardly be relied upon as a character of generic importance.

T. percostale is the only New Caledonian argiolestine which has been reported also from the New Hebrides. Unfortunately, I have seen no specimens from these islands, but it would be of great interest to re-examine the male from Banks Island and compare it with topotypical individuals.

Genus et species incert. (nov.?)

Megapodagrionidae, LIPPIT WILLEY, 1955: 138-144, pl. 12-14 (structures, young larva, New Caledonia). LIEFTINCK, 1956: 118-120 (notes).

Not represented in our collections. Known only from a single immature larva, found near Ciu in a sample of leaf litter material on the forest floor. The specimen was collected at some distance away from water and considered to have terrestrial habits.

The description is very full and accompanied by excellent illustrations of its morphology and internal structures. Considering the measurements of this young larva (total length including caudal gills $8.7+2.5=11.2$ mm), and the size of the developing wings, we may expect the perfect dragonfly to be a good deal smaller than *C. sarasini* and *A. ochraceus*. Since the forest-dwelling adults of *Podopteryx*, whose larval stages are not known with certainty, have never been observed over or near open water, the New Caledonian species might be a smaller-sized ally of that genus living in similar habitations.

In my forthcoming account of the immature stages of New Caledonian megapodagrionids I hope to reproduce all that is known of this remarkable insect.

FAM. ISOSTICTIDAE

Some time ago, J. A. L. WATSON (1969) published a well-illustrated description of the larval exuviae of *Nososticta solida pilbara*, a new north-western subspecies of a common Australian zygoteron, widely distributed over most of the continent.

The author established the fact that a larval form which TILLYARD (1917) had tacitly attributed to *Nososticta s. solida* Hagen & Selys, was wrongly associated with that genus and probably belonged to some genus of the *Isosticta* complex. At the same time WATSON argued that the characters of his *pilbara* conformed so closely to those of Indo-Australian species of *Notoneura* as characterized by LIEFTINCK (1953), that *Nososticta* should be removed from the isostictine group and transferred to the Protoneuridae. With this discovery, and the exposure of TILLYARD's mis-identification as well, I believe that the last hindrance has been cleared away which prevented to distinguish clearly between all Indo-Australian members of the isostictine and protoneurine alliances. In view of the experiences just mentioned, it may be remembered that in my "Note on the *Isosticta* series of genera" (in LIEFTINCK, 1951), the present group had been recognized and defined already as a distinct subfamily of the *Protoneuridae*, a view promptly put into practice by FRASER (1955), who first introduced the name *Isostictinae*. With the discovery of more larval forms of this assemblage, and additional characters for the imagines as well, I am deliberately of opinion that there is nothing left against giving this group higher systematic rank by keeping it apart from the protoneurids under the family name *Isostictidae*. It constitutes a fairly large group, represented by a number of closely interrelated genera which are restricted to Australo-Papua, taking this region in a somewhat wider sense. There are many species both in New Guinea and Australia, the family ranging from the most easterly islands of Indonesia as far as the Solomon Islands and New Caledonia.

According to CAMPION (1921), *Isosticta*, although typically a New Caledonian group, includes within its limits a number of not entirely accordant species. Of the 6 species included by CAMPION, 3 were recorded from New Caledonia and the Loyalties, 2 are Australian, while *I. filiformis* Ris was described from the Bismarck islands. The last-mentioned species has since been transferred to *Tanymecosticta* Lief tinck, a distinct genus now comprising 6 species, all from the Papuan subregion and surrounding islands. Two new *Isosticta* can be added on the present occasion to the 3 already known from New Caledonia, which brings the number up to 5.

To all appearance the regional species form a very natural group, although the range of venational and other differences is fairly large as compared to other members of the family. As the Australian members are very similar and evidently closely allied to the species from New Caledonia typified by *I. spinipes*, I can see no reason to split up the

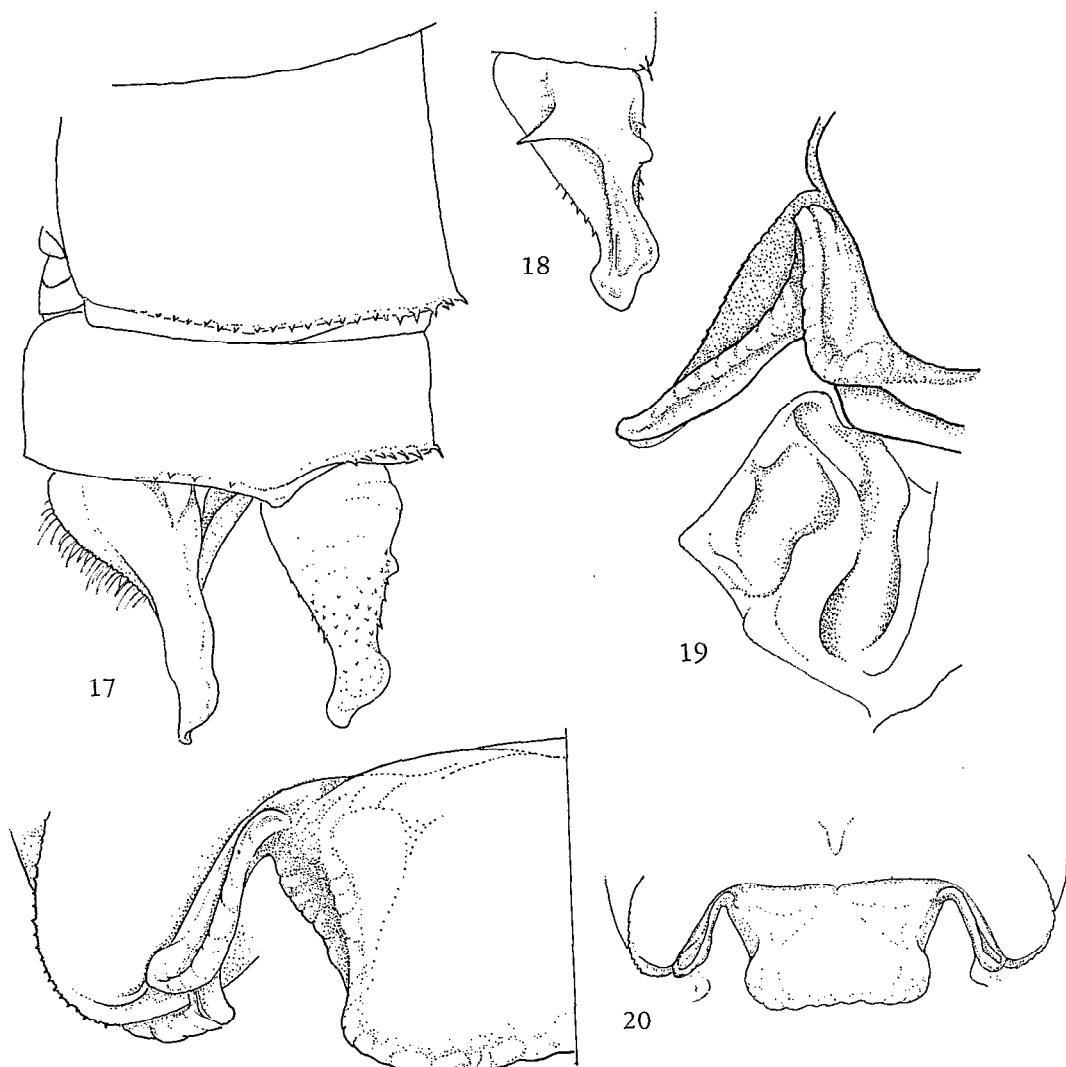


Fig. 17-20. — *Isosticta spinipes* Selys, male and female, Mt. Koghi. Apex of abdomen, neotype, lateral view (17), right sup. app., same specimen, interior view (18), posterior lobe of female prothorax, left lateral and dorsal views (19-20). Long radiating hairs fringing posterior lobe of prothorax omitted.

New Caledonian cluster any further than I have done in the key to the species, given below. With a comparative study of the numerous larval forms in our possession it may become necessary eventually to employ other characters for the recognition of distinct species-groups.

Isosticta spinipes Selys. *Fig. 17-20*

Isosticta spinipes Selys, 1885: exiv (♂ incomplete, New Caledonia); SELYS, 1886: 193-194 (full description). MARTIN, 1901: fig. 8B' (♂ wing-base, New Caledonia). RIS, 1915: 65-66 (♂ descr., Loyalty Is.), figs. 9-10 (♂ wings, Loyalty; ♂ anal apps., New Caledonia). CAMPION, 1921: 38 (♂ key),

41-42 (♀ descr.), fig. 4 (♀ proth., New Caledonia). SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 248 (list).

Material (imagines).—New Caledonia: 6 ♂ 1 ♀ (one pair incomplete), Mts. de Koghis, 4-600 m, 3.1959, 2.1962, 1 and 2.1969, N. L. H. KRAUSS; 1 ♂ 1 ♀, Pouébo, 400 m, 14.1.1964 and 15 km S of Pouébo, 480 m, 22.1.1964, R. STRAATMAN; 1 ♂, Col des Roussettes, 29.1.1969, N. L. H. KRAUSS; 1 ♀ (incomplete), Plat de Dogny, 5-900 m, 29.3.1968, J. L. GRESSITT & T. C. MAA (BISH, ML). Neotype: ♂ ad. (fig. 17-18), Mts. de Koghis, 2.1962, N. L. H. KRAUSS (BISH).

This is the type species of *Isosticta* Selys. The incomplete holotype male of *spinipes* is nowhere to be found and must be considered as lost. At

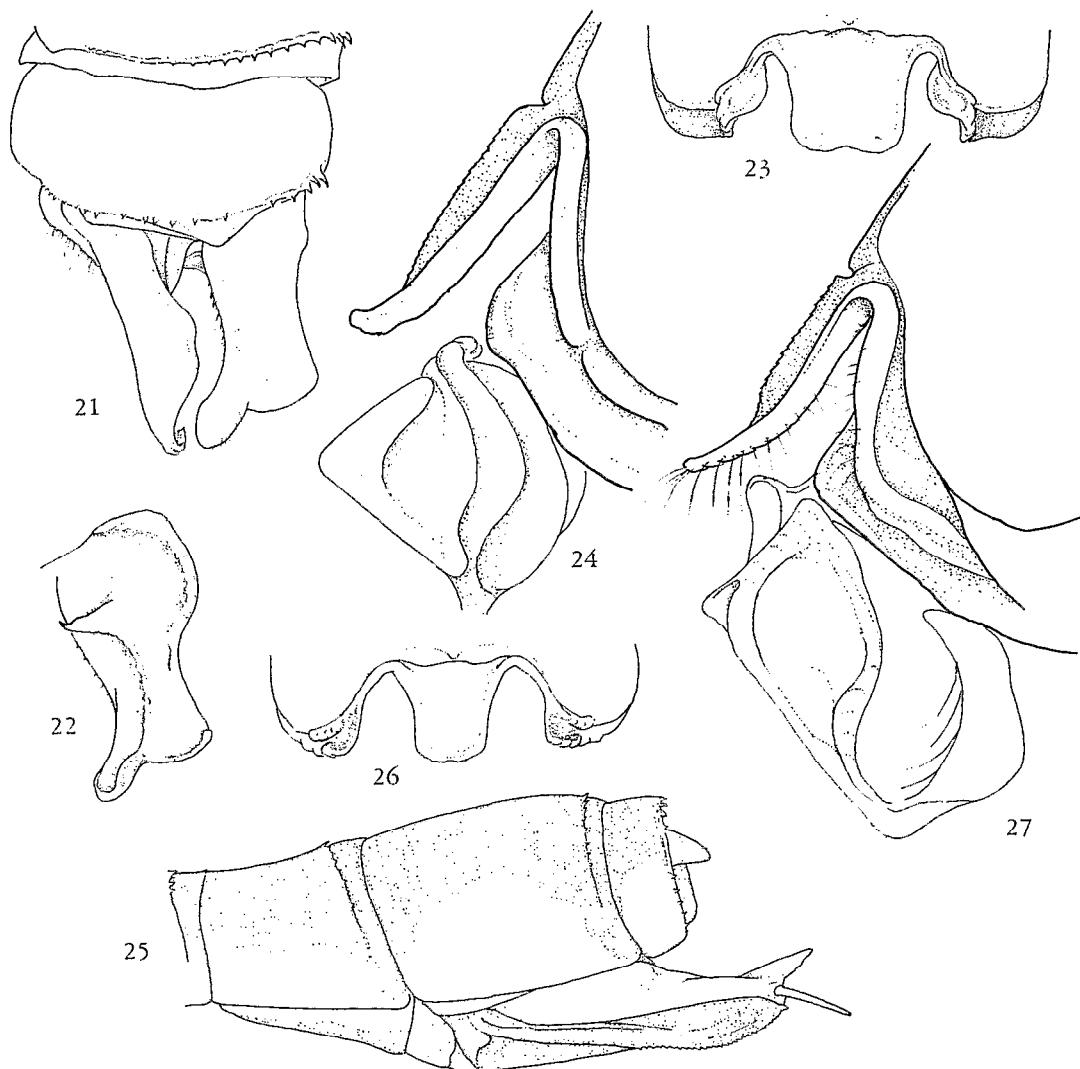


Fig. 21-27. — *Isosticta tillyardi* Campion, male and female. Apex of abdomen, left lateral view, Saramca (21), right sup. app., interior view, La Foa (22), posterior lobe of female prothorax, dorsal and left lateral view, Crouen (23-24), and apex of abdomen, River Bleue, N 51 (25); *I. tillyardi* var.?, posterior lobe of female prothorax, dorsal and left lateral view, Mt. Mou (26-27). Long radiating hairs fringing posterior lobe of prothorax omitted in fig. 23-24 and 26.

present, its place over the drawer label in DE SELYS' collection is, surprisingly enough, occupied by a complete specimen of a male *Elattoneura* with orange markings, which bears a pink label in DE SELYS' handwriting "N^o 1^e Calédonie" and a second purplish label "Cera. spinosa S. ♂", also written by DE SELYS. To this specimen I have attached an additional label indicating that the specimen belongs to a different genus. Incidentally, it may be mentioned that *C. spinosa* Selys is a nomen nudum. The only other individuals of *I. spinipes* mentioned in the literature are those recorded by Ris (1915) from

Oubatche in New Caledonia (apps. figured by Ris, i.e. fig. 10) as well as some other males from Lifou in the Loyalties,—all of them unfortunately lacking the terminal segments of abdomen. In August 1965, the male from Oubatche was kindly forwarded to me for inspection by the authorities of the Basle museum. It is a spirit specimen in poor condition which, like the others, proved to be incomplete, having lost most of its abdomen. I have compared this male with the series now available of both *spinipes* and *campioni* and found it to agree with the former in all remaining characters. Owing to

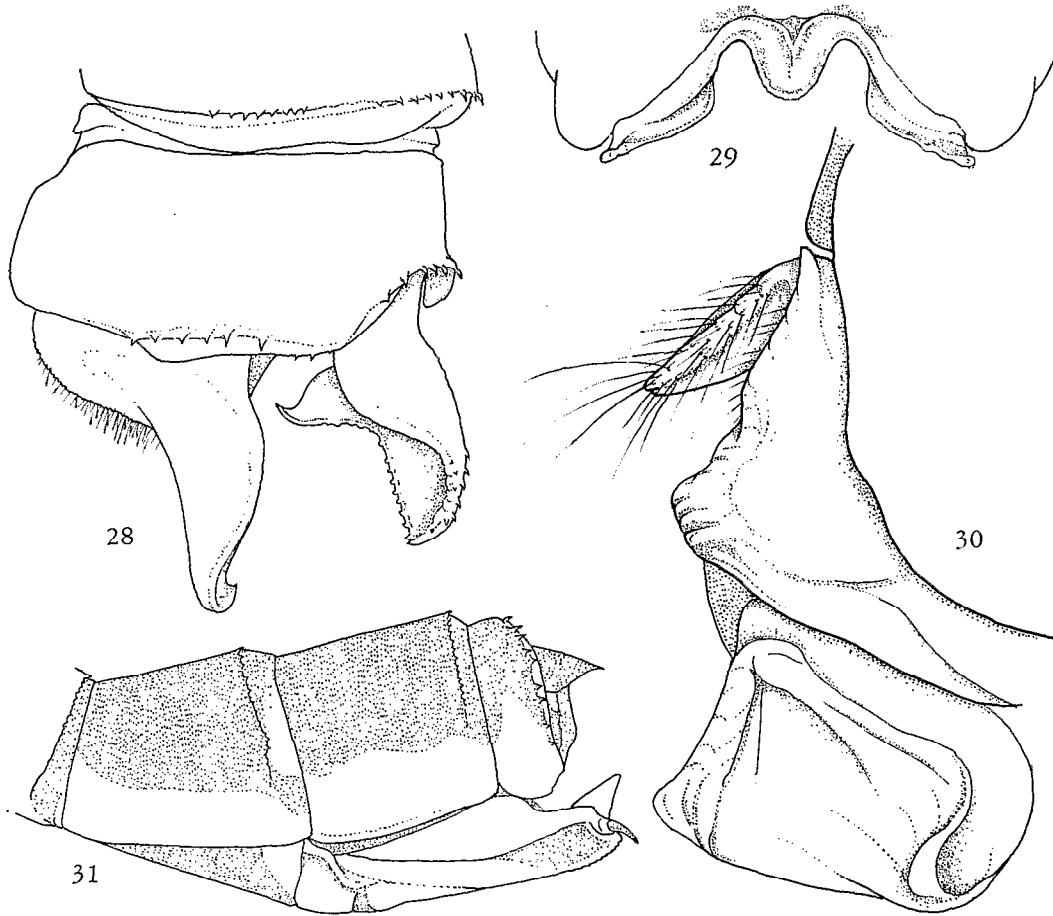


Fig. 28-31.—*Isosticta robustior* Ris, male and female. Apex of abdomen, left lateral view, Mts. de Koghis (28), posterior lobe of female prothorax, dorsal and left lateral view, Mokoue (29-30), and apex of abdomen, Mokoue (31). Long raised bristles at inferior margin of superior appendages (28) and radiating hairs fringing posterior lobe of prothorax (29), omitted.

the fact that no single complete example of *spinipes* does exist any more, I have selected a perfect specimen from the material presently available to replace the lost type, designating one of the males from Mt. Koghi, listed above, as neotype of *spinipes*.

The female "allotype", described by CAMPION, came from the same locality and conforms well with our specimens of that sex, except that the author's figure of the prothoracic hind lobe is rather too sketchy. For a characterization of this insect, see the key and illustrations.

Isosticta tillyardi Campion. Fig. 21-27

Isosticta tillyardi Campion, 1921: 38-41 (♂♀ and key), fig. 1 & 3 (♂ anal apps. and ♀ proth., New Caledonia). SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 248 (list).

Material (imagines).—New Caledonia FAMU Exp. 1972: 4 ♂ 1 ♀, N 31, N 42 and N 51 (CTFT, ML). 1 ♀ (immature),

Dothio River, 10.1940, F. X. WILLIAMS (BISH). 2 ♂ 1 ♀, Crouen, 3.1959, N. L. H. KRAUSS; 2 ♂, near La Foa, Couli, 3.1959, same coll.; 1 ♂ 1 ♀, Col d'Anuen (d'Amieu ?), 3.3.1960 and 21.3.1968, J. L. GRESSITT & T. C. MAA; 1 ♀ (aberrant, fig. 26-27), Mt. Mou, 11.2.1963, N. L. H. KRAUSS; 3 ♂, Saramcea, 12.2.1963, same coll.; 1 ♂, St. Louis Valley, 24.3.1945, H. E. MILLIRON; 1 ♂, Nouméa, 16.1.1966, G. F. EDMUNDS; 4 ♂ 3 ♀ (1 ♀ juv.), Plat de Dogny, 29.3.1968, J. L. GRESSITT & T. C. MAA (all BISH & ML).

(See key to the species.)

The female from Mt. Mou differs from all others in that the midlobe of the prothorax posteriorly is distinctly longer than broad, with a much broader gap separating it from the lateral lobes (fig. 26). In this respect it agrees closely with CAMPION'S "allotype" of *tillyardi*, from Mt. Canala, with which this example was directly compared; the sketch of the prothoracic processes as given by

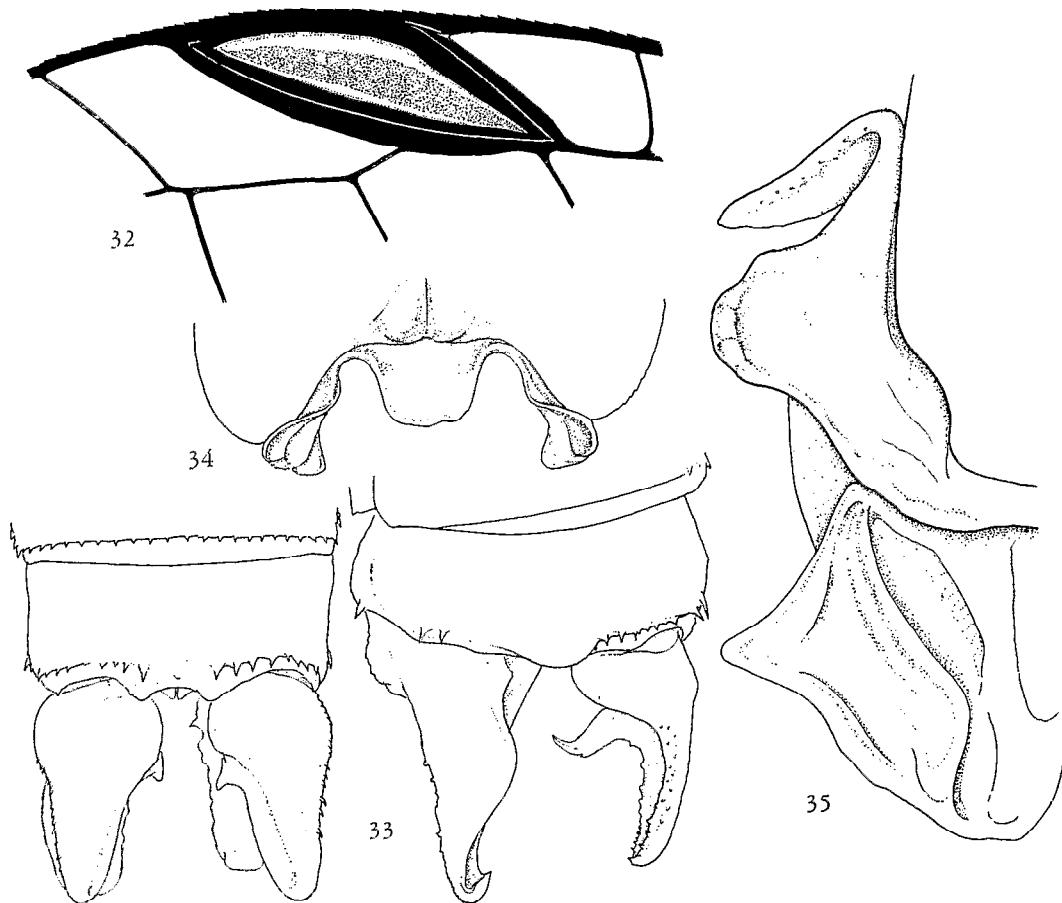


Fig. 32-35. — *Isosticta gracilior* spec. nov., male and female, River Bleue, N 51. Pterostigma region of left fore wing of male, dorsal view (32); apex of male abdomen, dorsal and left lateral view (33); posterior lobe of female prothorax, dorsal and left lateral view (34-35). Long raised bristles at inferior margin of sup. app. (33) and radiating hairs fringing posterior lobe of prothorax (34-35), omitted.

CAMPION for his allotype is incorrect, the midlobe being, in fact, shaped exactly as in our fig. 26. Is this a distinct species?

Isosticta robustior Ris. Fig. 28-31

Isosticta robustior Ris, 1915: 66-67 (♂ incomplete, New Caledonia), fig. 11 (♂ apps., Loyalty Is.). CAMPION, 1921: 37 (key), 42-44 (♂♀ addit. descr.), fig. 5 (♀ proth., New Caledonia). SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 248 (listed from the Loyalty Is. also).

Material (imagines).—New Caledonia: 1 ♂ (freshly emerged, with exuviae). Thi River valley, “issued Nov. 9, 1940”, F. X. WILLIAMS (BISH). 8 ♂ 1 ♀, Mts. de Koghi, 500 m, 3.1959, 28.I.1962 and 1.1963, N. L. H. KRAUSS; 1 ♂ 1 ♀, Col de la Pirogue, 21.4.1963, 330 m, YOSHIMOTO; 3 ♂ 2 ♀, Pouébo, 400 m, 10 km south, 24.I.1964, R. STRAATMAN; 5 ♂ 5 ♀ (two pairs in cop.), between Mokoue & Dothio,

22.3.1968, T. C. MAA; 2 ♂ 1 ♀, Dogny, 29.3.1968, J. L. GRESSITT & T. C. MAA (all BISH & ML).

Isosticta gracilior spec. nov. Fig. 32-35

Material (imagines).—New Caledonia FAMU Exp. 1972: 4 ♂ (one juv.) 2 ♀, N 51, River Bleue at bridge on Eaux et Forests road, 21 km NW of Ouénarou Forest Station, 183 m, 6-7.11.1972, W. L. & J. G. PETERS. Holotype ♂ and first described ♀ (ML); one paratype of either sex (GTFT).

This new species is obviously so nearly allied to *robustior* and resembles that species so closely in most respects that I do not propose to describe its morphology in every detail. The specific key below, together with the accompanying illustrations of structural features, will suffice to distinguish the two sexes from the allied regional members of the genus.

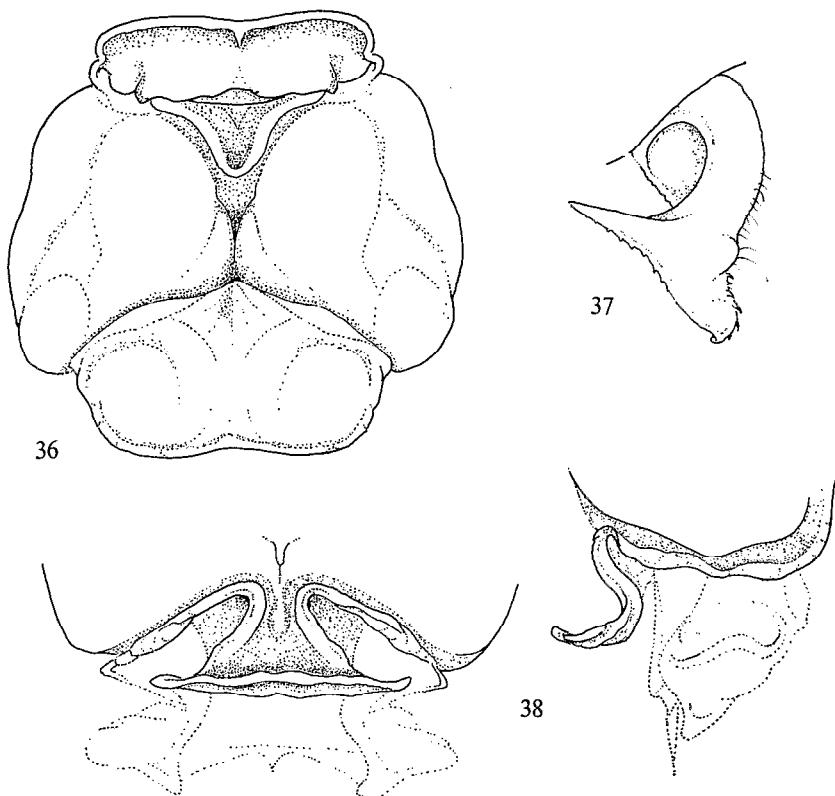


Fig. 36-38. — *Isosticta humilior* spec. nov., male and female, La Foa. Prothorax of male holotype, dorsal view (36), right sup. app. of same, interior view (37), posterior lobe of female prothorax, dorsal and left lateral view (38). Long radiating bristles fringing margin of posterior lobes of prothorax omitted.

Isosticta humilior spec. nov. Fig. 36-38

Material (imagines).—New Caledonia: 1 ♂ 1 ♀ (both immature), near La Foa, Couli, 3.1959, N. L. H. KRAUSS. Holotype ♂ and first described ♀ (BISH).

Like the last, the pertinent characters of this little species suitably refer the insect to the *robustior* group, as will appear from the following key and sketches of its most important appendages (fig. 36-38). Unfortunately only a single immature specimen of either sex has become known. Evidently a rare species.

Key to the New Caledonian species of Isosticta

1. Wings with M_2 separating well in advance of the subnodus, its basal fragment (ante-subnodal arc) distinctly curved; Rs at the subnodus or a trifle beyond that level. Cu_1 relatively long, entering the wing margin at least a little beyond the third postquadrangular cross vein. Male sup. anal app. placed in a horizontal plane, hollowed out ventrally, inner border bearing a robust, recurved subbasal spine followed by a row of marginal denticles..... 2
- Wings with M_2 separating at or beyond the subnodus,

very rarely slightly before and, if so, then the basal fragment is little curved; Rs arises somewhat more distad, both veins usually more closely approximated at their origin than in preceding species. Cu_1 short, entering the wing margin at the 2nd or 3rd (usually the 2nd) post-quadrangular cross vein. Proximal and distal sides of fore wing quadrangle parallel, or almost so. Position of M_2 and M_{1a} variable but their origin usually farther apart. Pterostigma frequently very oblique, but sides more nearly parallel. Male sup. anal app. placed in a vertical plane, hollowed out and armed within with a robust, subbasal spine-like process directed obliquely inward and downward..... 5

2. Males..... 3
- Females..... 7
3. Cu_1 enters the wing margin between the 4th and 5th postquadrangular cross vein in fore wing, a little beyond the 3rd in hind wing. Distal side of fore wing quadrangle slightly more oblique than proximal side. Postnodal cross veins 11-12 in fore wing, 10-11 in hind wing. M_2 at or slightly before Px_5 in fore wing, at Px_4 in hind wing; M_{1a} one or three cells beyond that level in fore wing, one or two in hind wing. Posterior lobe of prothorax hardly elevated, subquadrangular, shaped as in fig. 36. Body markings apparently much as in the next species. Anal

- appendages (shriveled) subequal in length, longer than segm. 10, but a little shorter than 9; sup. app. as in fig. 37. Known only from a single immature specimen. Size small, abd.+app. 27.4 mm, hind wing 18.3 mm..... *humilior*
- *Cu₁* enters the wing margin at the 5th to 6th postquadrigular cross vein in fore wing, at the 4th to 5th in hind wing. Distal side of fore wing quadrangle more markedly oblique than proximal side. Position of veins M_2 and M_{1a} variable, from 1-4 cells apart. Labrum glossy black. Middorsal thoracic carina black; a fine yellow juxta-humeral (mesepisternal) line, incomplete at both ends or below only; sides of thorax predominantly dark, lower portion of metepisternum with irregular, elongate yellow stripe ceasing at the metaspire; metepimeron with yellow anterior and posterior stripes, the former broadest, abbreviated above and often more or less confluent ventrally with the stripe along latero-ventral carina. Occasionally also diffuse ochreous antehumeral streaks and a lanceolate streak along upper portion of first lateral suture, both more or less coalescent with the yellow stripes. Front and rear of the head, sides and ventral surfaces of pro- and synthorax, as well as first and last two or three abdominal segments at least partly pruinescent blue. Pterostigma narrow, shape variable, but distal side usually more oblique than proximal, the apical angle sharply acute. Size larger, abd.+app. 30.8-39.5 mm, hind wing 20.5-26.0 mm..... 4
4. Genal area with bright yellow-green stripe extending upward along eye margin and tapering to a point that reaches level of fronto-epicranial depression. Mandibles for the greater part also yellow. No light mesepisternal spot above mesinfraepisternum. Postnodal cross veins very variable, 13-18 in fore wing, 12-15 in hind wing. Pterostigma oblique, dark brown, paler round the edges. Sup. anal app. in dorsal view subparallel, very broad and somewhat flattened basally, each tapering rapidly towards apex, which is downbent and triangularly pointed; lateral aspect of apps. as in fig. 28. Size larger: abd.+app. 37.0-39.5 mm, hind wing 23.0-26.0 mm..... *robustior*
- Genal area and mandibles black, only the raised sclerite between mandible and gena yellow. Light marks on thorax much as in *robustior*, but less defined and darker; mesepisternites with additional pale spot above mesinfraepisternum. Postnodal cross veins as variable as in *robustior*, 12-16 in fore wing, 10-12 in hind wing. Pterostigma extremely narrowed and still more oblique than in last species, ochreous centred with brown (fig. 32). Sup. anal. app. in dorsal view subparallel but more gradually tapered apically than in *robustior*, tips bluntly rounded; dorsal and lateral aspects of apps. as in fig. 33. Size smaller: abd.+app. 30.8-33.0 mm, hind wing 20.5-22.0 mm..... *gracilior*
5. Males..... 6
- Females..... 9
6. Mandible-bases glossy black. Labrum dark metallic green or blue, anterior border yellowish only at middle. Postnodal cross veins 14-18 in fore wing, 12-14 in hind wing. Sup. anal app. in dorsal view broadest a little beyond base, then narrowed, gently incurved, the tips swollen and bluntly rounded, each appendage furnished with a small yellowish, antemedian tubercle placed along inner border, and a second, much larger and ridge-like, outgrowth before apex; interior subbasal spine visible only when viewed from within. In profile the apical portion of each sup. app. is smaller than in *tillyardi* and less abruptly downbent (fig. 17); whole appendage black, except part of the inner faces, which are brownish yellow. Slightly larger: abd.+app. 34.0-35.0 mm, hind wing 22.5-23.0 mm..... *spinipes*
- Mandible-bases above with citron-yellow spot. Labrum as in *spinipes*, whole anterior border finely yellow. Postnodal cross veins 12-14 in fore wing, 10-12 in hind wing. Sup. anal app. in dorsal view broadest at base, at first subparallel, then gradually and slightly incurved, upper division of each ending in a roundish tubercle which slopes down so as to form a narrower, compressed and outbent ridge merging into a lower division, which is broader and also longer, more incurved, than the upper one, the apex oblique and bluntly rounded; interior subbasal spine at each sup. app. just visible in side view, the apical portion being of large size and more abruptly downbent than in *spinipes* (fig. 21-22); whole appendage black, except the concave inner face, which is brownish yellow. Slightly smaller: abd.+app. 31.0-35.5 mm, hind wing 19.5-21.2 mm..... *tillyardi*
7. Posterior lobe of prothorax with median lobe strongly constricted basally, then suddenly broadened, forming a triangular plate in dorsal view, its distal half in side view raised almost perpendicularly; lateral lobes reduced to mere swollen ridges (fig. 38). Venation much as in male. Postnodal cross veins 13 in fore wing, 11-12 in hinder pair. M_2 in fore wing at Px_5 , in hind wing at Px_5 ; M_{1a} four cells further distad in fore wing, three in hind wing. Shape of pterostigma and body markings apparently much as in *robustior*. Last abdominal segments missing. Small species, abd. (incomplete), hind wing 18.5 mm..... *humilior*
- Posterior lobe of prothorax deeply trifid, the median division neither abruptly raised nor constricted basally, shorter than the lateral lobes. Genital valves hardly projecting beyond end of abdomen, shaped and coloured as in fig. 31. Mesepisterna with rather broad, irregular, yellowish band, widest below and incomplete above, bordering humeral suture; a second stripe, of the same breadth as the upper portion of the mesepisternal band, but incomplete below, coalesces with the former but runs along the other (mesepimeral) side of the suture, its upper end curving back round dorsal margin and joining a much broader yellow band that occupies most of the metepisternum so as to include also the area below metaspire; this leaves only an incomplete wedge-shaped black metepisternal stripe, tapering ventrad, along second suture; metepimeron entirely pale. Larger species, with a higher postnodal index..... 8
8. Posterior lobe of prothorax with median lobe small, bluntly triangular in outline and directed obliquely upward and backward, markedly shorter than the lateral divisions, the latter diverging, forming somewhat raised triangular lobes of moderate size (fig. 29-30). Labrum black, yellowish line bordering anterior margin extremely narrow. Face marks, wing venation and shape and colour of pterostigma as described for the male. Size larger: abd.+app. 33.5-37.5 mm, hind wing 24.5-29.0 mm..... *robustior*
- Posterior lobe of prothorax with median lobe larger, subrectangular in outline and more depressed, not much

shorter than lateral divisions, the latter similar to *robustior*, but more pronounced and of larger size (fig. 34). Labrum black, broadly bordered with yellow anteriorly. Face marks otherwise as in *robustior*. Wing venation and shape and colour of pterostigma as described for the male. Postnodals 15-16 in fore wing, 13-14 in hind wing. Size smaller: abd.+app. 31.3-33.0 mm, hind wing 23.7-24.0 mm..... *gracilior*

9. Genital valves scarcely projecting beyond apex of abdomen, little more than the black styli being visible in dorsal view. Posterior lobe of prothorax with median division distinctly broader than long, exceeding lateral divisions, its swollen margin with long fringe of stiff, raised, radiating bristles; distance separating midlobe from lateral rims much less than its own diameter (fig. 20). Thoracic segments metallic bronze-green; no yellow stripe at middorsal carina but a fine incomplete and interrupted humeral line on mesepimerum; lower part of metepisternum with irregular yellow band ceasing at the spiracle but including lower angle of mesinfraepisternite and most of the mesocoxae; metepimeron yellow except a triangular dark spot at upper end of second suture and (occasionally) with indication of dark lanceolate central streak. Labrum dark metallic greenish black, anterior border indistinctly yellowish at middle only. Mandibles wholly black; genae citron yellow, this colour extending up along eye-margin as a tapering stripe which ceases at level of fronto-epicranial depression. Postnodal cross veins 15-18 in fore wing, 12-13 in hind wing. Size relatively large: abd.+app. 31.3 mm, hind wing 22.8-23.4 mm..... *spinipes*

- Genital valves projecting well beyond apex of abdomen so as to be conspicuously visible in dorsal view (fig. 25). Posterior lobe of prothorax with median division narrower, a little longer than broad, not exceeding lateral divisions, its swollen margin more distinctly upturned and fringed with long raised bristles similarly to *spinipes*; distance separating midlobe from lateral divisions only little less than its own diameter (fig. 23). Yellow thoracic markings more extensive: middorsal carina with yellow line, mesepimeral stripe at humeral suture, though incomplete ventrally, much broader, butt-shaped, its apex above hooked back abruptly somewhat before reaching upper end of humeral suture and cut off squarely at the first lateral suture; most of metapleurae likewise yellow; metepisternal band continued upward across spiracle and tapering to a point above, though confluent along full length of second suture with the yellow metepimeron, leaving only a vestigial dark spot at upper end of the latter. Labrum more broadly bordered with yellow, genal area as in *spinipes*, but vertical surface of frons in addition with pair of transverse, clear yellow-green spots, the postclypeus occasionally also with traces of a pale spot on each side of the middle. Postnodal cross-veins as variable as in male. Average size smaller: abd.+ovip. 25.5-30.5 mm, hind wing 18.5-23.0 mm..... *tillyardi*

FAM. GOENAGRIONIDAE

Xanthagrion erythroneurum Selys, 1876

Xanthagrion erythroneurum: KIMMINS, 1953: 242 (♂ Nouméa, New Cal., no descr.); KIMMINS, 1958: 248 (list, as *erythro-neura*).

An Australian species, reported from New Caledonia only by KIMMINS. I have not seen the single individual collected.

Ischnura a. aurora Brauer, 1865

Ischnura aurora: RIS, 1915: 67 (♂, no descr.), New Caledonia. SCHMIDT, 1938: 324 (cat.). KIMMINS, 1958: 248 (list).

Ischnura a. aurora: LIEFTINCK, 1960b: 229 (♂♀ larvae, New Caledonia).

Ischnura delicata HAG.: KIMMINS, 1953: 242 (♂♀ New Caledonia, no descr.).

Material (imagines).—New Caledonia: 2 ♂ 1 ♀ (red, androchrom.), Nouméa and Oua Tom, 9-10.1940, "sluggish roadside stream", F. X. WILLIAMS (BISH).

Originally described from Tahiti. A widely spread and wind-borne species, almost universally distributed in the Oriental and Pacific regions.

Ischnura heterosticta (Burmeister, 1839)

Ischnura heterosticta: SELYS, 1876: 272 (♀ descr., New Caledonia). MARTIN, 1901: 246 (list). RIS, 1915: 70 (cit., distrib.). CAMPION, 1921: 44 (♀ incomplete, New Caledonia). SCHMIDT, 1938: 324 (cat.).

Material (imagines).—Österr. Neukaledonien Exp. 1965: 14 ♂ and ♀, FNK 49, FNK 55, FNK 71, FNK 80, and Nouméa, C. P. S. bungalow, 12.9.1965 (NMW). FAMU Exp. 1972: 1 ♀ (incomplete), N 41 (ML). And a series of both sexes from various other localities, dates and collectors (BISH, CTFT, ML).

Ischnura torresiana Tillyard, 1913

Ischnura torresiana: KIMMINS, 1953: 242 (♂♀ Nouméa, New Cal., no descr.); KIMMINS, 1958: 248 (list).

We have no material of this species from the island. Most closely related to *I. heterosticta*. Its known range includes southern New Guinea, North Australia (N. T. and N. Queensland), the New Hebrides and New Caledonia (sec. KIMMINS).

Xiphagrion cyanomelas Selys, 1876

Xiphagrion cyanomelas: KIMMINS, 1953: 242 (♂♀ Lifu, Loyalty Is., no descr.); KIMMINS, 1958: 248 (listed from the Loyalty Is. only).

Not yet definitely known from New Caledonia. Like *Ischnura aurora*, this is a variable and widely distributed species, which has colonized a great many islands in the Indo-Australian archipelago. It ranges from the Paramalayan islands, to the west of Sumatra, as far east as New Georgia in the Solomons and the Loyalties, of the island group here treated. For a description of the larva, see LIEFTINCK (1936: 153-156, figs.).

Note. — *X. cyanomelas berlandi* Fraser (1951, Rev. fr. d'Ent., 18: 93-94, fig. 1), described and figured

as a subspecies from Halmahera (N. Moluccas), is a new synonym. The types (both sexes examined in the Paris museum) differ in no way from typical examples of *cyanomelas* occurring in northern Celebes. These (papered) specimens bear labels in F. C. FRASER's handwriting "*Nehalenniagrion berlandi* ♂♀ n. gen. et spec. TYPE", and are indicated as from "1931, Halmahera (Tobelo)". The generic name is a nomen nudum.

Agriocnemis e. exsudans Selys

Agriocnemis exsudans Selys, 1877: 148 (♂ New Caledonia).

RIS, 1915: 70 (cit.). CAMPION, 1921: 44 (♂ New Caledonia, notes). SCHMIDT, 1938: 325 (cat.). KIMMINS, 1953: 242 (♂♀ New Caledonia, no descr.); KIMMINS, 1958: 239 (list).

Agriocnemis vitiensis TILL.: KIMMINS, 1953: 242 (♂♀ New Caledonia).

Material (imagines).—Österr. Neukaledonien Exp. 1965: 4 ♂ 4 ♀, FNK 44 and FNK 80 (NMW). New Caledonia FAMU Exp. 1972: 3 ♂, N 16, N 29b (♂ alcohol specimen), and N 41 (ML). And a series of both sexes from various other localities, dates and collectors (BISH, CTFT, ML).

First described from New Caledonia, this species is known also from the New Hebrides, Fiji, Samoa, and Norfolk Island. The type of *exsudans*, a male in DE SELYS' collection (IRSN), is still intact and in good condition. The species is quite distinct from *A. pygmaea* (Ramb. et auct.), but it is the same insect as *A. vitiensis* Tillyard (1924, *Trans. Ent. Soc. Lond.* : 337-338, fig. 21, ♂ apps.), which KIMMINS recorded from New Caledonia under that name. WATSON (1969) re-defined *Agriocnemis argentea* Tillyard, 1906, as a north Australian subspecies of *exsudans*.

ANISOPTERA

FAM. AESHNIDAE

Gynacantha rosenbergi Brauer, 1867

Acanthagyna rosenbergi: KIMMINS, 1953: 243 (♂♀ New Caledonia, no descr.).

Acanthagyna dohsoni Fraser (= *rosenbergi* Selys partim): KIMMINS, 1958: 248 (listed as such from New Caledonia and the New Hebrides).

I have not seen any *Gynacantha* from the island, but the occurrence of *rosenbergi* in the north-west Pacific is not surprising as it is known also from the Solomons and New Hebrides. In fact, this aeshnid is one of the most widespread eastern species, ranging from islands in the south Moluccas and Tanimbar through Papua (terr. typ.) and North Australia as far east as the Fiji Islands.

Aeshna brevistyla Rambur, 1842

Aeshna brevistyla: RIS, 1915: 67 (♀ New Caledonia, no descr.). KIMMINS, 1958: 248 (list).

Material (imagines).—New Caledonia: 3 ♂ 1 ♀, Mt. Koghi, 500 m, 30.11 and 7.12.1963, J. SEDLACEK (BISH, ML); 1 ♀, Col d'Amieu, 500 m, 21.12.1963, same coll. (BISH).

Common in Australia and New Zealand and known also from Kermadec Island, the New Hebrides, and Norfolk Island.

Anax gibbosulus Rambur, 1842

Anax gibbosulus: CHEESMAN, 1927: 153 ("New Caledonia"). SCHMIDT, 1938: 329 (sec. Cheesman). KIMMINS, 1958: 248 (list).

Material (imagines).—New Caledonia: 1 ♂, Forêt de Thi, 1.11.1967, J. & M. SEDLACEK (ML).

The present specimen is discoloured but quite typical. It is definitely known also from Australia (terr. typ.), New Guinea, the Banda and Kei Islands, the Lesser Sunda chain, and from the Moluccas.

FAM. CORDULIIDAE

Subfam. Corduliinae

Hemicordulia oceanica Selys. Fig. 39-41

Hemicordulia oceanica Selys, 1871: 251 (♂ Tahiti). LIEFTINCK, 1942: 547-548 (notes on holotype); LIEFTINCK, 1949: 356-359 (discussion; excl. some references, and descr. & fig. 11 of ♀ from Bougainville!).

An extrazonal species, reported by the authors from many islands in the Pacific Ocean, but definitely known only from the Society Islands. It is here included for comparison with *H. hilaris* spec. nov., next to be described.

In two earlier communications (loc. cit., supra), I have published some notes on the status of this little known species, based on an examination of the holotype in the Brussels Museum. No figures of the male sexual organs could then be given and no more specimens of *oceanica* from Tahiti were available at that time. Since then, a great number of Oceanic *Hemicordulia* have come under my notice and, fortunately enough, two topotypical males of true *oceanica* were also amongst these. In August 1965, the latter were compared once more with the type, which resulted in a better knowledge of the status and characters of this dragonfly, which had remained a *species inquirendum* for quite a long time.

Material.—Society Is., Tahiti: 1 ♂ (ad., holotype), with label "Taiti" and specific name in de Selys' writing (IRSN); 1 ♂ (ad.), Tahiti, 9.1925, F. L. WASHBURN (BISH); 1 ♂ (ad., homotype, fig. 39-40), Society Islands, Raiatea, 10.1925,

F. L. WASHBURN (ex BISH, ML).—Of slightly doubtful identity: 1 ♀ (semiad., fig. 41), Tahiti, Mt. Aorai, NW Ridge, 1700 m, 11.7.1961, native coll., J. L. GRESSITT (BISH); 1 ♂ (ex alcohol), Tahiti, 84.10 (BM); 1 ♀ (juv.), Tahiti, 8.1880 (BM).

The following is a characterization of the topotypes, still before me.

Male.—Labium pale orange; labrum dark brown; clypeus somewhat more reddish brown. Frons brilliant metallic green, the anterior two-fifths of the vertical portion bright orange in the middle, this area forming a transverse band which broadens to twice its median width and becomes rather more brownish at the sides; surface rugosely punctate, the orange band more finely and simply punctate. Vertex densely punctate, metallic green. Occipital triangle deep black above; surface smooth and very shining, sparsely, finely punctate medially, the vertical (posterior) portion distinctly biconvex, forming a pair of subcircular brownish yellow tubercles, each of these clothed with long, radiating greyish hairs; a long fringe of erect hairs also on either side at some distance from postorbital border. Rear of the head blackish.

Pro- and synthorax throughout very brilliant metallic green, unmarked except brownish lines at the sutures ventrally; long raised dorsal pubescence on mesepisternum greyish yellow, hairs at sides and underneath shorter. Coxae dark brown, trochanters and most of the inner faces of femora definitely reddish brown save for the carinae and knees, which are obscured, as also are the tibiae and tarsi; tibial keels yellow-brown, running along distal half of fore and almost full length of hind tibiae. Length of hind femur only 5.0 mm. Wings hyaline, neuration brown; fore wing with 7 Ax (6 in one fore wing) and 6 Px, hind wing with 5 and 7-8, respectively. All fore wing triangles once traversed. Arc about midway between Ax₁ and Ax₂ in all wings; one Cux in all wings; Bxs wanting. Pterostigma small, brown. Membranula dark grey, whitish only at extreme base.

Abdomen very slender, hardly constricted at segment 3 but markedly spindle-shaped posteriorly, greatest breadth at apex of segment 7. Colour of tergites throughout dark metallic greenish black, rather shining, the green most brilliant on segment 3; light markings reduced to a brownish cloud low down at sides of 2, a yellow intersegmental ring laterally between 2 and 3, a yellowish stripe almost from end to end bordering latero-ventral margin of 3, and similar (though much less distinct) stripes under the lateral carinae on the ventral portions of tergites 4 to 8. Genital organs (fig. 39) dark brown. Anal appendages as in fig. 40, very slender, superior pair black, a little longer than segm. 9+10,

distinctly longer than 8 (10: 8 approx.) and twice as long as 9; inferior appendage very narrow and almost pointed in dorsal view, somewhat shorter than superior pair, colour dark brown with black carinae.

Measurements: abd.+app. 26.7+2.3 mm, hind wing 27.5 mm, pterostigma fore wing 1.5 mm (type and homotype); 24.7+2.3 mm, 25.3 mm, and 1.4 mm, respectively (third specimen).

Female (Mt. Aorai).—Slightly larger than the male. Colour and sculpture of head as described, but labrum still darker, almost deep black instead of dark brown. Yellow band in front of frons a little broader, occupying hardly less than one-half the median length of vertical surface. Occipital triangle of highly characteristic shape: the convex posterior tubercles slightly produced laterad to form blunt pyramids, each of them bearing a stiff apical brush of short and thick, golden brown bristles, which are directed obliquely outward and backward; rest of tubercles clothed posteriorly with the usual soft, raised, curly hairs which are shorter and less radiating than in the male and in females of related species. Rear of the head deep black.

Synthorax unicoloured light brown and, with the exception only of the median carina and anter-alar triangles, throughout with a very brilliant, light metallic green glaze, without indication of yellow spots. Coxae, trochanters and most of the inner faces of femora light brown, apices and outer faces of the latter as well as all tibiae and tarsi, dark brown. Wings hyaline, neuration brown; bases of all wings, as far out as the level of Arc and Ax₂, but excluding the anal field of hind wing, diffusely saffronated. Venation much as in male, but fore wing with 7 or 10 (sic) Ax and 8-9 Px, hind wing with 5-6 and 9-10, respectively; all wings (except right fore wing) with a Bxs. Pterostigma light brown. Membranula as in male.

Abdomen (partly deformed by pressure) brown, with brilliant metallic green lustre; yellow markings reduced to a triangular prejugal spot at sides of segment 2, this mark prolonged caudad forming a thick stripe along lower margin of tergite; sides of tergites 3-9 below with indistinct longitudinal yellow stripes (incomplete posteriorly), the ventral faces yellow-brown; sternites obscured. Valvula vulvae short, bilobed, the lobes rounded and diverging, separated by a wide and shallow emargination; colour brownish yellow. The reduced median processes are deep black. Anal appendages brownish black, cylindrical, about as long as segment 9, distinctly outcurved, the apex of each gently tapering, though not pointed (fig. 41).

Measurements: abd.+app. 32.3 mm, hind wing 32.1 mm, pterostigma fore wing 1.5 mm.

This somewhat immature specimen is the only female so far known from Tahiti. It exhibits a number of extraordinary features which, in combination, are not found in any of the allied species of that sex, viz. (1) the peculiar shape of the occipital triangle, with its bristly hair-tuft on either side; (2) the presence of a supplementary bridge-vein (Bxs) in three of its wings; and (3) the widely divaricated lobes of the unusually short vulvar lamina.

Though the possibility remains that the present specimen is the female of an undescribed species, I still believe that the sexes of *oceanica* are correctly associated.

For notes on specimens previously assigned to *oceanica*, see under the next species. It should be emphasized that the *Hemicordulia* from Bougainville (Solomon Islands), which I described and figured as the female of *oceanica* with much doubt (loc. cit., 1949), belongs to a distinct new species, both sexes of which will soon be described elsewhere.

Hemicordulia hilaris spec. nov. Fig. 42-43

Hemicordulia oceanica: MARTIN, 1907: 12 (pars: ♀ Nouvelle Calédonie only!). CAMPION, 1921: 45-46 (♂♀ New Caledonia, partim?).

Material (imagines).—New Caledonia: 1 ♂ (ad., holotype), Pouébo, 250 m, 19.I.1964, R. STRAATMAN (ML); 1 ♂ (ad., fig. 42-43), 1 ♀ (ad., terminal abdominal segments missing), St. Louis Valley, 21.3.1945 and 6.4.1945, H. E. MILLIRON (BISH); 1 ♂ (ad.), "Hemicordulia oceanica Selys Nelle Calédonie" (pink label in R. MARTIN's writing (MP); 1 ♂ (ad.), Plaine des Laes, 18.2.1914, no. 264, P. D. MONTAGUE, H. oceanica Selys, det. H. CAMPION (BM); 1 ♂ 1 ♀, Forêt de Tai, ex coll. F. C. FRASER (BM).

Extralimital material.—New Hebrides: 1 ♂ (ad.), Erromango, 11 km W of Ipota, 100-200 m, 3.1970, N. L. KRAUSS (BISH); 1 ♂ (slightly immature), Efate, SE corner, 10.7.1971, G. Gross, Roy. Soc. Percy Sladen Exped. (SAM); 1 ♀ (identity doubtful; immature and damaged), Efate, Vila, 10.12.1965, G. F. Gross, biospel Exped. (SAM); 7 ♂ 2 ♀, New Hebrides, loc. diff., 1929 and 1955, L. E. CHEESMAN (BM); 2 ♂, labelled "An" (eityum?), 102-121, identified by D. E. KIMMINS with *H. oceanica* Selys (BM); 3 ♂ 1 ♀ (in bad condition), Vila, N.H., 29.9.10 (AMS).

Male (holotype).—Labium bright citron yellow, labrum orange-yellow; mandible-bases, clypeus, and lateral portions of frons, uniform olive-yellow; frons brilliant metallic blue above and on upper half of its vertical surface, for the rest bright orange-chrome anteriorly, the non-metallic areas at the sides remaining just visible under the dark pilosity in dorsal view; vertex dark metallic blue. Sculpture of frons and vertex as described for *oceanica*. Occipital triangle dark chestnut above, the swollen bilobed posterior portion shaped and coloured

similarly to *oceanica*, the long grey radiating hairs covering the tubercles, as well as the postorbital fringe bordering the occiput, not differing from that species; rear of the head jet black, very shining.

Prothorax brown, the anterior lobe light yellow, posterior lobe grey-brown. Ground colour of synthorax brownish yellow, with very low greenish glaze only in certain lights; these non-metallic light areas ill-defined and definitely yellow only upon middle of meso-metapleurae. The following parts are vivid metallic green: upper two-fifths of mesepisterna very brilliant, but passing rather suddenly into the brownish yellow ground-colour lower down; two elongate patches upon mesepimeron, one anteriorly bordering upper portion of humeral suture, the second covering most of the lower part between the two infraepisternal sutures below metaspiracle; a dorsal spot upon metepisternum, more or less coalescent across first suture with the metallic mesepisternal area; and the whole anterior half of metepimeron. Venter of thorax dirty yellow-brown, the metepimeral areas with low metallic glaze. Coxae and inner faces of femora yellow-brown, remainder of legs black; tibial keels yellowish, occupying a little more than distal half on fore leg and almost whole length of hinder pair. Length of hind femur 5.5 mm.

Wing membrane subhyaline, bases diffusely tinged with greyish yellow, in hinder pair about as far out as apex of anal loop, deepest in tint at extreme base in cu and in proximal cells of loop. Neuration as described for *oceanica*; fore wing with 7 Ax and 5 Px, hind wings with 5 and 6-7, respectively. Pterostigma small, almost black. Membranula smoky black.

Abdomen and anal appendages of the same slender form as *oceanica*; colour brownish black with dull, dark metallic green or bronze (on 8-9) reflections, the basal segments somewhat lighter; sides of 2-8 with rather diffuse brownish yellow markings, as follows: a large, ill-defined and irregular patch occupying lower one-third of the tergal sides of 2, the broad intersegmental membrane 2-3 also pale; indistinct orangish stripes, incomplete posteriorly, just above the lateral carinae of tergites 4-8; a better defined, latero-ventral light yellow stripe bordering full length of tergite 3 continued more broadly, but less distinctly, upon basal three-fourths of the ventral parts of tergites 4-8.

Genital organs (fig. 42) brown, tips of hamuli yellowish; lobus posterior triangular, broad at base, tapering rapidly and appearing almost pointed in side view, but apex somewhat incurved; in caudal view the ventral faces of the lobes are flattened, plate-like and placed transversely, with obtuse tips. Anal appendages deep black; superior pair

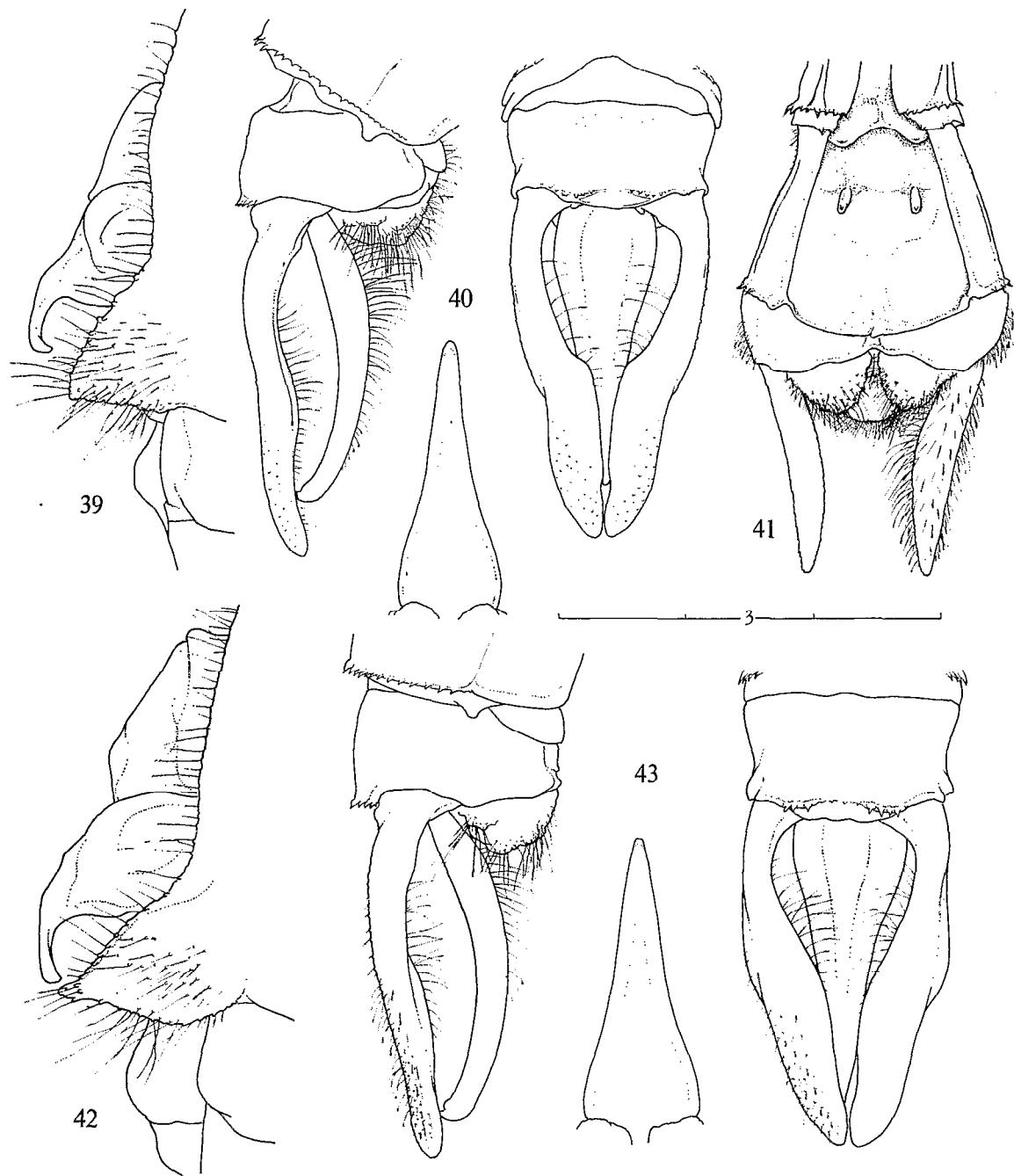


Fig. 39-41. — *Hemicordulia oceanica* Selys, male homotype and female, Tahiti. Genitalia, left side (39), apex of abdomen with appendages, right lateral and dorsal view, and inf. app., dorsal view (40), terminal segments of abdomen, ventral view, Mt. Aorai identity slightly doubtful (41). — Fig. 42-43. *H. hilaris* spec. nov., St. Louis Valley, New Caledonia. Genitalia, left side (42), apex of abdomen with appendages, right lateral and dorsal view, and inf. app., dorsal view (43).

somewhat longer than segm. 9+10, equal in length to 8 and almost twice as long as 9, gently and evenly downcurved in side view, lateral carina distinct, fading away slightly beyond halfway length of

appendage, the distal portion of the latter somewhat twisted, at first broadened, then tapering with bluntly rounded tips. Inferior appendage a little shorter than superior pair (fig. 43).

The other males, including the one from Erromango, only differ from the type by having the metallic areas on the thorax still more reduced, in two of them the yellow at the sides predominating. All agree in the shape of their sexual organs, the small and usually deep black pterostigma, and the very dark colour of the membranula. The nodal indices vary, but there are nearly always 7 Ax in the fore wings, 5 in the hinder pair; and 5-6 Px in fore wings, 7-9 in hind wings.

The following measurements were taken only from the few specimens still in my possession from New Caledonia and the New Hebrides. Abd.+app. 28.2+2.4 mm, hind wing 28.0 mm, pterostigma fore wing 1.3 mm (holotype); 28.0-28.4 mm+2.3-2.4 mm, 28.0-28.8 mm, and 1.0-1.1 mm, respectively (paratypes New Caledonia and New Hebrides).

A species distinct from *H. oceanica*. In general appearance and size the males are much alike, but can be easily recognized by the different colour scheme of the synthorax. Whereas *oceanica* has an almost entirely dark metallic green thorax, in *hilaris* the lower half or more of the mesothoracic dorsum is non-metallic, the sides at the same time showing conspicuous, more or less confluent, light-coloured areas. The shape of the genital hamule is very similar in the two species, but the lobus posterior of *hilaris* is more drawn out at its apex, the flattened ventral surface of the lobe in caudal view also being more attenuated, less broadened and obtuse apically, than in *oceanica*. The best character separating the two species is found in the superior appendages, which differ constantly in shape in both dorsal and lateral aspect (cf. figs. 40 and 43).

Female.—Not one of the regional specimens is in a sufficiently good state of preservation to admit of a full description, but the colour design of the body differs little from that of the male, except that all light marks are more extensive and, especially on the abdomen, better pronounced. A comparison with the apparently conspecific specimens collected in the Fiji and Samoa islands reveals no striking differences in colour and shape of the occiput and genital valve. In all well-preserved females the smooth globular convexities behind the occipital triangle are bright chrome or orange and more prominent than in the male, shallowly divided behind by a median sulcus, as in *H. fidelis*. The vulvar laminae also are similar (*fidelis*, fig. 45-46), but the incision appears to be more narrowly U-shaped and the lobes are almost pointed. All the same, females are so much alike that in some cases they could be told apart only on the basis of the differently coloured hind wing membranula (distinctly white basally, in *fidelis*), and the longer pterostigma of the latter.

Remarks.—Although CAMPION (1921) apparently compared his New Caledonian "*oceanica*" with a male from Tahiti in the British Museum (Nat. Hist.), he gave no description of that sex and simply referred both male and female to *oceanica*, only the female being described in some detail. The paratypic male from St. Louis Valley is absolutely identical with CAMPION's example from Plaine des Lacs. The female is said to have "anal appendages about as long as segment 9, black, straight, fusiform, convergent. Vulvar lamina not projecting conspicuously, about a quarter as long as segment 9; deeply bifid, each lobe triangular." These characters also pertain to *hilaris*.

Specimens now before me from the Fiji Islands, as well as a few from Tonga, are almost certainly conspecific with *hilaris*. Similarly, a long series of both sexes from Samoa, collected by J. S. ARMSTRONG (ex coll. FRASER, in BM), variously identified by FRASER with *pacifica* Fras., *assimilis* *oceanica* Selys, or *oceanica* Selys, are not these species and possibly also belong here. In the present context these eastern populations are of little concern, but will be treated in a forthcoming publication.

Hemicordulia fidelis MacLachlan., 1886 Fig. 44-46

Hemicordulia fidelis MacLachlan, 1886: 104 (♂ Loyalty Is.). MARTIN, 1907: 12 (♂ Loyalty Is., descr.; ♀ New Caledonia, descr.).? RIS, 1915: 67-68 (♀ New Caled., descr.). CAMPION, 1921: 46-47 (♂? descr. & compar. notes; New Caled. & New Hebrides). KIMMINS, 1958: 248 (listed also from Loyalty Is. and New Hebrides).

Hemicordulia assimilis oceanica: KIMMINS, 1936: 75 (♂♀ New Hebrides, no descr.; in 1955 transferred to *H. fidelis*).

Hemicordulia oceanica: KIMMINS, 1953: 243 (♀ Nouméa, New Caled., no descr.).

Material (imagines).—New Caledonia FAMU Exp. 1972: 1 ♂ (ad.), N 42, stream on Mt. Gaata, 4.3 km NW of Station Castex, 76 m, 22-29.10.1972, W. L. & J. G. PETERS (ML); 1 ♂ (ad., fig. 44) 1 ♀ (semiad.), "Hemicordulia fidelis MacLachl. N^e Calédonie", ♀ with addition "Type" (pink labels, R. MARTIN's writing, MP); 4 ♂, "N^e Calédonie, H. fidelis" (same labels, MP); 3 ♂, Loyalty Is., Lifu (IRSN); 1 ♂ 2 ♀ (ad.), New Caled., Mt. Koghi, 550-600 m, 30.11 & 5-7.12.1963, R. STRAATMAN (ML); 1 ♀ (ad.), Mt. Koghi, 28.1.1963, YOSHIMOTO (BISH); 1 ♀ (ad., fig. 45), Mt. Koghi, 450 m, 4-6.10.1967, J. & M. SEDLACEK (ex BISH, ML); 1 ♂ (ad.) 1 ♀ (juv.), Mts. de Sources, 500-550 m, 30.12.1963, R. STRAATMAN (ML); 1 ♀ (ad.), Forêt de Thi, 1.11.1967, J. & M. SEDLACEK (BISH); 1 ♀ (ad.), Yaté Road, 15 km from Fork, 25.3.1968, J. L. GRESSITT & T. C. MAA (BISH); 1 ♀ (ad.), Mokoué, 22.3.1968, J. L. GRESSITT (BISH); 1 ♀ (ad., fig. 46), with printed label: S. New Caledonia, Nouméa, 2.8.1949, L. E. CHEESMAN BM 1950-1 (BM, in box sub "*oceanica*").—Extrazonal material: 2 ♀, "Neue Hebriden, Slg. R. Oberthür Eing. Nr. 4, 1956", ex coll. F. C. FRASER (BM).

Males of *H. fidelis* are readily distinguished from other regional species by the characteristic shape

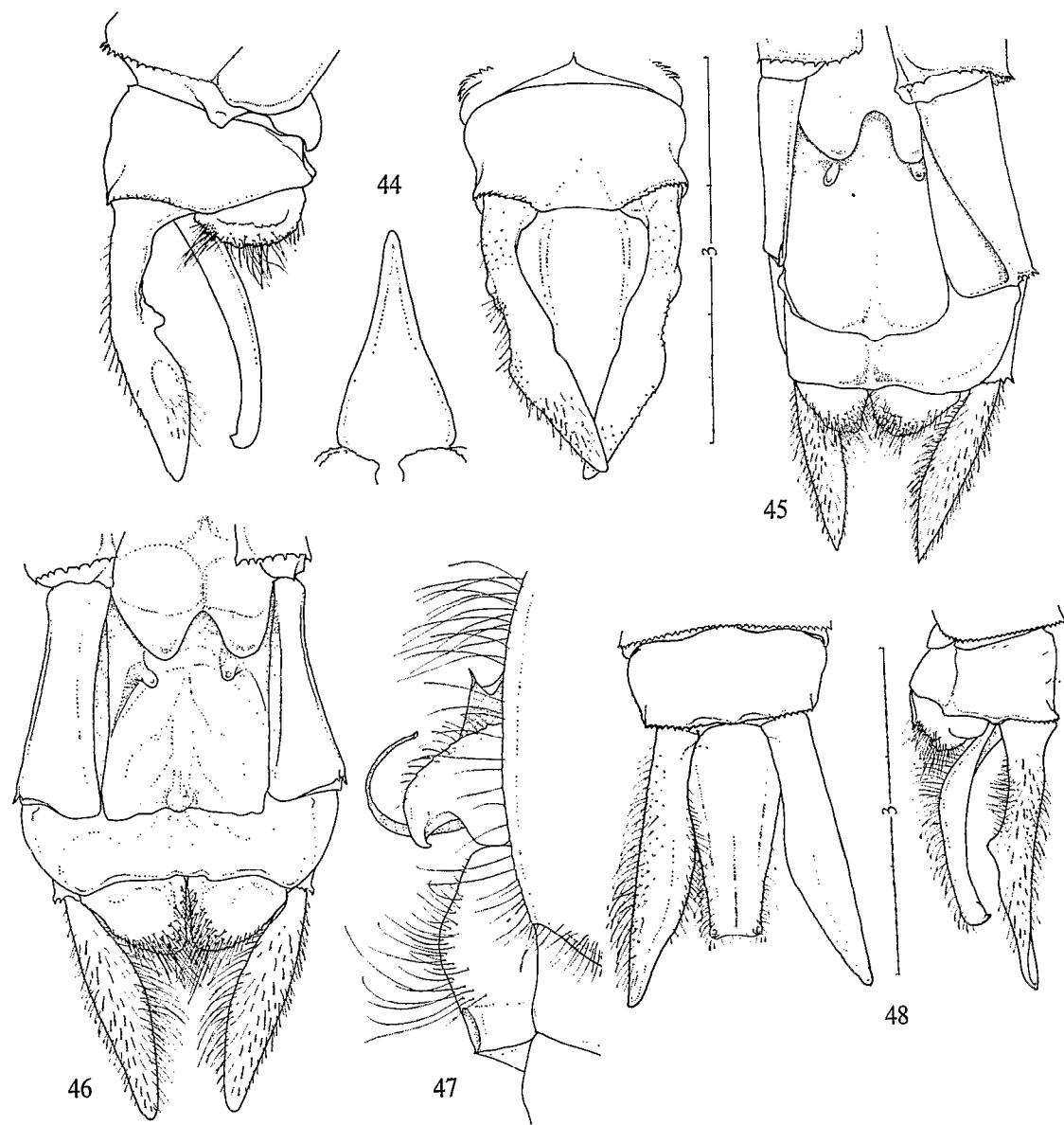


Fig. 44-46. — *Hemicordulia fidelis* MacLachlan, male and female, New Caledonia. Apex of abdomen with appendages, right lateral and dorsal view, and inf. app., dorsal view (44), terminal segments of abdomen, ventral view, Mt. Koghi (45), and the same, Nouméa (46). — Fig. 47-48. *Synthemis ariadne* spec. nov. Genitalia, left lateral view (47), and apex of abdomen with appendages, dorsal and left lateral view, holotype Yiambe (48).

of the anal appendages, which are here figured for the first time (fig. 44). The thorax is markedly villous and of a dull ochraceous-tawny to olive-buff tint, less metallic green than in *oceanica* and *hilaris*, the shiny areas being most brilliant upon lower portion of mesepimeron, on which the sheen partly surrounds an oval yellow spot; also conspicuous on upper half of metepimeron, along the second suture.

In all specimens the labrum is pale, as is also most of the anterior portion of frons. The elongate orangish streaks bordering the lateral carinae of the abdominal tergites, though rather dark and incomplete posteriorly, are well visible on segm. 3-8, and even in full-coloured examples of either sex the dorsum of 10 is also largely pale.

Some venational features shared alike in both

sexes are: Arc about midway between Ax₁ and Ax₂; one Cux in all wings; fore wing triangles once traversed, in hind wing free; internal triangle 3-celled; 7-8 (rarely 9) Ax in fore wing, 5 in hind wing; Bxs wanting. Pterostigma rather longer than in both *oceanica* and *hilaris*, 1.4—2.1 mm in fore wing. Membranula definitely white basally.

Most females can be recognized from others by the presence of a diffuse yellow or light orange cloud covering the distal-part of the fore wing anteriorly, this spot extending from a little beyond the nodus as far as the end of pterostigma. The shape of the vulvar lamina and appendages is here shown in fig. 45 and 46, the latter being taken from the largest specimen in our series, in which the appendages are slightly more rounded off apically than in the other females; this is also the only specimen in which the swollen "occipital triangle" is not biconvex but simply rounded posteriorly,—a peculiarity worth noting. CAMPION's female from Nouméa is a teneral specimen in bad condition, but his description corresponds with the somewhat aberrant example from the same locality just mentioned (collected by Miss CHEESMAN), which is, however, still larger (abd.+app. 39.0, hind wing 38.0 mm). Lastly, the identity of RIS's specimen of the same sex, from Canala, must remain uncertain; though mature, it is not in good shape and exceptionally small (abd. 31, hind wing 35 mm).

Size evidently very variable: ♂ abd.+app. 30.4—34.5 mm, hind wing 30.0—34.5 mm; ♀ 31.5—39.0 and 30.5—38.0 mm, respectively.

H. fidelis is apparently restricted to New Caledonia, the Loyalties, and New Hebrides.

Metaphya elongata Campion

Metaphya elongata Campion, 1921: 64-66, pl. 9 fig. 17 (wings), ♀ New Caledonia. SCHMIDT, 1938: 330 (cat.). LIEFTINCK, 1938, Nova Guinea, new ser. 2: 125 (notes on type). KIMMINS, 1958: 248 (list).

The male of this highly remarkable corduliid still remains unknown.

I have studied CAMPION's type, a unique female in the British Museum (Nat. Hist.) collection, which differs markedly from other members of the genus by having the abdomen longer than the hind wing, and also in that the apical plates of the gonapophyses are fused together. In the type species, *M. micans* Laidlaw, 1912, from Borneo, and in *M. tillyardi* RIS, 1913, from New Guinea as well, the abdomen in both sexes is shorter than the hind wing and the outer valves of the female ovipositor are separate. Further differences between *M. micans* and *elongata* are found in the wing venation (see CAMPION, loc. cit.). It may be noted,

that in the holotype of *elongata* the sectors of the arculus in both fore and hind wings are just separated at their origin.

Unless the morphology of the male of *M. elongata* should alter our views, it seems best to leave this interesting dragonfly in *Metaphya*.

Subfam. *Synthemistinae*

For a comprehensive review of the *Synthemis* species occurring in New Caledonia, the reader may be referred to my previous account (LIEFTINCK, 1971). The latter contains a key to the identification of adult *Synthemis*, as well as descriptions of some of their larvae. Shortly after its publication I received from the Bishop Museum a single male of yet another new species, allied to *S. fenella* Campion. This is characterized in the next pages, so that the total number of regional *Synthemis* now amounts to six. I have taken advantage of the present opportunity to include also copies of drawings illustrating structural features of some earlier described species.

Apart from the presence of a beautiful series of adult *S. fenella*, the genus is abundantly represented in the collection of larvae made by members of the recent FAMU expedition. This contains the early stages of at least four species of different sizes, the smaller-sized individuals probably belonging to both *fenella* and the new species *ariadne*. It is hoped to deal with these on a later occasion.

Synthemis miranda Selys. Fig. 49

Synthemis miranda Selys, 1871: 557-558 (121-122 sep.), ♀ New Caledonia. RIS, 1915: 70 (cit., notes). CAMPION, 1921: 34, 47-55 (♂♀), fig. 6-8 (♂♀ struct.), pl. 8 fig. 12 (♂ wings), New Caledonia. KIMMINS, 1958: 248 (list). LIEFTINCK, 1971: 47-48 (♂♀ addit. descr.), 54 (♂♀ key), fig. 16 (tarsal claw) and 17 (larval proventriculus), New Caledonia.

Additional material (imagines). —New Caledonia: 7 ♂ 1 ♀, Nouméa, 1.4.1945, F. E. MILLIRON (1 ♂), Pouébo NE, 400 m, 14.1.1964, R. STRAATMAN (1 ♀), Mt. Koghis, 350-600 m, 19.3.1968, J. L. GRESSITT & T. C. MAA (1 ♂), between Mokoué & Dothio, 22.3.1968, T. C. MAA (4 ♂), Dogny, 29.3.1968, J. L. GRESSITT & T. C. MAA (1 ♂) (BISH & ML).

Synthemis flexicauda Campion

Synthemis flexicauda Campion, 1921: 57-61 (♂♀), fig. 10 (♂ anal apps.), pl. 8 fig. 14-15 (♂♀ wings), New Caledonia. SCHMIDT, 1938: 330 (cat.). KIMMINS, 1958: 248 (list). LIEFTINCK, 1971: 55 (key, sec. CAMPION).

No material. Apparently a scarce species.

Synthemis montaguei Campion. Fig. 53

Synthemis montaguei Campion, 1921: 55-57, fig. 9 (♂ anal apps.), pl. 8 fig. 13 (♂ wings), ♂ New Caledonia. SCHMIDT, 1938: 330 (cat.). KIMMINS, 1958: 248 (list). LIEFTINCK,

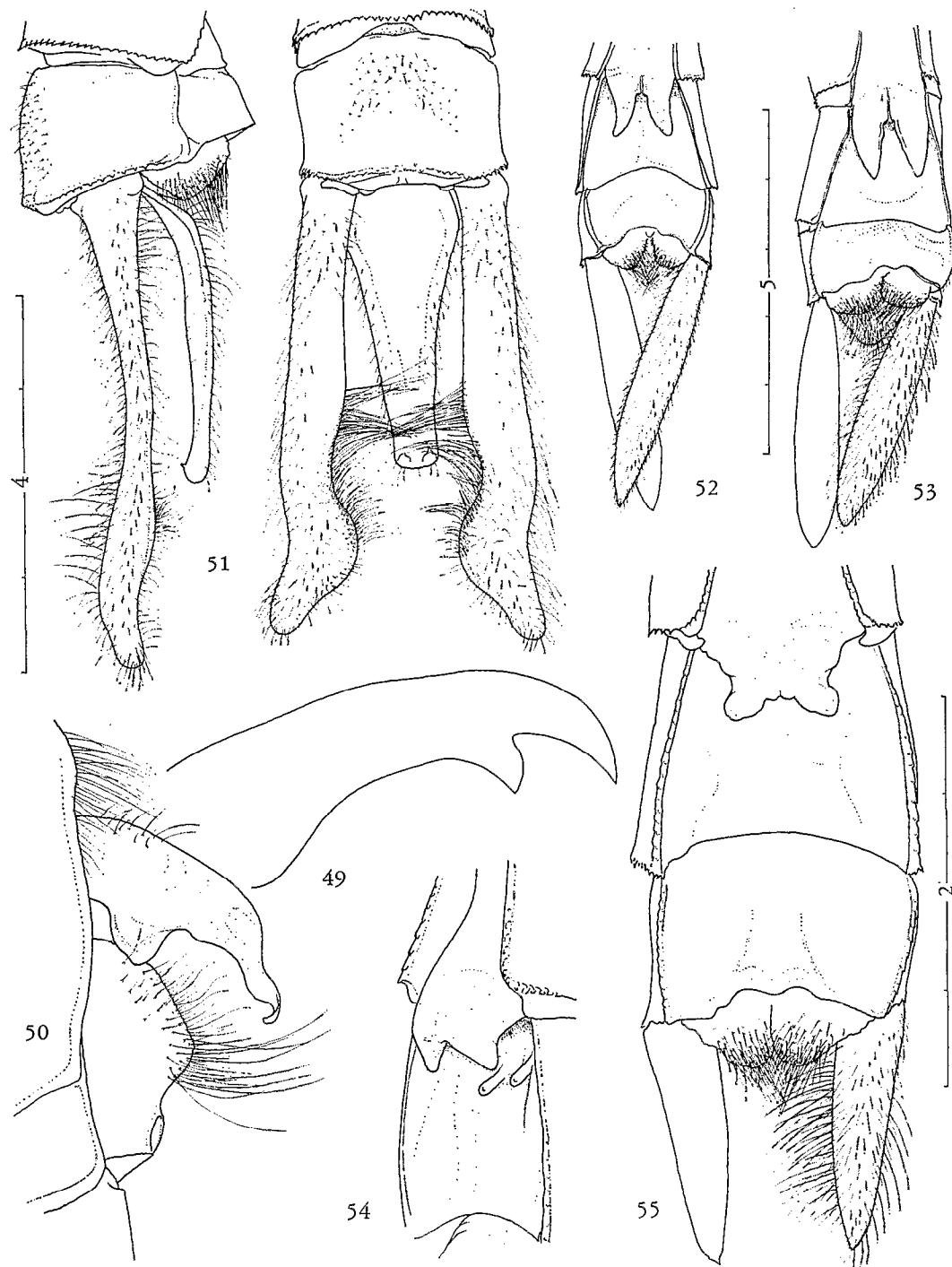


Fig. 49.—*Synthemis miranda* Selys, metatarsal claw of male, Mt. Mou. — Fig. 50-52. *S. campioni* Lief tinck, male and female, Pouébo. Genital organs of holotype, right lateral view (50), anal appendages of same, right lateral and dorsal view (51), and female terminal abdominal segments, ventral view (52). — Fig. 53. *S. montaguei* Campion, female terminal abdominal segments, ventral view, Pouébo. — Fig. 54-55. *S. fenella* Campion, female terminal abdominal segments, oblique lateral (54) and ventral view, Forêt de Thi (55). After LIEFTINCK (1971).

1971: 51-52 (♂♀), 55 (key), fig. 36 (♀ struct.), New Caledonia.

No additional material.

Synthemis campioni Lieftinck. Fig. 50-52

Synthemis campioni Lieftinck, 1971: 48-51 (♂♀), 54-55 (key), fig. 33-34 (♂ struct.), 35 (♀ struct.), New Caledonia.

No further specimens.

Synthemis fenella Campion. Fig. 54-55

Synthemis fenella Campion, 1921: 61-62 (♂), fig. 11 (♂ anal apps.), pl. 9 fig. 16 (♂ wings), New Caledonia. SCHMIDT, 1938: 330 (cat.). KIMMINS, 1958: 248 (list.). LIEFTINCK, 1971: 53-55 (♂♀ inclus. key), fig. 31, 37-38 (♂♀ imagoes, struct.), 44-50 (larval struct.), New Caledonia.

Additional material (imagines).—New Caledonia FAMU Exped. 1972: 21 ♂ 4 ♀, Stream on Mt. Gaata, 4.3 km NW of Station Castex, 76 m, 22-29.10.1972, W. L. & J. G. PETERS (GTFT & ML). 4 ♂, Dogny, 29.3.1968, J. L. GRESSITT & T. C. MAA (BISH, ML).

A splendid and very homogeneous series of this little species, the smallest among its congeners in New Caledonia.

As stated above, the small-sized larva doubtfully referred to *fenella* in my previous account of the Corduliidae, might as well belong to the new species *ariadne*, next to be described.

Synthemis ariadne spec. nov. Fig. 47-48

Material (imagines).—New Caledonia: 1 ♂ (adult), Yiambe, 0-550 m, 11-16.10.1967, J. & M. SEDLACEK. The specimen is the holotype (BISH).

Male (adult).—Labium dark chestnut, lateral lobes finely black. Labrum reddish brown, the anterior border somewhat obscured. Mandible-bases and clypeus dark brown with a slight ochraceous tinge, the postclypeus with a small, ill-defined yellowish spot on either side near the eye margin. Frons broader, less protuberant and much less deeply sulcate medially, than in *S. fenella*, also more densely hairy than in that species; colour uniform brown, not metallic, marked with a pair of small, subcircular yellow dots, one each side placed near eye-margin a little in advance of the fronto-clypeal suture; these spots, though small, a little larger than the postclypeal spots in front of them. Vertex and occipital triangle dark brown.

Prothorax dark brown, the anterior lobe and a transverse streak behind the posterior lobe, light yellow. Synthorax, including the ante-alar triangles, dark bronze-brown, almost black; mesepisterna, on each side of the middorsal carina, with slight metallic green reflections, the dorsal ridge itself citron-yellow; sides with almost continuous, more

or less wedge-shaped, cream-coloured metepisternal band, which is narrow ventrally, running up from just above base of metinfraepisternal suture and surrounding the spiracle, from which point it broadens rapidly to invade also part of the mesepimerum, then narrows again and tapers to a point at the dorsal crest at some distance from the second suture; metepimeron with a much narrower and isolated, rather club-shaped stripe occupying about one-third of the lateral surface of the sclerite. Venter unicoloured brown.

Legs throughout brownish black or black, inner faces of trochanters and basal three-fourths of fore femora diffusely yellow, outer faces and basal portions of mid and hind femora dark reddish brown. Tibial keels likewise obscured, extending along distal four-sevenths on fore and mid tibiae and a little over distal three-fourths on hinder pair.

Wings perfectly hyaline, except minute, diffuse, rusty brown spots at extreme base of all wings in c-sc and m-cu. Neuration dark brown. Shape of wings much as in *fenella*, but more densely veined. Fore wings with 15 Ax of first series and 9-10 Px, hind wings with 9-10 Ax and 11 Px. All triangles and subtriangles free; lt with one cross-vein in all wings; m with 3 cross-veins in all wings; cu with 6-7 in fore wings, 6 (including proximal side of internal triangle) in hind wings. Bridge cross-veins 5 in fore and 4-5 in hind wings. Discoidal field of fore wings commencing with one double cell followed by a row of 5-6 single cells, the expanded portion with rows of 2-4 and 9-10 marginal cells. Primary (distal) anal loop comprising 7-8 cells with or without a central one, the secondary (proximal) enclosure with 4 cells. Pterostigma larger and a little more expanded than in *fenella*, dark ochreous instead of black, lacking a brace vein. Membranula white at extreme base, becoming dark grey distally, extending to a little beyond cross-vein in anal triangle.

Abdomen slim and slender, basal segments a little inflated, apical segments, from base of 6 to end of 9, gradually broadened; colour dark brown to almost black from middle of segment 3 onward; 1 unmarked; dorsum of 2 with small, transverse, paired greenish yellow streaks immediately in front of the jugal suture; extreme base of 3 with pair of similar, though longer, streaks of the same colour, narrowly interrupted middorsally, dorsum of 3-8 each with pair of closely approximated, small, subcircular green to orange-yellow antemedian spots, each of these traversed by the partly obscured jugal sutures, the spots largest on 7 and 8, though occupying not more than one-fourth whole length of tergite; sternites dark brown.

Genital organs dark brown, shaped much as in

fenella; penis with the same long curled apical filament, lobus posterior sparsely clothed with very long yellowish bristles (fig. 47). Anal appendages brownish black, basal portion of superior pair almost black, not very hairy. Superiors of simple form, subequal in length to segments 9+10; outer border in dorsal view straight, the inner undulated, distal portion flattened from above down with slightly upturned tips, the ventral surface of each with well pronounced small tooth-like projection placed transversely at about halfway length from base; inferior appendage about one-fourth shorter than superiors, apex truncated, armed with pair of raised lateral teeth (fig. 48).

Measurements: abd.+app. 33.0 mm, hind wing 28.7 mm, pterostigma fore wing 1.7 mm.

Female unknown.

This very distinct species is the sixth member of the genus occurring in New Caledonia. It is intermediate in size between *S. fenella* and the four much larger species found in the island (cf. my specific key, loc. cit. 1971: 54-55).

FAM. LIBELLULIDAE

Agrionoptera papuensis lifuana Kimmins

Agrionoptera insignis lifuana Kimmins, 1953: 243-244 (incl. key to subspp.), fig. 1 wings; ♂♀ Lifu, Loyalty Is.; ♂♀ New Hebrides); KIMMINS, 1958: 248 (listed from the Loyalty Is.).

Agrionoptera insignis allegenes Till.: RIS, 1910: 142 (♂ New Caledonia, descr.); RIS, 1915: 68-69 (♂♀ Loyalty Is., descr.); RIS, 1919: 1069 (ditto). SCHMIDT, 1938: 332 (list; New Caledonia & Loyalties). KIMMINS, 1958: 248 (list, sec. RIS).

Agrionoptera papuensis lifuana: LIEFTINCK, 1962: 70 (comb. nov., notes).

I have seen no further material of *Agrionoptera* collected in the New Caledonia group. Judging from the notes and descriptions in the literature, specimens from these islands are best placed as a subspecies of *papuensis*. It should be borne in mind, however, that they do not at all form a homogeneous series. There are probably two species involved whose races occur sympatrically in New Caledonia, but for the present I can do no better than classifying them tentatively as *lifuana*, the types of which are in the British Museum (Nat. Hist.) collection.

Lathrecista asiatica festa (Selys)

Agrionoptera festa Selys, 1879, Ann. Mus. civ. Genova, 14: 300 (♂♀ Queensland).

Lathrecista asiatica festa: RIS, 1910: 129, 133; RIS, 1919: 1068.

Material (imagines).—New Caledonia: 3 ♂ (adult), Yiambe, 0-50 m, 11-16.10.1967, J. & M. SEDLACEK (BISH, ML).

New to New Caledonia. The present males agree in almost every respect with examples of typical *festa* from N. Australia and Guadalcanal (Solomon Is.), not with *L. a. pectoralis* (BRAUER, terr. typ. Ceram), a subspecies which RIS (1910) recorded from the Fiji Islands. Yet, in spite of that, I have found that specimens from the last-mentioned islands can be distinguished from the Moluccan subspecies.

Orthetrum caledonicum (Brauer, 1865)

Orthetrum caledonicum: RIS, 1910: 226 (♂ New Caledonia); RIS, 1915: 69 (♂♀ ditto); CAMPION, 1921: 66 (♂♀ New Caledonia); KIMMINS, 1953: 244 (♂ New Caledonia, Loyalty Is., New Hebrides, etc.); KIMMINS, 1958: 248 (list).

Material (imagines).—New Caledonia FAMU Exp. 1972: 2 ♂, N 33 and N 45 (CTFT, ML). And a series of both sexes from various other New Caledonian localities, dates and collectors (BISH, CTFT, ML).

Originally described from New Caledonia. A common and wide-ranging dragonfly in Australia and many parts of the Papuan region.

Diplacodes bipunctata (Brauer, 1865)

Diplacodes bipunctata: RIS, 1911: 471 (♂♀ New Caledonia); RIS, 1915: 71 (note). CAMPION, 1921: 66 (♂ New Caledonia). KIMMINS, 1953: 244 (♂♀ New Caledonia); KIMMINS, 1958: 248 (list, inclus. Loyalty Is.).

Material (imagines).—New Caledonia FAMU Exp. 1972: 1 ♂, N 45 (CTFT). 1 ♂, Nassisah, 100 m, 20.3.1968, J. L. GRESSITT & T. C. MAA (BISH); 1 ♂, Hienghene, 0-50 m, 1.1969, N. L. H. KRAUSS (BISH).

Originally described from Tahiti and New Caledonia. Recorded by CAMPION from Nouméa and Plaine des Lacs, in January and February. According to this author, his males are remarkable for the amount of saffron suffusion at the base of the wings, a peculiarity observed also in other specimens from the island. Although *bipunctata* is one of the most wide-ranging *Sympetrini* of the East, and usually extremely common where found, little information is available on its geographic variation. It has chiefly an insular distribution, but dense populations are known also from the high mountains in New Guinea, the latter still awaiting a careful comparative study. The species ranges from the Moluccan islands eastward far into the Pacific. Further notes and an illustration of the larva (from central New Guinea) have been given by LIEFTINCK (1962). In New Caledonia *bipunctata* seems to be a scarce insect, largely replaced in the island by *haematodes*.

Diplacodes haematodes (Burmeister, 1839)

Diplacodes haematodes: RIS, 1911: 474 (♂♀ New Caledonia);

RIS, 1915: 69 (ditto, note). GAMPION, 1921: 66 (δ New Caledonia). KIMMINS, 1953: 244 (φ New Caledonia); KIMMINS, 1958: 248 (list).

Material (imagines).—Österr. Neukaledonien Exp. 1965: 2 δ 1 φ , FNK 95 and FNK 107 (NMW). New Caledonia FAMU Exp. 1972: 5 δ 2 φ , N 16, N 33, N 40, N 41, N 42, N 43 (CTFT, ML). Also a series of both sexes from various other localities, dates and collectors (BISH, CTFT, ML).

Described from Australia, where it is widely distributed. Known also from Timor, the New Hebrides, and New Guinea. Apparently a common species in New Caledonia.

Rhyothemis graphiptera (Rambur, 1842)

Rhyothemis graphiptera: MARTIN, 1901: 221 ("aussi en Nouvelle-Calédonie", no descr.). RIS, 1913: 934 ($\delta\varphi$ New Caledonia, no descr.). KIMMINS, 1958: 249 (list).

No material. Locally common in northern Australia, the Torres Strait islands, southern New Guinea, the Aru Islands, and—sparingly—also in some of the Moluccan islands.

Rhyothemis phyllis apicalis Kirby, 1889

Rhyothemis apicalis: MARTIN, 1901: 221 (New Caledonia, no descr.).

Rhyothemis phyllis apicalis: RIS, 1913: 948, pl. 5 (φ col., New Caledonia); RIS, 1915: 71 (note, φ New Caledonia). KIMMINS, 1958: 249 (list).

Material (imagines).—New Caledonia: 1 φ , New Caledonia (BM). 1 φ , La Foa, 17.3.1961, J. SEDLACEK (ML).

The present example agrees with RIS's description (1913) and the colour picture of the wings in the same publication. First described from the New Hebrides, and so far reported only from these islands and New Caledonia. The male is apparently still unknown.

Pantala flavescens (F.)

Pantala flavescens: RIS, 1915: 69-70 (note, ? New Caledonia). GAMPION, 1921: 67 ($\delta\varphi$ and larvae, New Caledonia, no descr.). KIMMINS, 1958: 248 (list).

Material (imagines).—New Caledonia: 1 φ , NE New Caledonia, Yiambi, 15.10.1967, J. SEDLACEK (BISH).

Tramea loewi Brauer

Tramea Löwii Brauer, 1866, Verh. zool. bot. Ges. Wien, 16: 563-564 (δ Ceram).

Tramea l. loewi and *l. lillyardi*: LIEFTINCK, 1942: 526-529 (revision, incl. key), pl. 33 fig. 96-97, pl. 34 fig. 103, pl. 38 fig. 125 ($\delta\varphi$ Moluccas to Australia).

Tramea limbata forma f: RIS, 1913: 987 ($\delta\varphi$ New Caledonia, pars!).

Material (imagines).—New Caledonia: 1 δ 2 φ . Nouvelle Calédonie (coll. SELYS, IRSN).

These three specimens form part of a series of six,

all from New Caledonia, referred to "limbata" by RIS (loc. cit.), who apparently overlooked the structural differences between the two.

Tramea transmarina intersecta subsp. nov. *Fig. 58-59.*

Tramea limbata f' RIS, 1913: 787 (δ —not φ !—New Caledonia, descr.); RIS, 1915: 70 (δ New Caledonia or Loyalty Is., note).

Tramea limbata Desj.: KIMMINS, 1953: 244 (φ New Caledonia, no descr.).

Trapezostigma limbata Desj.: KIMMINS, 1958 (listed also from the New Hebrides).

Material (imagines).—New Caledonia FAMU Exp. 1972: 1 δ (adult, holotype), Iles des Pins, stream on Pic Meunier, 80 m (N 33), 3.10.1972, W. L. & J. G. PETERS (ML). 3 δ , Nouvelle Calédonie (IRSN).—Extralimital material: 1 φ (ad.), New Hebrides, Espiritu Santo, Narango village, 25-31.5.1960 W. W. BRANDT (BISH).

Material (larvae).—Österr. Neukaledonien Exp. 1965: 1 exuviae (supposition), FNK 62, Neklai, 150 m, 10.8.1965, "unter Niaouli Rinde" (sic) (NMW). 1 δ (ad.), 3-5 miles up Toutouta River, 27.2.1945, H. E. MILLIRON (BISH); 1 δ (in fragments), Hougilau, 17.10.1925, N. H. FORD (BISH); 1 φ (juv., imperfect), Nouméa, 20.6.1945, H. E. MILLIRON (BISH).

The New Caledonian specimens (4 δ 2 φ) in DE SELYS' collection (IRSN), reported from the island by RIS in the monograph (1913), are a mixed lot. Three males belong to the present subspecies, one male—undescribed by RIS!—and two females are *T. loewi*, a species not hitherto known from the island. I have come across several more individuals of *intersecta* in other museum collections, but these are no more available for comparison.

The following is a complete description of the holotype, which is a male in perfect condition.

Male.—Stature of *T. transmarina* Brauer. Head moderately large, width across eyes 8.3 mm. Labium yellow-brown, the median lobe almost black; mouth-parts, clypeus and sides of frons dark olive-brown, almost black in middle. Frons dark metallic purple, the vertical surface only partly metallic, acquiring gradually a dark reddish brown tint anteriorly. Summit of vertex darker than frons, purplish black, its base brown. Occipital triangle dark brown, rear of the head somewhat lighter, the postorbital carina light brown.

Thoracic segments uniform brown with faint bronzy reflections (possibly distinctly more reddish brown in life), with traces of dark metallic black streaks at upper end of humeral and second lateral sutures, a somewhat larger dark area behind mesinfraepisternite, upon lower portion of mesepimeron, and a short streak above the metaspiracle. Coxae and trochanters brown, legs otherwise black.

Venation black, but all veins as far out as a

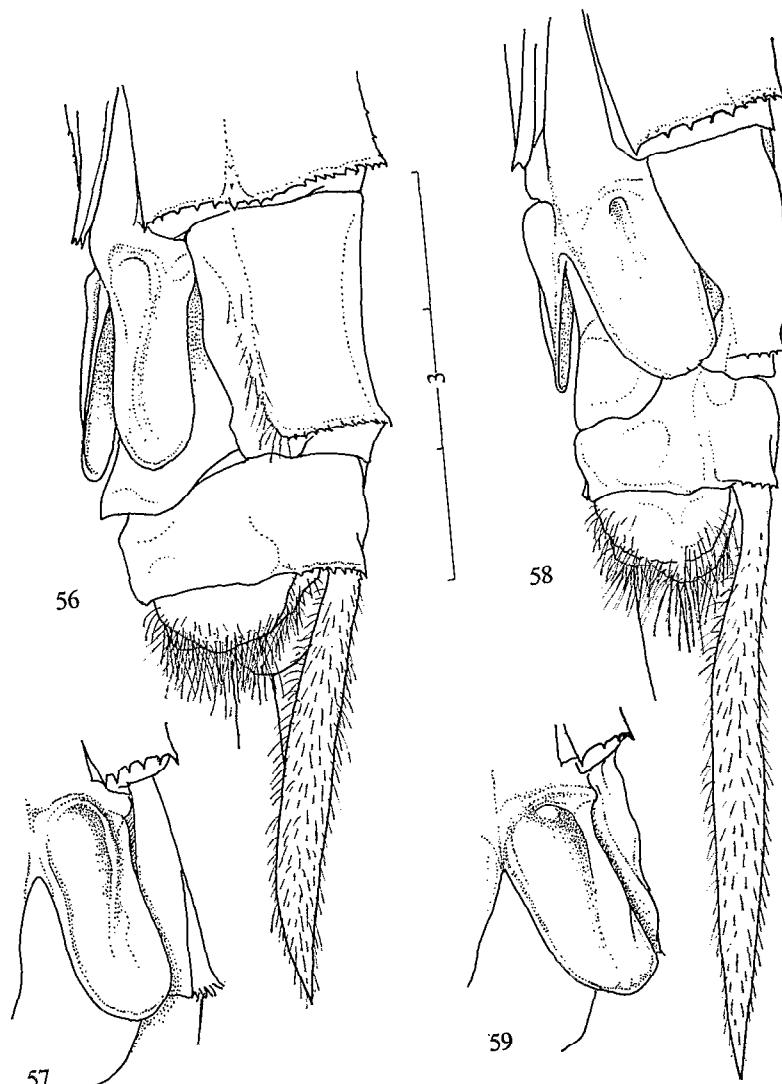


Fig. 56-57. — *Tramea l. liberata* Lieftinck, female abdominal segments, oblique left lateral view (56) and part of vulvar lamina, ventral view, Plum (57). — Fig. 58-59. *T. transmarina intersecta* subsp. nov., female terminal abdominal segments, oblique left lateral view (58) and part of vulvar lamina, ventral view, Espiritu Santo, New Hebrides (59).

little beyond the nodus (but including also the anal area of hind wing) light reddish brown, all veins distal to the bend of anal loop black. Wing membrane perfectly hyaline, except the hind wings that carry a pair of sharply delimited, well-separated, very dark brown, opaque basal spots not invading base of anal loop and traversed by light red veins: (1) a transverse, more or less oval spot occupying cu as far as Cux and a little more than two cells beyond it in the anal area along membranula; (2) a much larger, completely isolated, rather pear-shaped spot (pointing costad) in the anal field, the spot at its widest point covering about 10-11 transverse cells and separated from the first spot

by a hyaline space of 2-4 mm breadth; inner boundary of spot almost touches basal margin of wing but curves back outward so as to leave a hyaline area about 3-4 cell-lengths away from the tornal angle. A vestige of dark brown discernible also at extreme base of sc-cu in hind wing. Fore wing with $11\frac{1}{2}$ Ax and 10 Px of first series, hind wing 7 and 13-14, respectively. Pterostigma of the normal shape, unequal in fore and hind wings, colour light reddish brown. Membranula light grey at base, almost pure white apically.

Abdomen slender, red-brown, 1-7 lacking any dark markings, except the intersegmental rings 3-7, which are slightly darker; dorsum of 8-9 black,

the spot on 8 rather narrowed basad; 10 and anal appendages reddish, the extreme base and apical border of 10 somewhat obscured. Superior appendages very long and slender, a little longer than segments 8+9, in dorsal view broadest and somewhat outbent at extreme base, then converging, approximated and running parallel, the tips slightly outcurved, acuminate; in side view at first straight, then angulated, with a row of 8-9 denticles beneath angulation, finally narrowly cylindrical as far as the apex; inferior appendage less than half length of superior pair, shaped as in other members of the *T. transmarina* group.

Measurements: abdomen 28.0+4.4 mm, hind wing 41.5 mm, pterostigma $\frac{2.3}{1.5}$ mm.

The Hougilau male is almost a replica of the holotype, the measurements and nodal index of the wings also being alike. The genital organs of this specimen are indistinguishable from those of *t. propinqua* Lieftinck (1942, pl. 33 fig. 90-91). The specimen from Toutouta River only differs from the former in that the two portions of the basal spot on the hind wings are both a little more extensive and fused together outwardly at middle for a breadth of four cells, the anal spot being separated from the tornal angle for a distance of only 2-3 cells, thus approaching the condition seen in nominotypical *transmarina*.

Female.—The only New Caledonian example is a freshly emerged specimen that has lost most of its abdomen. The wing markings are exactly as described for the type male. Owing to its immaturity, a dark stripe at the base of the frons is barely discernible.

The mature female from Espiritu Santo (New Hebrides) is referred to the new subspecies with little doubt. It shares with the male such characters as the hyaline wing membrane, rather open venation, the widely separated hind wing spots, and a light-coloured pterostigma. Width of head across eyes 8.4 mm. Mouth parts and face coloured as in male, the middle of labium deep black. Frons bright ochreous with a thick metallic blue-black stripe occupying basal half of dorsal surface, this stripe broadest in the median line and descending about half-way down margin of orbits; anterior face of vertex likewise blue-black, above olive-brown but summit again ochreous; occipital triangle light brown above and behind, rear of the head blackish brown. Thoracic segments coloured as in male. Wings clear, except hind wings with traces of amber at extreme base in c-sc and m, and two blackish brown patches in the anal field: the basal spot squarish, rather irregularly outlined, in cu as far

as halfway Cu_x and proximal side of t, beyond Cu to a little before apex of membranula and as far as midrib of anal loop; distal spot larger, about 3 mm deep, suboval, oblique and isolated, equal in size to the hyaline area separating it from the basal spot, barely entering anal loop outward and remaining far away from tornal angle of wing (about 4 mm). No amber-coloured areola. Fore wing with 12½ Ax and 10 Px, hind wing 7 and 11, respectively. Abdomen brown, marked with black similarly to male. Vulvar lamina and appendages black, as in fig. 58-59.

Abdomen 30.6+4.4 (total 35.0) mm, hind wing 45.3 mm, pt. fore wing 2.6 mm.

Since last discussing the Pacific forms of the polytypic species *T. transmarina* Brauer (LIEFTINCK, 1962: 89-94), I have been able to examine a good many individuals from the oceanic islands of Fiji and Samoa, which included the type series in the Vienna and Brussels museums. There can be no doubt that the present taxon, like other Oriental "forms" of the *limbata*-group having a more western distribution (i.e. *curyale* Selys and *propinqua* Lieft.), are subspecies of *transmarina*.

Tramea liberata liberata Lieftinck. Fig. 56-57

Tramea liberata Lieftinck, 1949: 371-372 (♂ Solomon Is.).

Trapezostigma l. liberata: WATSON, 1967: 377-400, figs. (♂♀ Bismarcks & Solomon Is.).

Material (imagines).—New Caledonia: 1 ♀ (adult), Plum, 23.1.1963, N. L. H. KRAUSS (BISH).

This is a member of the *T. eurybia* group, revised by LIEFTINCK (1942) and WATSON (1967). The present specimen is here described in some detail inasmuch as the female characters of typical *liberata* are still imperfectly understood.

Female.—Head of moderate size, width across eyes 8.3 mm. Labium pale ochreous, except inner border of lateral lobes somewhat obscured and the midlobe, which is brownish black. Labrum pale orangish, marked with black in the middle along anterior margin; mandible-bases, clypeus and frons uniform olivaceous to greenish yellow, the frons with thick blackish brown basal stripe, incomplete laterally and tapering against eye-margin, with very faint bluish purple sheen. Anterior (vertical) face of vertex coloured similarly to basal stripe of frons, its summit and posterior face dirty yellowish olive, as are also the occipital triangle and rear of the head.

Thoracic segments unicoloured, with the usual dark (though non-metallic) marks in the sutures, the brown metapleurae with faintest metallic gloss. Legs, except coxae and trochanters, black.

Wing membrane colourless, main veins of fore wing anteriorly dusky red, neuration in antenodal portion of hind wing brighter, light red. Base of fore wing unspotted, hind wing with extensive warm dark brown markings, outer limits of all spots narrowly and diffusely orange-brown; shape of basal patch much as in fig. 39 of *liberata* ♀ from the Admiralty Is. (WATSON, 1939), except that the hyaline fenestra is considerably larger, as shown in fig. 41 (loc. cit.) of a specimen from the same locality, completely dividing the basal orange patch into two portions. Fore wing with $13\frac{1}{2}$ Ax and 10 Px, hind wing 8 and 13-14, respectively. Pterostigma dark brown, almost black.

Abdomen definitely lighter than in *transmarina*, bright red, all carinae finely black; dorsum of segments 8 and 9 black, these marks broadest at middle and occupying only upper one-third of the sides; 10 also somewhat obscured dorsally. Vulvar lamina brown, relatively short, not exceeding apex of 9th tergite. Anal appendages distinctly shorter than in *transmarina*, subequal in length to segm. 9+10 (fig. 56-57).

Measurements: abdomen 28.5+2.9 mm, hind wing 42.2 mm, pterostigma 2.7 mm. 1.9

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