Apr. 15 - Dec. 12, 1899

ZOOLOGICAL RESULTS

BASED ON MATERIAL FROM

NEW BRITAIN, NEW GUINEA, LOYALTY ISLANDS AND ELSEWHERE,

COLLECTED

DURING THE YEARS 1895, 1896 AND 1897,

BY

ARTHUR WILLEY, D.Sc. Lond., Hon. M.A. Cantab.
BALFOUR STUDENT OF THE UNIVERSITY OF CAMBRIDGE.

PART I.

CAMBRIDGE:
AT THE UNIVERSITY PRESS.
1898

Price Twelve Shillings and Sixpence.

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PART I.

London: C. J. CLAY AND SONS,
CAMBRIDGE UNIVERSITY PRESS WAREHOUSE,
AVE MARIA LANE,

AND

H. K. LEWIS,
136, GOWER STREET, W.C.

Glasgow: 263, ARGYLE STREET.
Leipzig: F. A. BROCKHAUS.
New York: THE MACMILLAN CO.
Bombay: E. SEYMOUR HALE.

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PREFATORY NOTE.

THE present issue is the first of a series of five or six similar parts which will be devoted to an account of material collected during my recent expedition to the Pacific in search of the eggs of the Pearly Nautilus. The research was rendered possible by my appointment in 1894 to the Balfour Studentship of the University of Cambridge and by substantial grants from the Royal Society. Perhaps the character rather than the quantity of the material which from first to last came into my hands justifies this method of publication. The general collections which I made have no claim to completeness since they were not part of my special object; but new facts relating to such forms as Nautilus, Peripatus, Amphioxus, Ctenoplana, Balanoglossus, etc., cannot fail to possess a peculiar interest.

Some of these facts have been already recorded in the pages of the Quarterly Journal of Microscopical Science, and it is proposed to incorporate them anew in the present work.

It is impossible to deny that the undertaking was an anxious and an arduous one, and it is on that account that I am the more deeply sensible of the interest manifested in, and the stimulus imparted to my efforts by Prof. Alfred Newton, Mr Adam Sedgwick and Prof. E. Ray Lankester.

On two successive occasions my tenure of the Balfour Studentship has been extended for a year beyond the allotted triennium.

It is my earnest hope that the work now in course of publication will be regarded by the Board of Managers of the Balfour Studentship and by the Government Grant Committee of the Royal Society as an adequate proof of my endeavour to fulfil the commission with which I was entrusted and that it will be acceptable to my zoological confrères.

My thanks are due to those zoologists who are co-operating in the production of this work. Special acknowledgment of services rendered must be made to my friend Mr A. E. Shipley who has undertaken the essential but ungrateful task of reading the proofs.

In due course it is intended that a general introduction comprising an account of my successive voyages shall be published as part of this series and I shall then have further occasion to state my indebtedness to Dr Anton Dohrn, Mr Richard Parkinson of New Britain, Prof. W. A. Haswell, and others, who have favoured me with their valuable assistance from time to time.

A. W.

CHRIST'S COLLEGE,
CAMBRIDGE.
Aug. 4, 1898.

CONTENTS OF PART I.

THE ANATOMY AND DEVELOPMENT OF PERIPATUS NOVAE-BRITANNIAE.

By ARTHUR WILLEY, D.Sc. Lond., Hon. M.A. Cantab.

With Plates I—IV.

The only previous notice of the occurrence of Peripatus in any of the islands of the Indo-Pacific region is that of a species recorded from Sumatra in 1886 by Dr R. Horst (8)[1], and subsequently named *P. sumatranus* by Sedgwick (19). One specimen only was found in the Museum at Leyden in a bottle containing insects said to have come from East Sumatra. Its general characters (e.g. number of spinous pads on legs, position of generative orifice, and shape of primary papillae) were those which are common to all the Neotropical species of Peripatus. New Britain is geographically an intermediate locality between Sumatra and the Neotropical region, but the Peripatus which occurs there does not possess a single external structural feature of importance (apart from sexual dimorphism) in common with the Neotropical species; although by a singular coincidence the female has the same number of claw-bearing legs—24 pairs—as the alleged Sumatran species. Under these circumstances, the evidence that the latter was actually found in Sumatra, which Sedgwick regarded as inconclusive, must appear more than ever worthy of suspicion. Nevertheless, the fact that this unique genus is represented in New Britain by the species which forms the subject of the present paper, makes it very desirable that the islands of the Malay and Melanesian Archipelagos should be carefully watched for their peripatine possibilities. For Peripatus is one of those animals whose presence lends a distinct character to the fauna of any region.

The fact was definitely established by Sedgwick, about ten years ago, that the species of Peripatus hitherto described could be arranged in three groups in accordance with their geographical ranges, namely, Neotropical, Australasian and Ethiopian; those from any one of these regions having certain common features. As I have already pointed out in a preliminary diagnosis (25), the New Britain Peripatus cannot be associated with one of the three groups named above, but forms the type of a fourth group which, in correspondence with the nomenclature adopted by Sedgwick, may be designated Melanesian.

Account of Material. The material at my disposal consisted of thirteen specimens, which I obtained myself from the bush at an elevation of several hundred feet above

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[1] The numbers in brackets refer to the Bibliography at the end of the Paper.

sea-level, during the months of August and September 1897. The exact locality was in the immediate vicinity of a fresh water source and in the gully in which the stream from the source flowed, in the hills behind the native village of Karavia which lies at the head of Blanche Bay, in the Gazelle Peninsula, New Britain. There was a similar source about half a mile distant where I sought in vain for Peripatus. This is not to be wondered at, since the extremely local or sporadic occurrence of Peripatus is well known. The first specimen, a large female, was found beneath decaying leaves, another was taken from a rotten but still standing stump of a cocoa-nut palm, while the rest were found under stones and about the roots of plants growing on the banks of the stream. The earth here was black, and to the unaided eye the Peripatus appeared also quite black and, as the integument has a dull velvety tone and is not glossy like that of the millipedes, there was some little difficulty in distinguishing them amidst their dark surroundings. They were found singly, and it is fair to conclude that Peripatus is not very abundant in that locality. Those that were obtained seemed to be remarkably sluggish, and though I handled them freely I did not once observe the emission of the tenacious slime from the tips of the oral papillae, which is so characteristic of Peripatus. This was possibly due to the time of the year at which they were taken. Hutton (10) says that the New Zealand Peripatus becomes half-torpid during the winter months and will neither feed nor emit their viscid slime at that time of the year "although procreation still goes on" (Hutton). Similar observations have recently been recorded by Steel (23) in the case of the Peripatus of New South Wales.

Preservation. My material was preserved in 4—5 per cent. formol. I immersed the animals in water until they were fully extended and either drowned or at least quiescent, and then placed them directly in the preservative fluid without opening them. If a living Peripatus be dropped into a dish of water it floats on the surface and when forcibly submerged the whole skin becomes covered with an envelope of air presenting a beautiful silvery sheen. Although I did not make any incision in the specimens to allow for the penetration of the formol, this admirable fluid preserved them so well that they arrived home in almost perfect condition, and I am able to give a fairly complete account, not only of the internal anatomy, but also of the embryonic development. Only the youngest stages were not well preserved owing to the resistance to the penetration of the preserving medium offered by the egg-membrane, which is at first very thick and subsequently attenuates.

Name. It is, rather unfortunately perhaps, necessary to consider the propriety of further providing our species with a name having generic or subgeneric value. Sedgwick, in his monograph on the species and distribution of Peripatus (19), did not deem it advisable to create generic subdivisions within the limits of such a homogeneous group as the Onychophora, but the method of description adopted by him as well as the facts which he brought forward, would seem to leave no other course open. In fact, while tabulating the general (i.e. generic) characters respectively of the South African, the Australasian, and the Neotropical groups of species, Sedgwick refrained from definitely naming them.

This want has accordingly been met by Pocock (16) who subdivided the genus Peripatus into three generic groups which he regarded as "equivalent to, or indeed of considerably greater value than, the genera of other orders." These are

I. *Peripatus s. str.*, comprising the Neotropical species in which the legs are furnished with 4 spinous pads and the generative aperture lies between the legs of the penultimate pair.

II. *Peripatoides*, comprising the Australasian species, with 3 spinous pads on legs and generative aperture between the last pair of legs.

III. *Peripatopsis*, comprising the South African species, with 3 spinous pads on legs and generative aperture subterminal, between a pair of rudimentary appendages.

I can find no reason to question the validity of Pocock's names except in so far as he ascribes full generic value to them. For various reasons which it would not be profitable to enumerate I prefer to call them subgenera, and with this reservation I add to the preceding, the following name for systematic use:—

IV. *Paraperipatus*[1], comprising the New Britain species, with 3 spinous pads and generative aperture behind the last pair of legs.

The above table of definitions of subgenera has a purely systematic value and does not take into account the remarkable differences in internal anatomy and mode of reproduction. Moreover it might produce the impression that IV differed very slightly from III, whereas in most respects it least resembles the latter.

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[1] During the correction of the proofs of this paper, a number of the Comptes Rendus de l'Acad. des Sciences Paris, containing a description by Mons. E. L. Bouvier of a new species of Peripatus from the Gaboon district on the West Coast of Africa, has come to hand.

This species, which Bouvier calls *P. tholloni*, possesses certain external characters which indicate that it stands in an intermediate relation between the South African and the Neotropical species. The generative orifice lies between the legs of the penultimate pair as in the latter, but there are only three spinous pads on the legs as in the former. Bouvier states that there are 24 or 25 pairs of legs; the nephridiopores of the 4th and 5th legs do not lie in the centre of the 3rd spinous pad but proximally outside of it; the jaws are of the same type as those of the Neotropical species. If the subgeneric names, given above, are to be retained, as I think they should be, then a fifth subgenus will have to be created for this new species. Bouvier does not state definitely what view he takes of the matter.

[E. L. Bouvier. Note préliminaire sur la distribution géographique et l'évolution des Péripates. C. R. Acad. des Sc. Paris, T. 126, May 9, 1898, p. 1358.]

In a second note (Nouvelles observations sur les Peripatus. Ibid., May 23, 1898, p. 1524), the same author describes a new species from a single specimen which was captured in a house at Popayan, New Granada (Colombia). The name of the collector is unknown. Bouvier names this species *P. tuberculatus* on account of the presence of characteristic wart-like tubercles on the dorsal surface.

In the position of the generative orifice, and in character of the jaws, it resembles other Neotropical species, but, according to Bouvier, it exhibits the very great peculiarity that the legs, of which there are 37 pairs, are provided with 5 spinous pads (except the last 3 pairs). It is much to be desired that more specimens of this species should be obtained. The feet are provided with four marginal papillae, two anterior and two posterior. The jaws, as described by Bouvier, resemble, though differing somewhat from those described and figured by Camerano for *P. quitensis* Schmarda.

Bouvier does not quote Camerano's paper. (Lorenzo Camerano. Sul *Peripatus quitensis* Schmarda. Atti Acc. Torino, Vol. 32, 1896—7, p. 395.)

GENERAL CHARACTERS

Of the subgenus Paraperipatus.

1. The females are larger and more numerous and have a greater number of appendages than the males.

2. There are three spinous pads on the legs; and the apertures of the enlarged segmental organs corresponding with the fourth and fifth legs, lie in the centre of the proximal pad of these legs.

3. The outer blade of the jaw is simple, without a small accessory tooth at the base of the main tooth.

4. The generative aperture is placed immediately behind the last pair of legs.

5. Receptacula seminis are present in the female, but there are no receptacula ovorum.

6. The ova are small and without yolk.

7. Embryos in all stages of development may occur in the uteri of one female.

DESCRIPTION OF THE SPECIES, PERIPATUS (PARAPERIPATUS) NOVAE-BRITANNIAE.

Colour. The ground-colour of the living animal is black and this is seen, with a lens, to be dotted over with large and small brown or brownish-yellow spots. On the dorsal surface the larger brown spots are arranged segmentally in four rows, namely, one row on each side above the bases of the legs and another row on each side of the median line. The median line is occupied, in preserved specimens, by a prominent narrow black longitudinal tract with segmental intensifications; and in the centre of it is a fine light brownish-tinted or whitish line. The black tract is not so apparent in small specimens, but the median white line is more so. The rest of the black ground-colour developed a bluish tinge after preservation in 5 per cent. formol. To the unaided eye the larger segmental brown spots look like more or less square-shaped areas presenting a block-like appearance, and the intervening space is occupied by the numerous smaller brown spots. The median dorsal white line is continued backwards to the anus where it merges into the brown pigment surrounding the latter.

On the ventral surface there is a median row of brown spots surrounding the modified segmental epidermal areas known as the *ventral organs.* The ventral surface generally is less deeply pigmented than the dorsal surface, but the spinous pads of the legs are dark and the pigmentation is also slightly intensified about the segmental grooves at the bases of the legs.

EXTERNAL FEATURES.

I. *Sexual differences.* Of the thirteen specimens in my collection I find three are males. One of these had escaped my notice at the time that the diagnosis of the species was published (25). They are to be distinguished externally from the females by their less numerous appendages. To judge from the material at my disposal which, including the older embryos taken from the females, amounted to at least 20 specimens, the rule seems to be for the female to have 24 pairs of claw-bearing appendages and the male 22 pairs. But one of my adult males has 23 pairs of claw-bearing appendages (V)[1].

The females attain larger dimensions than the males, ranging in length from 14·75 mm. (X) to 54·75 mm. (II) and in width of body from about 2 to 5 mm. Two of the males (XII and XIII) were of almost equal size, namely 15 mm. long and 2 mm. wide—the third male (V) was considerably larger, attaining a length of 26 mm. with a width of about 3 mm.

The predominance of the female over the male appears to obtain with all species of Peripatus. In *P. leuckarti* (New South Wales) Mr Steel (23) found that out of 579 specimens collected by him in one season, 390 were female and 189 male or 67 per cent. female and 33 per cent. male; and the females were, on the average, one-third to one-half longer than the males.

For the present, I regard the male of *P. novae-britanniae* which had 23 pairs of legs (No. V) as an exception rather than as a frequent variety, because I have taken advanced embryos from the uterus with their full complement of claw-bearing appendages, viz. 22 pairs (I have four such embryos), while less advanced embryos from the same female were found to have 24 pairs of claw-bearing appendages. Thus in specimen No. II the two embryos which lay nearest to the vagina had 22 pairs of legs; while the two younger embryos following upon the first two, had 24 pairs of legs. I cut sections through one of the former and one of the latter, and as I had expected they turned out to be male and female respectively.

In the Neotropical species of Peripatus the females tend throughout to have a larger number of legs than the males, but the numbers vary considerably within the limits of a given species. Thus in *P. jamaicensis* Grabham and Cockerell, the number of claw-bearing appendages is said to vary from 29 to 43 pairs, so that some of the males would have a greater number of appendages than some of the females. [Pocock (16) and Cockerell, Notes on *Peripatus jamaicensis*, Zool. Ang. 1894, p. 341.]

Sedgwick established the fact that in Peripatus the young are born with the full number of legs, none being added after birth. Indeed in the South African species there seems to be a tendency to reduce rather than add to the appendages, in so far that the rudimentary appendages between which the generative orifice lies, which have been called the *anal papillae*, are stated in Balfour's posthumous memoir (2) to be "most marked in small, and least so in large specimens."

In the position of the generative aperture behind the last pair of legs our species superficially resembles the Cape Peripatus more than any other. In the female the aperture is surrounded by tumid lips. Its position in the male is highly distinctive for the species, being placed at the tip of a relatively long backwardly-directed conical papilla [Fig. 10 *a* and *b*]. The last-named structure, i.e. the penial papilla, is the unfailing external sign of the male in *P. novae-britanniae*.

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[1] **Roman numerals in brackets merely refer to particular specimens.**

II. *Appendages.* i. *Antennae.* I have made an observation with regard to the antennae which may be worth recording, namely, that the annular spine-bearing ridges increase in number during the life of the animal by the intercalation of new rings between the older rings, so that the number of these rings is not a reliable specific feature. In one individual I counted about 33 rings and in another about 50 [Fig. 6].

ii. *Jaws.* The character of the jaws and oral papillae is adequately shown in Fig. 5. The outer blade of the jaw is quite simple, while the inner blade is provided with a variable number of minor teeth, generally about 5. In the absence of an accessory denticle at the base of the outer jaw-blade, *P. novae-britanniae* resembles *P. novae-zealandiae* as well as certain other Australian species or varieties (Fletcher 5). In other Australian forms, e.g. in the larger Victorian species *P. oviparus* Dendy and in the New South Wales variety *P. leuckarti var. orientalis* Fletcher, there is an accessory denticle as in *P. capensis* and *P. edwardsii.*

With regard to the inner ramus of the mandible or inner jaw-blade there is no diastema between the first accessory denticle and the remainder of the series, such as occurs in the Neotropical species (Sedgwick 19).

iii. *Nephridial apertures.* The apertures of the enlarged segmental organs of the 4th and 5th pairs of legs are placed in the centre of the proximal pad of these legs [Fig. 7] and sometimes they divide the pad into two disconnected halves, and sometimes again the two halves remain united by a narrow bridge passing distally from one to the other. The division of the proximal pad of the 4th and 5th legs into two separate halves by the intercalation of the papilliform structure which carries the nephridiopore is characteristic of *P. capensis,* according to Sedgwick. In *P. novae-zealandiae* Sedgwick showed that the portion of the pad which carries the nephridiopore is continuous distally with the rest of the pad. Finally in *P. edwardsii* the papilla bearing the nephridiopore of the above segments is quite separate from the 3rd pad and lies between the latter and the 4th pad. Thus in *P. novae-britanniae,* the relations of the 4th and 5th nephridiopores sometimes approach the condition observed in the Cape species and sometimes that of the Australian species. In Fig. 7, one half of the proximal pad is seen to be independent while the other half is confluent with the pore-bearing papilla. Another most interesting variation, which probably is of frequent occurrence in this species, is the presence of a nephridial aperture in the centre of the proximal pad of the 6th leg in addition to those normally present on the 4th and 5th legs. In no fewer than three individuals—all females—(I, III and VIII) such an aperture occurs on the 6th leg of the left side only (Fig. 11). In one individual—a male—(V) a nephridial aperture occurs in the middle of the proximal pad of the 4th, 5th and 6th legs of each side of the body. As far as I was able to observe the segmental organ of the 6th leg was not specially enlarged in those cases where its external aperture was abnormally situated. The occurrence of a distally-placed nephridial aperture on the 6th leg can hardly be regarded as a mere instance of meristic repetition, because it does not involve the absolute number of nephridial apertures but only the number of those which are placed in a certain position. There must be some reason for such a position, and the occasional appearance here of the aperture of a segmental organ whose usual place is at the base and not near the extremity of the 6th leg, looks very much like atavism. Perhaps the enlarged nephridia corresponding to the 4th and 5th legs are the vestiges of an ancestral form in which all or most or some only of the ordinary nephridia served for the passage of the genital products to the exterior. If there were sufficient grounds for accepting this as a legitimate hypothesis it would afford an explanation of, or at least throw light on, the great contrast there is between the anteriorly-placed genital pores of the Diplopoda and the terminal posterior pores of the Chilopoda.

iv. *Segmental grooves.* At the bases of the legs on the ventral surface there is, in the older individuals, a series of not very well-defined grooves at the inner ends of which the segmental organs open to the exterior. They are characterised by a rather deeper pigmentation but by no other special feature. They occur at the bases of the 4th and 5th legs although here the segmental organs do not open into them. These grooves are therefore not so distinctive as are the corresponding structures in *P. capensis* and in *P. edwardsii.* In the latter they are separated from the apertures of the nephridia (Gaffron).

v. *Crural glands.* There are no white papillae on the ventral side of the legs in the male such as occur in most other species of Peripatus. These papillae, when they occur, bear at their tip the aperture of a crural gland. But crural glands may occur without having their external apertures borne on white papillae. In *P. novae-britanniae* as in *P. novae-zealandiae* (Sheldon 22) there are no crural glands in either sex.

Wherever they occur they are found only in the male except in *P. capensis* where they are said to occur in the female also (Sheldon 22). Without denying their occasional existence in the female *P. capensis* I may say that I have failed to find them present so far as I have looked for them. They are therefore in any case not always present, and I should doubt, on *à priori* grounds, if they normally occur in the female. There is a well-developed "fat-body" to be seen in sections through legs of female *P. capensis* and perhaps this has been confused with a crural gland.

In the male *P. capensis* the crural glands are well-defined structures and, as may be gathered from Balfour (2) and Sheldon (22), they are present in all the legs except those of the first pair. Only the crural glands of the last pair of legs in the male *P. capensis* have their external apertures borne on white papillae and these constitute the unfailing external sign of the male in this species.

In *P. leuckarti* of Australia, of which Fletcher (5) has clearly established the existence of three distinct varieties, viz., typica, orientalis and occidentalis, white papillae may occur in the male on each leg of the first pair only, or of the last pair only, or of all or only some of the pairs with the exception of the first, or of the first five (Fletcher). Here again, however, Fletcher notes that crural pores may occur in the absence of white papillae.

In *P. edwardsii,* Gaffron (6) and Sedgwick (19) have shown that white papillae occur on certain of the posterior legs of the male, often two such papillae on one leg. Thus Gaffron figures a specimen with two papillae on each of the legs of the six praegenital segments and one each on those of the 7th praegenital segment. The genital and post-genital segments never have white papillae in this species.

Thus the absence of crural glands and of white papillae on the legs of the male of *P. novae-britanniae* is a feature in which this species resembles *P. novae-zealandiae.*

vi. *Feet.* The variability of the primary papillae which occur on the feet is another interesting peculiarity of the New Britain Peripatus. In all species except *P. sumatranus*, there are three papillae in the immediate neighbourhood of the claws on each foot. In the African and Neotropical species one of these papillae occurs on the hinder margin of the foot, and the other two papillae lie close together at the anterior margin of the foot. In the Australasian Peripatus there is a primary papilla at the anterior and posterior margins, while the third papilla has a median dorsal position. In *P. sumatranus*, as described by Horst, there are only two papillae on the foot at its anterior and posterior margins respectively. Sedgwick (19) states that the condition last described is, if true, unique in his experience of Peripatus[1].

In the Peripatus of New Britain the foot is duly provided with three papillae, two of which constantly occur in the usual marginal positions, but the third papilla may be median dorsal or it may be slightly excentric, or again it may be approximated to the anterior papilla (Figs. 8 *a* and *b*). The variation occurs in the feet of individual specimens. In the greater number of cases, so far as I have observed, the dorsal papilla is not median but sub-median or sub-anterior. Thus in one specimen (X) I found that the dorsal papilla was generally sub-median, but sometimes median. In another (XI) on the right side it was median in 10 feet and not median in 13 (in one foot its position appeared doubtful), while on the left side of the same individual it was median in 6 feet and not median in 18. In this specimen, to take a concrete example, the dorsal papilla of the 16th foot of the right side was markedly excentric (Fig. 8 *a*), while that of the corresponding foot of the left side was accurately median.

The primary papillae in our species are simple conical structures without a constriction separating the distal spine-bearing portion from the rest of the papilla.

INTERNAL ANATOMY.

The several subgenera of Peripatus differ from one another very considerably in the constitution of the reproductive organs. Otherwise the main features of their organisation are fairly uniform although it is probable that a detailed investigation of their finer anatomy would reveal certain contrasts among themselves.

Segmental Organs.

It has been mentioned above that when the segmental organ belonging to the segment which carries the 6th pair of legs opens distally by a pore situated in the centre of the 3rd spinous pad, the organ itself is not specially enlarged as are those of the 4th and 5th legs, but resembles a normal nephridium.

Here, as in other species of Peripatus, a typical nephridium consists of four principal portions, viz. (1) an outer dilated vesicle or bladder, (2) a coiled portion recurved upon itself so that (3) the thick-walled funnel lies approximately in the same transverse

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[1] The third papilla is not figured by Gaffron in the feet of *P. trinidadensis* (=*edwardsii* partim).

plane with the bladder; (4) an inner vesicle whose walls usually appear shrunken in section—this is *Sedgwick's end-sac,* and is a remnant of the true coelom into which the funnel opens. In a series of sections through a young female (IX) of *P. novae-britanniae,* Sedgwick's end-sac can be demonstrated with the utmost clearness (see Text-figure 1). It can also be easily seen in sections through a mature female (III). The thin membranous wall of the vesicle passes with characteristic abruptness into the thick glandular wall of the funnel. As I shall have further occasion to point out, there is a similarly sudden transition in the connection between the thin-walled ovarian tubes and the thick-walled oviducts, though this is not so pronounced when seen in section. Both Kennel and Gaffron missed the nephridial end-sac which was discovered by Sedgwick.

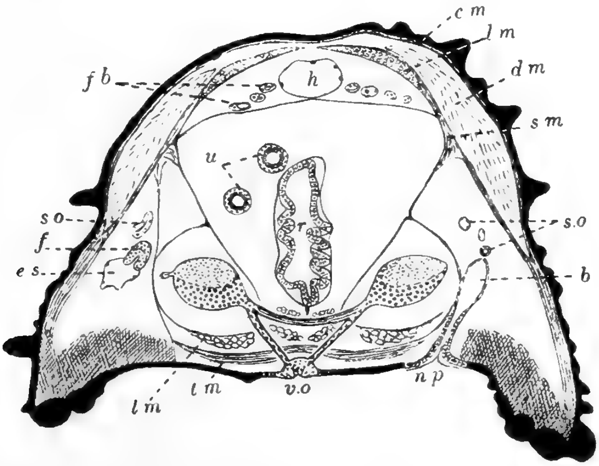

Fig. 1. Semi-diagrammatic transverse section through a young female of *P. novae-britanniae.*

The segmental organs are represented as seen in a single slightly oblique section. The structures in connection with the nerve-cords are inserted from a combination of several consecutive sections. The ventral nerve-cords are connected with each other by a commissure and with the ventral organ by cellular cords. *b.* bladder of segmental organ. *c.m.* circular muscles. *d.m.* diagonal muscles. *e.s.* Sedgwick's end-sac. *f.* funnel. *f.b.* pericardial cell-groups (so-called fat-bodies). *h.* heart. *l.m.* longitudinal muscles. *n.p.* nephridiopore (a portion of the cuticle is shown entering the ectodermal portion of the excretory tubule). *r.* rectum. *s.m.* sagittal muscles. *s.o.* segmental organ. *t.m.* transverse muscles. *u.* uteri. *v.o.* ventral organ.

There are no segmental organs corresponding to the last pair of legs, either in male or female, in this species; and in the male I have not found a dilated bladder in the nephridia of the 20th and 21st leg-bearing segments. In my sections through these segments the proximal excurrent portion of the nephridium is simply tubular.

Female Reproductive Organs.

On opening a mature female, the first structures to meet the eye are the coils of the uteri and the ramifications of the slime-glands (Fig. 12). The latter extend backwards as far as the ovary, and their smaller branches cohere and intermingle with the convolutions of the uterus. It may be that the slime-glands of Peripatus are comparable to, if not homodynamous with, the cement-glands of Cirripedes, which also interdigitate with the genital organs.

Ovary. The ovary lies primitively dorsally and is attached to the floor of the pericardium approximately in the region of the 21st and 22nd pairs of legs. It appears however from at least one of my dissections either that the floor of the pericardium is capable of being much stretched or that the attachment of the ovary can be drawn out as a ligament, because in the first adult female opened by me, a drawing of which is reproduced in Fig. 12, I had at first some difficulty in finding the ovary, as it was almost completely concealed to the right and below the convexity of the descending portion of the left uterus. By turning the latter aside, the two whitish, closely approximated receptacula seminis came into view. In this example the ovary was coherent with the uterine wall, and a portion of the latter had to be removed and mounted together with the ovary.

The ovary consists of two hollow tubes with thin, folded walls, provided with follicular outgrowths which project into the body-cavity (haemocoel) (Fig. 16). The two cavities end blindly at one end and are separated from one another by a thin septum except near the opposite end, where the cavities unite into a common chamber. The latter communicates by a single aperture with the oviducts which immediately divaricate (Fig. 17). From my preparations it appears that sometimes the oviducts communicate with the ovary at or near its posterior end and sometimes near its anterior end. In Fig. 16 the erect portion of the ovary which enters into connection with the oviducts is obviously posterior. That portion of each oviduct which lies between the ovary and the receptaculum seminis differs in the character of its walls from the rest of the genital duct. The lumen is narrow and the epithelium columnar. In surface view the cells seem to interlace with one another. It requires a special name and I shall call it the *infundibulum.*

Thus *the thick-walled infundibula stand in essentially the same relation to the ovarian chambers as the thick-walled funnel of a nephridium does to its thin-walled end-sac.*

The contrast between the infundibula or oviducal tubes and the ovarian tubes which is so striking in *P. novae-britanniae* does not seem to be exhibited in the Neotropical species and has not been remarked upon in the Cape species. In the character of its ovary the Neotropical Peripatus differs fundamentally both from the

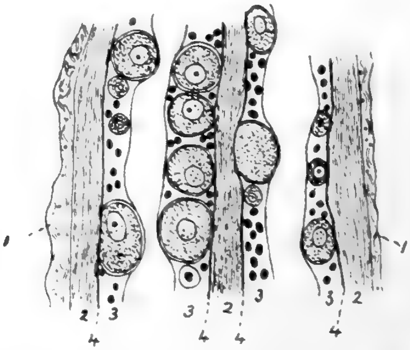

FIG. 2. HORIZONTAL SECTION THROUGH THE OVARIAL TUBES OF *P. edwardsii*. [After Gaffron.]

1. Peritoneum traversed by tracheae.
2. Tunica muscularis.
3. Germinal epithelium.
4. Tunica propria.

New Britain species and from the Cape and Australasian forms. The ovarian tubes in the subgenus Peripatus (see above, p. 3) have thick walls composed, according to Gaffron, of exactly the same layers as the uterine wall, namely, peritoneal investment, tunica muscularis, tunica propria and [germinal] epithelium. The ova mature in situ (Text-figure 2) and make low projections towards the lumen of the ovarian tube, the basal membrane (tunica propria) of the germinal epithelium maintaining its even course below the ova. They may be called "epithelial ova" in contradistinction to the "follicular ova" of the other forms.

In the other three subgenera (see p. 3) the wall of the ovarian tubes is thin and the ova do not retain their epithelial position during maturation, but they cause the wall of the ovary to project in the form of follicles which are attached to the ovary by longer or shorter stalks and hang freely into the central division of the body-cavity (haemocoel) (Fig. 18). In *P. novae-britanniae* I do not find a tunica muscularis distinct from the peritoneal investment of the ovary, and there is no regular tunica propria. In these respects, the present species resembles *P. capensis* and *P. novae-zealandiae* (Sheldon 21).

These facts have their bearing on the interpretation of the morphological character of the ovarian tubes themselves. It is possible that these are not strictly homologous structures throughout the genus Peripatus (see below, section on Receptaculum ovorum).

The ova of our species contain granular protoplasm and are without yolk; when fully formed they measure about ·11 mm. in diameter. In point of size they are therefore intermediate between the Neotropical and the Cape species.

Receptacula seminis. The infundibuliform oviducts, which have the shape of ram's horns, lead direct from the ovary to the corresponding receptacula seminis.

Before reaching the receptaculum seminis, each oviduct communicates by a short canal with the uterus. In Fig. 17, this cross-way has the appearance of being a secondary connection. Gaffron (6) has described the origin of the receptaculum seminis by a looping up of the genital duct, the two folds which combined to produce the loop then fusing together, so that the lumen of the duct becomes continuous past the receptaculum seminis with which it is connected by two ducts (Text-figure 3).

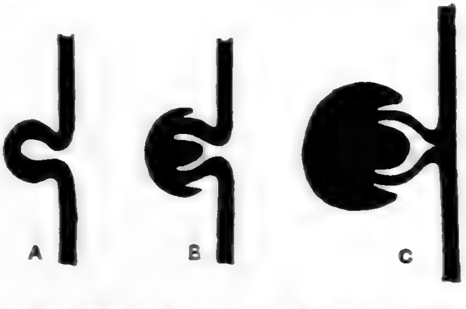

FIG. 3. DIAGRAM TO ILLUSTRATE THE MODE OF FORMATION OF A RECEPTACULUM SEMINIS WITH ITS TWO DUCTS.
[Simplified after Gaffron.]

In A the oviduct is simply looped.
In B the convex portion of the loop has begun to enlarge and to cause lobe-like projections.
In C the angles of the loop have met and fused.

The receptaculum seminis of Peripatus, besides presenting the peculiarity of a double duct, is very remarkable on account of its occurrence in the immediate neighbourhood of the ovary, far removed from the vagina. It occurs in all the subgenera with the exception of the Cape form: and it is always paired. In the young female, 17 mm. long, to which Fig. 17 relates, the receptacula seminis were quite empty. In older specimens, whether there are few or many embryos in the uteri, there is an abundant supply of spermatozoa in the receptacula seminis: and, as they probably arrive there by way of the vagina, it seems extremely likely that fecundation takes place once only, in other words, that when a female reaches maturity, fecundation takes place, the receptacula seminis are filled with spermatozoa and then ovulation begins. After the embryos have begun to pass into the uterus no more fecundation can take place. In the Cape Peripatus, the conditions are widely different. In the absence of receptacula seminis, the spermatozoa penetrate into the ovary itself and fill up its cavity (Moseley 14). Moreover they appear rarely if ever to travel to the ovary by way of the vagina, but they reach the ovary from the outside, being probably injected into the body-cavity through the body-wall by the process described by Whitman as *hypodermic injection*. In the case of leeches and other forms, this has been satisfactorily observed (Whitman 24). In *P. capensis* Sedgwick (18) found that the small spermatophores characteristic for this species were deposited upon any part of the body of the female. This observation, combined with Moseley's description, confirmed by Sedgwick and Sheldon, of the ovary filled with spermatozoa some of which projected through the wall of the ovary into the body-cavity, is enough to justify Whitman's suggestion that hypodermic injection of spermatozoa takes place in Peripatus as well as in leeches.

Receptaculum ovorum. In the Neotropical Peripatus there is a thin-walled diverticulum from each oviduct between the ovary and the receptaculum seminis. This sac was mentioned and figured by Grube (7), but its true physiological nature was first ascertained by Kennel (11). This structure only occurs in one known subgenus, Peripatus s. str.

Sedgwick suggested that it was morphologically equivalent to his nephridial end-sac. In this case therefore the lumen of the ovary is merely a continuation of the lumen of the oviduct, and the ovary and its duct are not two structures but one structure. And this deduction is confirmed by the anatomical facts. The funnel of the nephridium would thus be represented by the pore leading from the oviduct into the receptaculum ovorum. This is also borne out by the histology of the parts in question (Kennel 11, Pt. II) and, as is known, the receptaculum ovorum was described by Gaffron (6) as the "Ovarialtrichter." In *P. novae-britanniae*, as we have already indicated, the appearances are in favour of a distinction being drawn between ovarial tube and oviduct.

The presence and absence of receptacula ovorum seem to be correlated with the occurrence of what I have called "epithelial ova" and "follicular ova" respectively. In the latter case the stalks of the follicles represent so many secondary ducts discharging into the main ovarial cavity. *The latter therefore functions as receptaculum ovorum.*

In *P. capensis*, Sedgwick described the segmental origin of the generative organs from the median or generative portions of somites XVI to XX inclusive. The generative ducts arise from the 21st pair of somites (somites of the anal papillae). "The nephridial portion of the twenty-first somite," says Sedgwick (Monograph, p. [illegible]), "does not separate from the median or generative portion, but remains in connection with the latter and forms the channel by which the generative part of the coelom communicates with the exterior. The generative ducts are therefore modified nephridia, but it is important to notice that the connection between them and the generative tubes is not to be compared with the so-called funnel of the normal nephridia. The latter is merely a special portion of the lateral portion of the somite, and does not seem to be represented in the twenty-first somite."

According to Kennel (11), the sexual organs of *P. edwardsii (trinidadensis)* are nothing else than the metamorphosed segmental organs of the penultimate leg-bearing segment.

In the last-named species therefore the generative organs arise in one segment only. Thus from the beginning to the end the female generative organs of *P. edwardsii* and *P. capensis* appear to differ radically from one another.

In *P. capensis* the ovarial cavity acts at once as receptaculum ovorum and receptaculum seminis, and is in this respect unique.

In *P. novae-britanniae* the anatomical relations of the infundibula and ovary involuntarily suggest an exact homology with the funnel and end-sac of a nephridium. I have no observations on the development of these organs.

Uteri. The only parts of the female generative system whose topography is fairly constant, are its two terminal portions, ovary and vagina; what lies between has no regularity whatever in its disposition and it is impossible, from my material, to say whether any particular arrangement is the normal one. In the individual figured in Fig. 12, the outer or vaginal ends of the uteri each contain a pigmented embryo nearly ready for birth. The portion of the uterus which lies posteriorly over the rectum appears from the figure to belong to the right side of the animal. It is really the left uterus and its narrow end passes to the left side and bends under the left nerve-cord to open into the vagina. In another specimen the uteri on being exposed, presented a nearly identical appearance to the one just referred to, but the uterus lying over the rectum in this case turned out to be actually the right uterus and its narrow terminal portion bent down and passed under the right nerve-cord to open into the vagina.

Each uterus on leaving the region of the ovary passes forwards for a varying distance and then bends sharply round upon itself to lead back to the vagina. These two portions of the ∩-shaped uterus may be referred to as the ascending and descending portions respectively. The distal portion of the uterine tubes, that is the portion which abuts on the receptacula seminis, is much coiled and the stiff coils will not easily unravel in preserved specimens. In Fig. 13, the ascending right uterus, after emerging from the coil, is seen to pass over and then under the ascending left uterus. Up to this point both uteri are directed towards the ventral side of the body-cavity; but now the ascending right uterus rises to the dorsal side of the intestine, and retains its dorsal position until its descending portion reaches approximately the point where the intestine passes into the rectum, when it becomes concealed below the left uterus for the rest of its course to the vagina. The ascending left uterus (Figs. 3, 4) has a straight course forwards along the ventral wall of the body-cavity to the right of the intestine until it bends over into the descending portion of the same uterus, the loops of which were deeply imbedded in the wall of the gut. On reaching the point where the intestine passes into the rectum the descending left uterus passes below the alimentary canal from the right side to the left and finally, as we have seen, passes over the rectum with an arcuate bend until it reaches the posterior end of the body, when it passes below the left nerve-cord into the vagina.

In another specimen the entire uterine system lies to the left of the intestine and neither uterus passes below the intestine from one side of the body to the other. In this individual also the distal portions of the ascending uteri embrace and loop round a bend of the right descending uterus (Fig. 15).

There is some evidence to show that, accompanying parturition, either simultaneously or subsequently, a resorption or reconstitution of that section of the uterus from which an embryo has been liberated, takes place. In addition to direct signs of shortening in the terminal (vaginal) region of a uterus, there is the fact that in one female 42 mm. long the uteri extended 15 mm. from the posterior end, while in another which measured 40 mm. in length, the uteri extended 27·5 mm. from the posterior end. Evidence of resorption of the uterus after parturition is also shown by the fact that partially pigmented embryos occurred behind the nearly ripe embryos shown in Fig. 12. Whereas in other cases non-pigmented embryos occur next to the vagina—thus developing *in situ.* Finally the terminal narrow portion of the uterus lying between the oldest embryo and the vagina, is of varying length. In the Neotropical forms, Kennel has given reason for supposing that a permanent shortening—i.e. resorption—of the uterus is a necessary phenomenon in parturition. An analogous phenomenon has been observed in widely different animals, e.g. Salpa.

MALE REPRODUCTIVE ORGANS.

It is in the constitution of the male reproductive organs that *P. novae-britanniae* exhibits what is perhaps its most distinguishing anatomical characteristic.

The tubular, more or less hook-shaped, testes debouch into the large ellipsoidal seminal vesicles, as usual at one side of the latter some distance from the anterior tip. The coiled vasa efferentia emerge from the seminal vesicles from a point on the opposite side some distance from the posterior tip. The coiled vas efferens of each side proceeds backwards for a certain distance, when the coils cease and the duct is continued on each side as the straight vas deferens to the extreme posterior region of the body (Fig. 19). Arrived there, each vas deferens passes under the corresponding nerve-cord and then the two meet together in the middle line to form the median ductus ejaculatorius (Fig. 20). Thus *the unpaired portion of the male duct is hardly any longer than the vagina.* Its actual length would hardly exceed 1·5 mm. including the projecting papilla.

In *P. edwardsii* according to Gaffron the unpaired portion of the male genital duct attains the remarkable length of 7 centimetres.

In *P. capensis* the unpaired portion of the duct is much shorter than in *P. edwardsii*, but is still a fairly long bent tube which does not occupy the median line and is quite asymmetrical (Moseley 14; Balfour 2). According to Moseley's account, which was confirmed by Balfour, the unpaired terminal duct of the Cape species appears to be "a continuation of one of the ducts only, the other duct being cut short and entering "from the side." It may be either the right or the left vas deferens which is directly continued into the terminal duct. Moseley goes on to say that "from the way in which "one duct passes under the nerve-cord [i.e. nerve-cords] and not the other, and from "the curious sharply-turned loop formed by this latter duct on entering its fellow, it "would appear that the original condition had been almost exactly similar to that existing "in the female organs." (Moseley 14, p. 769.)

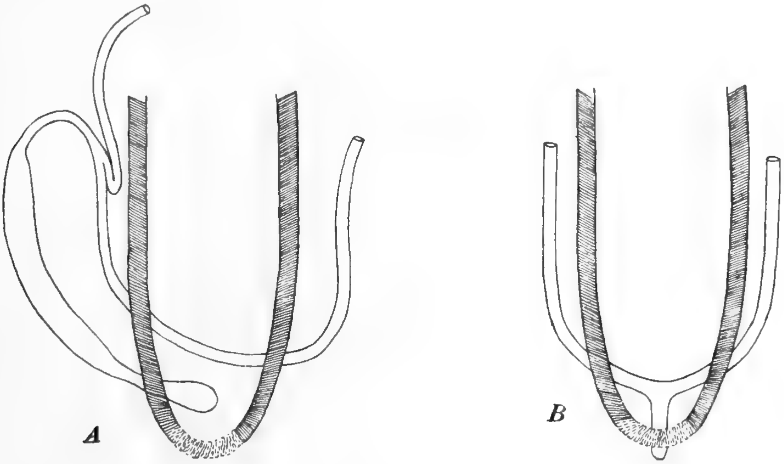

FIG. 4 A AND B. TERMINAL PORTIONS OF THE MALE GENITAL DUCTS OF *P. capensis* (A) AND OF *P. novae-britanniae* (B). The shaded structures represent the ventral nerve-cords which pass into each other behind by the supra-rectal commissure; A is after Moseley, B is original.

Thus in the symmetrical manner of formation and in the short median course of its ductus ejaculatorius, the male of *P. novae-britanniae* exhibits a distinctly primitive feature as compared with all species hitherto described. This is a matter of some importance in view of the fact that hitherto "no gradation of structure within the genus" (Sedgwick) had been observed.

In *P. novae-zealandiae* according to Miss Sheldon (22) the unpaired portion of the male genital duct is much longer than in *P. capensis* and closely resembles that of *P. edwardsii*. It seems to me that the length of the unpaired portion of the genital duct is in correlation with the production of spermatophores. In *P. capensis* (Sedgwick, Sheldon) the spermatophores are little oval bodies consisting of a thin structureless case filled with spermatozoa.

In *P. novae-zealandiae* (Sheldon 22) the posterior part of the duct contains "an enormously long spermatophore which is surrounded by a horny case" and has "precisely the same structure as that described by Gaffron in *P. edwardsii*."

In *P. edwardsii* we are informed by Gaffron (6, p. 154) that the spermatophore is a thread-like structure exceeding 4 centimetres in length. This spermatophore has a definite and complicated structure for the details of which Gaffron's excellent Memoir should be consulted.

In *P. novae-britanniae* the vasa efferentia, vasa deferentia and ductus ejaculatorius contain abundant loose felted spermatozoa, *but I have observed no spermatophore.*

It must not be supposed that the short median ductus ejaculatorius of the New Britain species is the equivalent of the entire unpaired duct of *P. edwardsii* and *P. novae-zealandiae* or even of *P. capensis*, but it is only equivalent to that portion of the duct in these species which is lined by a chitinous intima and is the true ductus ejaculatorius. In the Cape species the greater part of the terminal duct, upwards of three-fourths, is ductus ejaculatorius and is characterised by its muscular wall and rich supply of tracheae (Moseley). In *P. edwardsii* the terminal portion of the unpaired duct which, by its muscular walls and chitinous intima, discloses the character of an ejaculatory duct has a length of 2 centimetres (Gaffron).

In *P. novae-britanniae* what there is of an unpaired duct is all ductus ejaculatorius and is alone lined by a chitinous intima. [See Fig. 20 and remarks thereon.]

PYGIDIAL GLANDS. These are a pair of large tubular glands only present in the male and homologous with the accessory glands of the African and Australian species and with the anal glands of the Neotropical species. They resemble the corresponding glands of the other species in their general structure but differ altogether in their method of discharging to the exterior (Figs. 19—22). The glands generally have a dorsal position. The anterior moiety is whitish in the preserved condition while the posterior moiety has a straighter course and a smooth glistening brown-coloured surface with a white axis running up the centre of the tube. The appearance of a white axis is presumably caused by the chitinous intima which lines the ectodermal portion of the gland. The whitish, coiled, anterior portion of the gland is the mesodermal portion. Upon arriving near the posterior end of the body, the two pygidial glands enter a large muscular bulbus, the pygidial bulbus (Figs. 19—22, *p. b.*). The latter opens to the exterior in the dorsal middle line immediately above and in front of the upper margin of the terminal anal opening (Fig. 19, *p. o.*). In *P. edwardsii* the anal glands are so called because they open at each side of the anus as shown by Gaffron. In *P. novae-zealandiae,* they are described by Miss Sheldon as accessory glands opening near the posterior extremity of the body, the two openings lying outside the nerve-cords and therefore widely separate. In *P. leuckarti,* Fletcher has described the external openings of the accessory glands as occurring close together between the generative orifice and the anus. Finally in *P. capensis* they discharge into the terminal portion of the ductus ejaculatorius (Balfour 2).

In *P. novae-britanniae* the muscular coat of the ductus ejaculatorius is not very thick, while the pygidial bulbus occupies a large portion of the mass of the body in that region, and this is particularly the case in late uterine embryos. In *P. capensis* on the other hand the muscular coat of the terminal end of the ductus ejaculatorius is extremely thick, about as thick, in fact, as the pygidial bulbus of our species; and the two narrow accessory glands enter the muscular mass of the ductus in the Cape species, exactly as the ducts of the pygidial glands enter the bulbus in *P. novae-britanniae*. We have here, therefore, an interesting example of compensating growth.

In *P. novae-britanniae* the external opening of these glands leads into a narrow tube with smooth epithelial lining and chitinous intima. After the median tube has divided and the paired ducts emerge from the bulbus, the lumen soon increases slightly in diameter. At the point where the ectodermal portion of the tube is continued into the mesodermal portion[1], the lumen becomes suddenly narrowed and the intima ceases. But this constriction is not visible externally because the muscular coat becomes proportionately thicker in this region. The enlarged muscular coat and the reduced lumen continue for a short distance and then the lumen gradually enlarges *pari passu* with a diminution in the thickness of the tunica muscularis. Finally, the anterior portion of the gland appears in section as a thin-walled tube with very wide lumen, lined by a well-marked smooth epithelium.

The preceding account of the finer anatomy of the pygidial glands (apart from the highly characteristic bulbus) differs from Gaffron's description of the anal glands of *P. edwardsii* chiefly in the fact that in the latter, the external aperture of each gland leads into a wide chamber with folded walls, presenting the same appearance as the rectum itself. So that they are well called anal glands and I think it is advisable to give separate names to structures, even though obviously homologous, when they have such very different anatomical relations.

Kennel (11, Pt. II, p. 70) has shown that in the Neotropical species whose development was studied by him, the anal glands are the modified nephridia of the apodal anal segment. This fact is confirmed by the position of the openings of the corresponding glands in *P. novae-zealandiae* outside the nerve-cords (Sheldon). Kennel further states that a rudiment of these glands is laid down in the female embryos and subsequently undergoes degeneration.

Why do these glands differ so very much in their manner of discharging to the exterior, in one case opening coincidently with the anus, in another opening into the ductus ejaculatorius, in another opening independently with paired apertures between generative pore and anus, and in a fourth case opening by a median dorsal aperture? This is no doubt a difficult question to answer, but the fact that such differences do occur is one of considerable interest. For my part, I am tempted to think that these accessory, anal and pygidial glands of Peripatus are capable of throwing light upon the morphological nature of the Malpighian tubules of Insects and some other Arthropods and of providing an explanation of the fact that these structures are sometimes ectodermal and sometimes entodermal.

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[1] Gaffron does not use the word "mesodermal" in describing the anterior portion of the anal glands of *P. edwardsii*, but he described it as "entodermal." I do not know whether he made any mental distinction between entoderm and endoderm—but in any case Kennel objected strongly to the term. If it were not for the risk of falling foul of the germ-layer theory, I should myself prefer the word "entodermal" not as signifying any relation to the technical term "hypoblast" but in simple contrast to "ectodermal." The mesoderm has not the same value as ectoderm and entoderm as has long been realised by many zoologists—but this is a controversial subject. Certainly Gaffron did not mean "hypoblastic" when he used the term "entodermal."

VENTRAL ORGAN AND PAIRED ECTODERMAL ORGANS OF THE ANAL SEGMENT.

Approximately in the same transverse plane with the pygidial orifice, I have observed five shallow epidermal involutions, two dorso-lateral, two ventro-lateral and one median ventral above the ductus ejaculatorius (Fig. 22).

Their symmetrical disposition indicates that they are definite structures and they bear a strong resemblance to the *ventral organs.* Moreover the median ventral involution is, in fact, the *ventral organ of the anal segment,* and it occurs also in the female behind the vulva, between the latter and the anus. Of the other involutions I have only observed the ventro-lateral pair in the female where they occur in the same transverse plane with the supra-rectal commissure.

In Fig. 22 the section is taken slightly posterior to the supra-rectal commissure immediately in front of the line of insertion of the free male papilla on to the body-wall, and therefore in the male the ventral organ of the anal segment opens into the angle formed between the penis and the body-wall. In sections through a late male embryo these structures present more the appearance of ectodermal thickenings with slight traces of involution exactly like the ventral organs. The occurrence of paired organs in the anal segment possibly homodynamous with the ventral organ of the same segment is a fact of some interest and importance.

DEVELOPMENT.

The amount and state of preservation of my material enable me to give an account of the development of *P. novae-britanniae* complete enough to render intelligible the principle according to which it takes place. As I have already mentioned, all stages of development from the segmenting ovum to the fully formed and pigmented embryo are to be found in one adult female.

The first intimation which I received that there was anything remarkable about the embryos of this species was from an examination of the embryo represented on Plate III, Fig. 35. In this figure it is seen that the anterior extremity of the embryo is not coincident with the insertion of the antennae, but there is a long process of the body extending nearly to the tip of the recurved abdomen and covering over the ventral surface of the embryo like a cap, or better still perhaps, like an amnion. It is however not an amnion, but is the remains of a large embryonic vesicle which promotes the nutrition of the embryo and may therefore be called a *trophic organ.*

For convenience of treatment the development may be divided into twelve stages, which I will at once enumerate.

Stage I. segmentation stages.
„ II. formation of blastodermic vesicle.
„ III. embryonic area (including primitive streak) at hinder end of blastodermic vesicle (Fig. 23).
„ IV. caudal extension of blastodermic or trophic vesicle, so that the embryonic area becomes removed from posterior end (Fig. 24).
„ V. invagination to form the ventral surface (Fig. 26).
„ VI. forward free growth of primitive streak (Fig. 27).

Stage VII. oblique U-shaped stage—primitive streak is directed obliquely transverse (Fig. 29).
„ VIII. involute or Ʊ-shaped stage—primitive streak directed backwards (Fig. 30).
„ IX. spiral or S-shaped stage (Fig. 33).
„ X. biflexed or ⊂⊃-shaped embryo (Fig. 35).
„ XI. embryo with simple cephalic flexure or ⊂—-shaped embryo.
„ XII. pigmented embryo nearly ready for birth.

Stage I. As mentioned above, the egg of *P. novae-britanniae* is small and without yolk, and averages rather more than one-tenth of a millimetre in major diameter. During the first two stages the egg-membrane is remarkably thick (·0075 mm.) and must require special treatment in order to get the contained embryos properly preserved. In my sections through these stages they were all hopelessly collapsed, so that I can give no details as to the process of segmentation. There are indications however that up to a certain point the segmentation proceeds very much as in the Neotropical species as described by Kennel and Sclater, and that it results in a solid morula. But how the inner layer is formed I am quite unable to say. Most likely it arises *in situ* in the solid morula as in the Mammalian ovum.

Stage II. I have some preparations of embryos in the second of the above stages where an oval cavity with sharply defined contour has appeared in the anterior portion of the embryo, and apparently does not yet extend into the posterior third of the embryo. At this stage the embryo measures ·33 mm.

Stage III. In Stage III. the embryo measures about 1 mm. in length. The vitelline[1] membrane has become much thinner and consequently this is the first stage of which I obtained adequately preserved representatives, capable of being mounted *in toto* or of being cut into sections. I had two or three embryos at this stage, one of which is shown in Pl. II, Fig. 16, and another in Pl. III, Fig. 23. The embryonic area proper is confined to a thickened tract at the posterior-ventral side of a large oval vesicle. The rest of the wall of the vesicle is composed of embryonic ectoderm and endoderm, which however take no immediate part in the formation of the embryo. Physiologically it corresponds exactly with the peripheral epiblast and hypoblast of a Mammalian blastodermic vesicle. As in the latter, it is the ectoderm which is chiefly concerned in the absorption of nutriment for the use of the embryo as evidenced by the vacuolar character of the cells. In view of this remarkable physiological resemblance of this embryonic vesicle to the blastodermic vesicle of a Mammal we may well describe it as a trophoblastic structure, adopting the word trophoblast in the sense in which it has been employed by Hubrecht in relation to the peripheral epiblast of the Mammalian embryo. (Hubrecht 9.)

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[1] In this species vitelline membrane and egg membrane are used as synonymous terms. In *P. capensis* according to Sedgwick and *P. novae-zealandiae* according to Sheldon there are two membranes, an outer firm membrane and an inner more delicate membrane. The former is often spoken of as the egg-shell or egg-membrane or chorion, and the latter as the vitelline membrane.

Sections through the trophoblastic or trophic vesicle of the present species in front of the posterior ventral embryonic plate show that the wall of the vesicle consists of two layers. The outer layer, the ectoderm, consists of cubical cells of moderate height with vacuolar contents, each containing a large nucleus with usually two "nucleoli." The nuclei of the trophoblastic ectoderm differ from those of the cells forming the embryonic plate, in their staining properties; they take the stain (haematoxylin) less deeply than do the latter. The inner layer, or endoderm, consists of a thin irregular layer of protoplasm applied against the inner surface of the ectoderm and contains scattered globular nuclei which project into the cavity of the vesicle.

The *cavity of the vesicle* in the early stages is as a rule quite free from foreign bodies of any description, but at a later stage (Stage VIII.) we shall find that it contains many wandering endoderm cells with large nuclei containing a chromatin reticulum with wide meshes—the latter character occurring frequently also in the endodermic epithelial nuclei. These in-wandering cells may be called *trophocytes*, and compared with the *vitellophagous* cells in the insect ovum.

The ectoderm of the embryonic plate, except over the primitive streak, consists of a high epithelium with large nuclei densely packed in several tiers. The endoderm here does not differ materially from the peripheral endoderm; sometimes the nuclei are set more closely together than in the latter.

Sections through the primitive streak of an embryo at this stage are given in Pl. IV, Figs. 39—40. Figure 39 passes through the primitive groove. As the series is traced forwards this groove nearly flattens out until, as the anterior portion of the streak is approached, another depression is met with (Fig. 40). This second depression may be called the cranial groove, since in later stages it is bounded by the procephalic lobes.

The interpretation which my preparations lead me to put upon them is that the stomodoeal involution bears a similar relation to the cranial groove to that which the proctodoeal involution bears to the primitive groove.

The extraordinary resemblance of the embryo at this stage to an Insect embryo with short superficial embryonic area on the ventral side of the egg, as occurs in some Orthoptera, as also its likeness to any Insect embryo before the infolding of the embryo (see Korschelt and Heider, 13, p. 774), cannot fail to strike the reader.

When we come to compare the trophic folds of the embryo of *P. novae-britanniae* with the amniotic folds of Insects, this remarkable similarity of the embryos should be borne in mind (see below, p. 32).

Stage IV. Figures 24 and 25 represent portions of two blastodermic vesicles in which the embryonic area no longer has the posterior position seen in the preceding stage. The trophoblastic wall of the vesicle has grown backwards beyond the embryonic plate, so that the latter lies on the ventral side of the vesicle at some distance from the posterior end. In Fig. 24 the embryonic tract has not yet arrived at its definitive location. Fig. 25 is somewhat farther advanced, and it shows well two pits which denote the positions of the primitive and cranial grooves respectively. The ventral surface which commences in the next stage appears as a transverse groove occupying the region between these two grooves.

Figures 46—50, Plate IV, are taken from a series through the embryo represented in Pl. III, Fig. 25, and will, I hope, suffice to elucidate the structure of the embryo at this stage. As these figures are described as fully as possible in the explanation of the plates at the end of this memoir, I think it will not be necessary to repeat here what is stated there.

Stage V. (Pl. III, Fig. 26). In this stage a transverse groove has formed across the centre of the embryonic area, and *pari passu* with the appearance of the groove, the ectoderm underlying the groove has become a very thin layer with nuclei arranged in a single row. In the rest of the embryo and in the whole of the embryonic plate of the foregoing stages, the nuclei of the ectoderm are arranged in multiple rows. This transverse groove, which is accompanied by local thinning out or flattening of the ectoderm, is the Anlage of the ventral surface of the animal. It finally separates the cephalic end from the caudal end. The embryo is now to all intents and purposes bent double upon itself, but the doubling up is a passive procedure and is effected *in situ* by the involution which gives rise to the ventral surface. The flexed embryo is produced, as I have just said, *in situ*, and a somewhat similar method of development *in situ* has been described by Miss Sheldon in *P. novae-zealandiae* where, as is known, the egg is of large size and contains abundant yolk.

Stage VI. (Pl. III, Figs. 27—28). I had one very satisfactory embryo belonging to this stage, and it is faithfully portrayed from the frontal aspect in Figure 27. The total length of the cylindrical blastodermic vesicle, which is now proportionately at its maximum development, was 3·25 mm. It will be noticed how small a tract of this enormous trophoblastic organ is occupied by the embryo proper. It is from the attentive examination of such an embryo as this that one may obtain the best impression of the very singular mode of nutrition of the embryo of *P. novae-britanniae*.

The ventral transverse groove now appears crescentic in shape in surface view. This effect is due to the growth of the primitive streak which becomes raised up from the surface of the vesicle and projects forwards, arching over the ventral surface. As in all other cases where it occurs, the primitive streak is here essentially the growing point of the embryo. It consists of a solid undifferentiated mass of cells which by their remarkable power of proliferation cause the caudal end of the embryo to twist and turn in the manner characteristic for this species. Thus the anterior region of the embryo is practically a punctum fixum, and the contortion of the embryo in a later stage is almost entirely due to the growth which is taking place at the primitive streak. At this stage the free growth of the latter has already commenced but the embryo is still symmetrical, and that is why it is so instructive. It cost me a struggle to cut this unique embryo up into sections, but it had to be done and the result was satisfactory. So well were these embryos preserved in the formol solution which I employed, that mitotic figures are frequently met with in the mesoderm. In surface view the somites of the anterior region were distinctly visible, and the first three pairs of somites can be seen in Fig. 28. From the figure referred to it will be at once evident that a single transverse section may involve several pairs of somites. For at this stage, as in the preceding stage, the transverse diameter of the embryo proper is nearly twice the length of its antero-posterior axis.

Figures 51—57 will sufficiently elucidate the structure of this embryo. Fig. 51 is taken through the centre of the primitive streak which, as already described, now projects in a tongue-like manner over the depressed ventral surface of the embryo. The greatest number of somites which I have met with in a single transverse section was five on each side in sections passing posterior to the primitive streak and tail-swellings, through the region of the backwardly directed cornua of the crescent-shaped embryo.

In consequence of the folding over of the primitive streak, the primitive groove now appears to lie on the reversed side as compared with previous stages (cf. Figs. 39, 48 and 51).

I would further direct special attention to the condition of the stomodoeum in this stage. This is the first appearance of the true stomodoeum, and its lumen is enclosed within the thickness of the ectoderm at the base of the cranial groove on each side of which the praeoral lobes are commencing to project (Fig. 55). This enormously thickened ectoderm is the rudiment of the cerebral ganglia, and only occurs through a few sections. A section or two in front of that shown in Fig. 55, the ectoderm undergoes considerable reduction in thickness, and the blind end of the stomodoeum is cut tangentially (Fig. 56). Thus the stomodoeum precedes the proctodoeum in time of appearance, and this holds good also for *P. novae-zealandiae* (Sheldon 20) and *P. edwardsii* (Kennel 11).

Stage VII. (Plate III, Fig. 29). In this stage the primary symmetry of the embryo is lost owing to the oblique direction into which the caudal end of the embryo becomes bent as a necessary result of its continued growth. The first pair of somites are now present as prominent lobes. They are not free however but attached by their dorsal sides throughout their whole extent to the wall of the trophic organ. This condition will be again met with in the next stage.

Traces of the crescentic form of the embryo as seen in Stage VI. can still be observed in this embryo. The primitive streak is the cause of the contorted shape of the embryo. The free caudal extremity is now no longer directed forwards as it was in the last stage but it is directed to one side and consequently the whole embryo is twisted on to one side. The embryo is now in a state in which transverse sections are of next to no avail. The total length of the embryonic vesicle shown in Fig. 29 was 4·25 mm. In Fig. 29 *a* another embryo belonging to this stage is shown in which the primitive streak is directed quite transversely. The praeoral lobes and the caudal process are the prominent features of the embryo at this stage.

Stage VIII. (Pl. III, Fig. 30). In this stage the continued flexure of the embryo brought about by the growth of the primitive streak has resulted in the restoration of a certain amount of symmetry in the topographical relations of the various regions. Accordingly sections through an embryo at this stage are instructive.

In addition to the more or less continuous endodermic layer which lines the wall of the *trophic cavity*, the latter now contains numerous wandering amoeboid cells or trophocytes, which have been mentioned above. These are endoderm cells which have relinquished their epithelial connections and wandered into the cavity of the vesicle. They are present in great numbers in this stage and up to Stage X. All the endoderm cells appear to be potential trophocytes.

In Fig. 30, the free-growing point or caudal extremity of the embryo is directed backwards so that transverse sections will pass accurately through the primitive streak

(Fig. 65). I think Figure 31 speaks for itself. The enormous trophic organ (trophoblastic vesicle) which is such a remarkable characteristic of these embryos, is here clearly seen to be a dorsal structure. The rudiments of the appendages are clearly represented. From the preparations it is evident that the thickened ectoderm which takes part in these rudiments also gives rise to the ventral organs from which the nerve-cords are delaminated. This intimate primary union, in such a form as Peripatus, of the appendicular and the neural folds or thickenings, may be a fact of profound physiological meaning. For, presumably, the forefathers of Peripatus were amongst the earliest terrestrial animals to acquire *pedal locomotion.* When viewed from a purely physiological stand-point one is inevitably reminded of the lateral line of lower Vertebrates and its possible relation to a more or less hypothetical continuous lateral fin-fold or appendicular ridge.

The complementary functions of locomotion and equilibration[1] combined with the fact of the united origin of nerve-cords and appendages so far as the ectoderm is concerned, may go some way towards explaining or giving a reason for the divarication of the nerve-cords of Peripatus. The old idea held 40 years ago, was, that this indicated a relationship to the Plathelminthes. I think it is safe to say that this view has now a chiefly historical interest.

It might be inferred, from the double fold in the embryo at this stage, that sections through the middle region would involve three distinct portions of the embryo; and such is the case, as a glance at Figures 63—65 will show.

The stomodoeum (Figs. 59—61) is now present as a long tube opening to the exterior at its posterior end at the base of the cephalic lobes and consequently at the base of the cranial groove which lies between the latter. The stomodoeal tube extends at present straight forwards, below the ectoderm of the cranial groove, and ends blindly at its anterior end.

This stage is also characterised by the origin of the segmental organ of the 3rd pair of somites (Fig. 62). It arises, as do all the segmental organs, in the hinder somatic mesodermic wall of the somite. It is a tube opening anteriorly into the somite and ending, at present, blindly at the other end. A vestigial segmental organ in the form of a deep pit in the somatic mesoderm occurs also in the second somite but it is not shut off as a tube from the rest of the somite (Fig. 61). No other segmental organs are present at this stage, and I have not attempted to follow their further development with the limited material at my disposal. If any zoologist should have the opportunity on some future occasion of examining these embryos in the fresh condition, I should recommend him to look for the possible occurrence of cilia in connection with the somatic walls of the somites. The segmental organ of the 3rd somite at this stage looks, in my sections, as if it might be ciliated. The general absence of cilia in the adult Peripatus, except in the male genital ducts and in the ducts of the receptacula seminis in the female where they were discovered by Gaffron whose observation was confirmed by Sedgwick (19), is no doubt connected with the great reduction of the coelom in the adult.

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[1] I may be permitted to refer to what I have said on this subject in a former publication (*Amphioxus and the Ancestry of the Vertebrates*, 1894, p. 42).

In this stage the meso-somatic wall of the somite is thicker than the meso-splanchnic wall. In the latter there are often relatively wide intervals between the scattered nuclei whereas they are always compact and often many-layered in the somatic wall. In the first somite, however, the mesodermic layer is uniformly thick, the nuclei occurring throughout in a single row.

Stage IX., Fig. 33. This is the stage at which the embryo is coiled upon itself spirally. I have seen other embryos of approximately the same age as this which were not spirally coiled but merely flexed, and it may be stated that every embryo does not necessarily pass through a stage in which it is coiled exactly in this manner (Fig. 33 *a*). The caudal extremity of the body has now grown to such an extent that it has come to lie in front of the head. The cephalic end of the embryo has maintained its primitive position, and there is, as yet, no cephalic flexure but only caudal and abdominal flexures. A true cephalic flexure is met with for the first time in the next stage. The antennae have now made their appearance as outgrowths from the cephalic lobes, or to speak perhaps more correctly, the cerebral ganglia have become differentiated from the ectodermal thickenings at the bases of the cephalic lobes while the antennary portions of the lobes have increased in length and independence. This is the stage during which the lips which enclose the 2nd pair of appendages—the manducatory appendages—are formed (Fig. 37). The eye-vesicles are also present. The optic groove was present in the preceding stage (Fig. 59).

Rotation of Stomodoeum. The stomodoeum no longer extends straight forwards but is directed dorsalwards. In still later embryos the stomodoeum is seen to project as a stout funnel-like tube backwards and somewhat dorsally from the mouth (cf. Fig. 36). In the present stage it stretches dorsally and somewhat anteriorly from the mouth and is now best seen from the dorsal aspect of the animal. In earlier stages, as we have seen, it was directed straight forwards. This stage of its development is therefore intermediate between its primary forward direction and its secondary definitive backward direction. Thus, in effect, *the stomodoeum is rotated through* 180°. In the later stages it is best seen from the lateral aspect. A similar rotation, the result of differential growth, has been described by Gaffron in connection with the development of the female generative organs of *P. edwardsii*. The following is the passage referred to in the second part of Gaffron's work on the anatomy and histology of Peripatus (6, p. 147):—"Bei einem ...... Embryo von 1·8 cm. Länge ... findet man vor Allem, dass das Ovarium seine Lage um 180° geändert hat, indem es jetzt von seinem Befestigungsort nicht mehr nach hinten, sondern nach vorn gerichtet ist." (See Gaffron, *loc. cit.* Taf. XXI., Figs. 1 and 2.)

Such instances as these of the ontogenetic transposition of parts are probably of some importance. It is at least a remarkable fact that the stomodoeum of *P. novae-britanniae* occurs at first as a praeoral tube and is later transposed into a post-oral tube. This is not a mere playing with words, because, what is at first the anterior extremity of the stomodoeum becomes, after the transposition has been effected, its posterior extremity.

Stage X. (Pl. III, Figs. 35 and 36). In this stage the relative dimensions of the trophic organ and embryo have undergone a considerable change, and were it not for the remarkable procephalic prolongation of the vesicle which is still present in Figure 35, there would hardly be occasion to speak any longer of a trophic organ. In short the vesicular character of the latter is now disappearing and the trophic cavity is becoming nothing else than the definitive gastral cavity. Figure 36, which also belongs essentially to this stage, shows a variation in the flexure of the embryo, the head not being bent under and pointing (when lying in the uterus) accurately in the direction of the vagina. Moreover in this figure the trophic vesicle is more restricted than in Fig. 35 and there is only a small procephalic prolongation of it which does not arch over the ventral surface of the embryo. Possibly this embryo would never have gone through a stage with cephalic flexure. There seems to be some latitude in the amount of flexure which it is necessary for an embryo to undergo. Shortly after this stage the trophoblastic vesicle becomes quite absorbed into the composition of the embryo.

Stages XI and XII. These stages differ from one another chiefly in the amount of pigment which has been deposited in the integument and it will be convenient to treat them together. The full complement of legs is present and it is therefore possible to determine infallibly male and female embryos. They do not differ materially in size—their length, which represents approximately the length of the young at birth, averages about 15 mm.—but the male embryo has 22 pairs of ambulatory appendages and the female has 24 pairs. I have examined sections through such embryos for the purpose of confirming the determination of sex and found the conclusion well grounded. The section of an ovary, shown in Fig. 18, is from a female embryo belonging to Stage XI. In the male the sexual organs are also well differentiated and the pygidial bulbous appears even more pronounced relatively than in a mature male.

In the two oldest embryos which I obtained (belonging therefore to Stage XII) the antennae and entire dorsal surface were darkly pigmented but the ventral surface was on the whole unpigmented. The head and neck were bent under the abdomen, the 2nd leg lying in the bend. The antennae in one were stretched out along the abdomen and in the other were bent back under the head. These embryos were taken from one female and were lying in the terminal portions of the uteri next to the vagina. I have never found a darkly pigmented embryo in any other portion of the uterus than this, but I have found an unpigmented embryo in this position.

From the same female from which these embryos were taken, the embryos following them belonged, in accordance with the successional mode of development followed by this species, to Stage XI. The antennae were pigmented as in Stage XII but the dorsal surface was only very faintly pigmented, the general colour effect being whitish with faint greenish tinge.

Although in all extensive collections of Peripatus which have been made as well as in my own, the males are much less numerous than the females, yet, singular to say, the two oldest embryos in each of the two females which I opened first were all four of them males, and three of the embryos immediately following upon these respectively were females. The fourth was probably a female but I could not count the number of its appendages. This order may be a mere coincidence but at first sight it suggests a periodicity in the production of males and females and any future observer of this species should pay attention to this matter.

ORIENTATION OF THE EMBRYO. The embryos without exception, from the youngest in which the anterior and posterior poles are discernible, to the oldest, are placed in one direction. That is to say, the polarity of the embryos is constant. The anterior end of the embryo is invariably directed towards the vaginal end of the uterus. Thus, when an embryo is lying in the ascending portion of the uterus, its anterior end will point towards the head of the mother, and when it comes to lie in the descending portion of the uterus it will head towards the posterior end of the mother. Peripatus offers an interesting example of the comparatively late appearance of bilateral symmetry. There can be no question of bilateral symmetry throughout the segmentation stages. In *P. novae-britanniae* it probably appears coincidently with the formation of the trophic cavity.

TRANSFORMATION OF THE TROPHIC CAVITY OF THE EMBRYO INTO THE GASTRAL CAVITY OF THE ADULT.

Although I have correctly stated above that the trophic cavity of the embryo becomes the gastral cavity of the adult, the transformation of the one into the other is not such a simple matter as might be supposed. The embryonic endoderm which was largely used up in the production of the trophocytes in Stage VIII has to be reconstituted, and this reconstitution is accompanied by some remarkable phenomena, chief among which is the appearance of very numerous eosinophile globules in the wall of the gut. I cannot attempt to give full details as to the processes involved in the reconstitution of the wall of the gut, but can only indicate the broad outlines.

The first indication of change in the endodermic lining of the trophic cavity that I have observed, appears in Stage X. Here the endoderm with its scattered nuclei is seen to separate from the ectoderm leaving a space between the two layers. The space thus left between ectoderm and endoderm is the commencement of the definitive body-cavity or haemocoel and in it are to be observed wandering mesoderm cells. There is a fairly continuous somatic layer of mesoderm but no splanchnic layer at all yet. The latter appears to be represented at first merely by the wandering mesoderm cells. The somatic layer probably grew out from the somites between the ectoderm and endoderm before the separation of the latter to form a space. I have clear indications of this in my preparations. This observation coupled with that of Sedgwick's nephridial end-sac (see p. 9) may I think be regarded as an indirect corroboration of Sedgwick's account of the history of the somites in *P. capensis*. The cells of the endoderm have secreted a fine basal membrane, the membrana propria of the gut, to which they appear more or less loosely attached and from which they project boldly into the gastral cavity. Indications are not wanting that the wandering trophocytes apply themselves to this membrane and take part in the formation of the gastral epithelium.

In sections through an embryo belonging to my Stage XI, which is considerably farther advanced than the preceding stage, the dimensions of the trophic or gastral cavity are much more reduced, there is a wide body-cavity, and the endoderm cells which in the preceding stage were described as projecting into the gastral cavity have now attained a great height (·09 mm.) and moreover have secreted another membrane —a cuticular membrane—at their free ends. There are no definite cell outlines but between the basal membrane and the cuticular membrane are stretched irregular strands of protoplasm up the centre of which may often be traced a fine supporting axis which perhaps represents a cell-membrane. The strands of protoplasm are beset with innumerable eosinophile globules of varying sizes. The supporting axes mentioned

FIG. 5. PORTION OF THE ENDODERM OF *P. novae-britanniae* AT STAGE X.

The coarsely granular endoderm-cells or trophocytes lie upon the membrana propria projecting freely into the trophic cavity. The cells are often separated by wide intervals.

above, which stretch from membrane to membrane, obviously serve the purpose of holding the granules in position and, on the other hand, the cuticular membrane which is a temporary structure and not always if ever present in the adult, serves the purpose of providing a *point d'appui* for the strands of protoplasm with their globules. The nuclei lie near the base of this thickened epithelium.

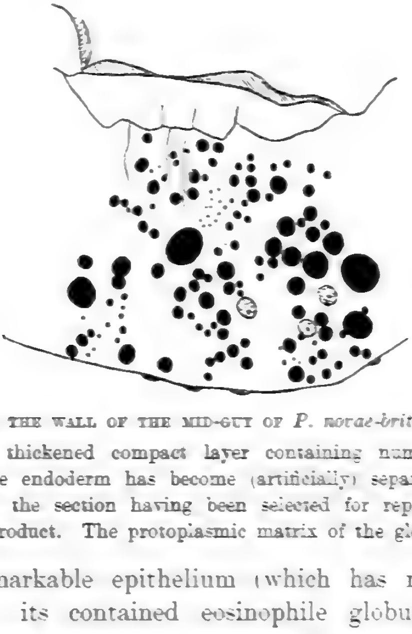

FIG. 6. PORTION OF THE WALL OF THE MID-GUT OF *P. novae-britanniae* AT STAGE XI.

The endoderm has become a thickened compact layer containing numerous eosinophile globules. The cuticle at the inner surface of the endoderm has become (artificially) separated at this point from the cells which secreted it, this portion of the section having been selected for representation in order to show the membrane as a distinct cuticular product. The protoplasmic matrix of the globules is not shown in the figure.

In Stage XII this remarkable epithelium (which has meanwhile still further increased in thickness) with its contained eosinophile globules is, in my preparations, in process of undergoing complete disintegration. The cuticle is ruptured locally and the globules are passing singly and *en masse* into the gastral cavity presumably preparatory to their resorption. In other words, the wall of the gastral cavity is undergoing a histolytic change and the scene presented while it is doing this, is one of the utmost disorder[1]. In this stage the globules average larger and are somewhat less numerous than in the preceding stage.

These globules are clearly the product of the metabolism of the endoderm cells which have converted the nutrient matter derived from the maternal fluids into

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[1] This is true of the posterior region of the particular embryo referred to. In the anterior region the changes are far less advanced although there are indications of their approach.

yolk-like bodies, possibly as a reserve food-stuff to tide the newly-born young over the first few days of its independent existence.

This late appearance of yolk-like globules, if they are not actually identical with true yolk, seems to me to be a fact of some interest.

In *P. capensis,* Balfour (2) described the gastral epithelium of the adult as consisting of much elongated fibre-like cells attaining a maximum height of nearly ·5 mm. He says "the cells are mainly filled with an immense number of highly refracting spherules, probably secretory globules, but held by Grube, from the fact of their dissolving in ether, to be fat[1]." Balfour goes on to say, "The epithelial cells are raised into numerous blunt processes projecting into the lumen of the stomach." But in his Figure 20, Plate XVIII, the gastral epithelium is represented with a smooth inner surface.

With regard to the embryos of *P. capensis,* Sedgwick says:—"In Stage G the endoderm is reduced to a layer of extreme tenuity. It soon, however, begins to increase in thickness................ The nuclei are placed in the deeper parts of the layer, and the protoplasm stains deeply and contains a large number of granules.......... In old embryos the enteron generally contains a deeply-staining material with a number of highly refractile particles in suspension. This substance is probably a secretion of the endoderm cells." Sedgwick adds that the alimentary canal in free-living adults is "permeated by a number of similar highly refracting bodies." The granules referred to by Sedgwick are indicated in one of his figures as somewhat irregular bodies—that is to say, irregular like sand-grains, not like seed-grains. I do not know whether the word granule means a body like a small grain of sand or like a small seed. But there is a considerable difference between these two interpretations, and it is very desirable to be precise. For my present purpose I make a mental distinction between *globules, spherules* and *granules,* using the last term in the sense of minute irregular bodies, or mere points.

By globules I refer to the bodies described above in late embryos of *P. novae-britanniae* which vary much in size between a minimum and a maximum.

By spherules are intended minute round bodies of generally uniform size.

I have seen Balfour's spherules in *P. capensis* and also in *post partum* young of *P. leuckarti* and *P. novae-britanniae.* They react towards staining media differently from my globules. They do not take the eosin nearly so readily as do the latter.

In his well-known work on the histology of Peripatus, Gaffron is absolutely reticent about the histology of the gut. Was it because he could not understand the appearances presented?

Unfortunately I cannot give any decisive account of what does actually take place. This could only be attempted with an abundance of fresh material at one's disposal. But enough may be said to show that the subject is one of singular interest.

From what I have seen I am led to the conclusion that Balfour's account of the gastral epithelium of Peripatus is only true of one phase—a periodically recurring phase—in the life-history of Peripatus. There are long periods during which Peripatus

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[1] The yolk-like globules in late embryos of our species were not dissolved after 4 hours' treatment with chloroform.

takes no food. During such periods life must be sustained by the absorption of reserve nutrient matter, and it would probably be found, if the subject were investigated, that the gastral epithelium undergoes profound changes and differs immensely during a period of feeding from its condition during a period of rest.

P. novae-zealandiae does not feed during the winter months (Hutton). In the colder months, *P. leuckarti* becomes sluggish and remains for considerable periods without eating (Steel). With regard to *P. capensis*, Moseley (14, p. 762) says "It is very possible that the animals feed very little or not at all during the breeding-season, but rest, as does Julus according to Newport, at the time of the production of the eggs."

It is further possible that the nutrition of the free-living Peripatus is affected during the moulting periods. Hutton's observation of the occurrence of the so-called *reserve teeth* below those in actual use rendered it probable that moulting did take place in Peripatus. This has now been finally observed by Steel (23). Steel obtained several perfect casts from both young and adult individuals. He however did not observe how often this ecdysis recurs.

In my sections through a young *post partum* female of *P. novae-britanniae*, there is no regular gastral epithelium at all, but nuclei occur in numbers irregularly distributed in the gastral cavity in the midst of a mass of foreign, presumably ingested material. I found a similar condition in a young male. From these observations I am led to the following conclusion, which is of value only as a working hypothesis. During certain periods the gastral epithelium is a regular columnar epithelium as described by Balfour, and its cells contain abundant spherules of reserve nutrient matter. At certain other periods, perhaps periods of rest, the gastral epithelium undergoes histolysis, and the endoderm performs its function of digestion by a process allied to phagocytosis, its cells having exactly the properties of the trophocytes which I have described above in certain stages of the development of *P. novae-britanniae*.

I have little doubt that in discharging its digestive function Peripatus is quite as original as it is in every other respect[1].

The young female referred to above, in which I observed this extraordinary "wandering endoderm," was the specimen in which the nephridial end-sacs were so capitally preserved.

With regard to the globules described above in late embryos of *P. novae-britanniae*, the smallest of them are much smaller than Balfour's spherules but, as already stated, they behave differently towards staining reagents. The largest globules in Stage XI measure ·0125 mm. in diameter, in Stage XII nearly ·02 mm. Possibly the larger ones are sometimes produced by coalescence of smaller ones, and this would account for their larger size in Stage XII.

Besides differing in chemical properties, the globules differ from the spherules in their source, in that while the latter owe their origin ultimately to foreign ingested matter, the former are derived from the maternal organism.

Finally, with regard to the histolysis which my sections show in Stage XII, it is to be noted that it takes place *pari passu* with the opening of the proctodoeum into the gastral cavity. In Stage XI the proctodoeum still ends blindly.

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[1] See Appendix.

The cuticle which occurs during Stage XI over the free surface of the gastral epithelium is a definite membranous exuvia and not merely a condensation of the peripheral protoplasm (see Text-figure 6).

My observations on the endoderm of *P. novae-britanniae* may be briefly summarised as follows:

1. In Stage VIII many endoderm cells forsake their epithelial position and become converted into wandering trophocytes.

2. In Stage X the endoderm commences to reconstitute itself. The trophocytes tend to become less numerous, either being absorbed or applying themselves to the basal membrane, which has been secreted by the endoderm cells concomitantly with the separation of the inner and outer germ-layers to form the definite body-cavity. The endoderm may be said to contract away from the ectoderm.

3. In Stage XI the endoderm cells have increased in height and secreted a cuticular membrane, and now constitute a fairly compact epithelial layer containing numerous eosinophile globules of varying sizes. The proctodoeum does not yet open into the gastral cavity.

4. In Stage XII the endoderm commences to undergo histolytic changes, the cuticle ruptures and the globules tend to loosely fill up the gastral cavity. The proctodoeum now opens into the latter.

5. In young individuals the brightly staining globules have entirely disappeared. The endoderm does not form an epithelial layer, but consists of cells lying loosely and freely in the gastral cavity like the trophocytes in the embryo. Faintly staining minute spherules may be present.

The production of trophocytes may be looked upon as a partial histolysis, so that one histolytic change with subsequent reconstitution of the endoderm is at least an observed fact. Then appear the yolk-like globules in the endoderm, and then comes a second histolysis. These are also observed facts. What I have not observed is the reconstitution of the endoderm after this second histolysis. The reconstitution might not occur—assuming that it would occur—till months after birth. To definitely establish the existence of a periodic phenomenon, such as I suppose this histolysis of the endoderm to be, periodic observations are required, and these are at present lacking, with no immediate prospect of the want being met, and this must be my excuse for the imperfection of the above remarks.

NUTRITION OF THE EMBRYO.

It is quite clear that the nutrition of the embryo is effected through the walls of the trophic organ or vesicle and that the ectoderm of the vesicle is physiologically comparable with—perhaps its function is identical with—the peripheral ectoderm or trophoblast (Hubrecht) of the Mammalian blastodermic vesicle.

The trophic organ occupies at first the entire dorsum of the embryo, beyond which it projects freely in front as the head-fold, and behind as the tail-fold. As growth proceeds the caudal or growing end of the embryo emancipates itself from the wall of the vesicle, although the cavity of the latter is directly continued into the caudal or abdominal region as it increases in length and independence. After the appearance of the cephalic flexure (Stage IX), the trophic organ gradually decreases in relative dimensions until it is finally completely reduced to its definite proportions as part of the body of the animal.

In its capacity of dorsal trophic organ, the trophoblastic vesicle of the embryos of *P. novae-britanniae* is therefore comparable with the stalk of the embryo of the Neotropical Peripatus.

The stalked embryos of *P. torquatus* and *edwardsii* (=*trinidadensis*) were discovered and described by Kennel in 1886, and the discovery was confirmed by W. L. Sclater (17) in 1888. The two authors however differed considerably in their interpretation of their observations. Both agreed that the embryo is attached by a dorsal stalk to the inner wall of a closed vesicle. The embryo therefore lies inside the vesicle as in a brood-chamber. Kennel described the vesicle as being derived from the uterine epithelium which entered into relations with the embryo and rounded off at the ends to form a closed chamber. Sclater described the wall of the vesicle as a pure and simple derivative of the embryonic ectoderm, the cavity of the vesicle being produced by separation of the inner and outer layers of the so-called pseudo-gastrula, as in the Mammalian embryo. The figures given by Kennel and Sclater are remarkably alike, only they differ in their statements as to the relative ages of embryos. On the whole there are fewer gaps and fewer unique phenomena in Sclater's than in Kennel's description. In *P. novae-britanniae* there is no question as to whether the vesicle is an embryonic or uterine derivative. It is of course an embryonic structure, and the embryo lies outside and upon it, instead of inside it, as in the Neotropical species. Korschelt and Heider (13) summed up in favour of Kennel's interpretation. I think my results rather favour Sclater's conclusions.

In the embryo of *P. novae-britanniae* there is normally no space between the egg-membrane and the enclosed embryonic vesicle, but the membrane closely hugs the latter, and no doubt the vesicle in life is turgid and tightly pressed against the uterine wall. The uterine epithelium shows signs of great glandular activity with its vacuolar cells, and its inner surface is often raised up into small prominences caused by the artificial separation of the embryo from contiguity with the wall. The uterine epithelium is locally thickened in the neighbourhood of an embryo.

In *P. capensis* Sedgwick states that in normal embryos there is always a space between the embryo and the membrane filled with fluid, and in his Stages E to F the dorsal ectoderm is much thickened and vacuolated, especially in the region of the so-called dorsal hump, and probably, according to Sedgwick, has a nutritive function, absorbing the fluid in which the embryo lies.

In *P. novae-zealandiae* the dorsum of the embryo is occupied by yolk: and Miss Sheldon has described a peripheral layer of yolk or ectodermal yolk between the embryo and the egg-membrane, thus occupying the same position as the nutrient fluid in *P. capensis*.

In the Neotropical Peripatus the egg-membrane completely disappears before the close of the segmentation stages (Kennel 11, Sclater 17), and the embryo becomes applied against the uterine wall without any intervening membrane. In some cases (*P. torquatus* Kennel) circular ridges are developed on the outer wall of the vesicle in which the embryo lies, which fit into corresponding depressions of the uterine wall. One such ridge was also figured by Sclater round the embryonic vesicle of the species investigated by him (*P. imthurni = demeraranus*). *P. edwardsii = trinidadensis* is without such a ridge (Kennel). It therefore appears that the various Neotropical species offer considerable differences *inter se*, in their development. The uterine wall of the Neotropical Peripatus appears to differ from anything that has been described in the other subgenera in that the thick wall of the uterus includes and is traversed by blood-spaces. These were described and figured by Kennel, and again figured by Sclater. Therefore I do not understand the following statement made by the latter author. He says "In the case of *Peripatus imthurni* (*demeraranus* Sedgwick), there is certainly, as far as I have been able to observe, no plexus of blood-vessels at all [in the uterine wall]: and Kennel, I think, makes no mention of this matter."

In this quotation the use of the word "blood-vessels" instead of "blood-spaces" is unfortunate. Kennel was also unfortunate in his selection of terms when he applied the term "placenta" to the mechanism by which the embryo acquires its nutrition.

MORPHOLOGY OF THE TROPHOBLASTIC VESICLE OF P. NOVAE-BRITANNIAE.

While discharging its nutritive function, the trophic organ at the same time serves as a water-cushion for the protection of the embryo, like the amnion of higher Vertebrates (cf. Haddon quoted by Hubrecht 9). Thus the trophic organ has a double function, (1) that of nutrition and (2) that of protection of the embryo. The function of nutrition is its primary function while that of protection is quite a

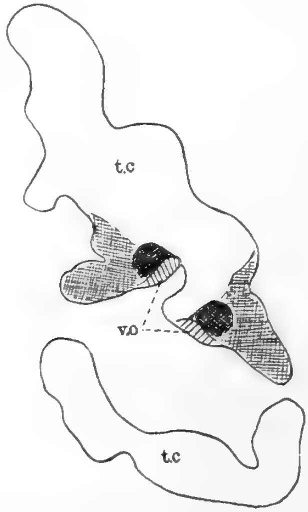

FIG. 7. OUTLINE SKETCH OF TRANSVERSE SECTION THROUGH THE MID-REGION OF THE EMBRYO SHOWN IN PLATE III, Fig. 35.

t.c. trophic cavity. *v.o.* thickened patches of ectoderm from which the nerve-cords are delaminated. These unite later to form the ventral organs.

secondary or accessory function. The amniotic folds of Insects are purely protective. Thus the primitively secondary function of protection has entirely superseded the original nutritive function. It follows from this view that the amnion of Insects is not a new acquisition of their yolk-laden eggs, but is the derivative of an original nutritive organ developed in correlation with an alecithal ovum.

The trophic organ of the embryo of *P. novae-britanniae* is analogous to a temporary larval structure—like the suckers of a tadpole. But unlike the latter it is not developed for use during an independent larval existence, but is essentially developed for use during intra-uterine development. When the embryo is flexed and the anterior portion of the trophic organ covers its ventral surface as with a cap (see Text-figure 7) the superficial resemblance to the amnion of an insect is remarkable—and this resemblance must, in principle, be still more remarkable in the case of those insects (certain Diptera, see Korschelt and Heider, p. 783) in which the amniotic folds do not fuse together, but remain as separate folds[1]. This is the case, according to Kowalevsky and Graber (quoted by Korschelt and Heider) in the Muscidae "bei denen die Kopffalte äusserst rudimentär bleibt und nur die Schwanzfalte zu etwas deutlicherer Entwicklung gelangt. Bei der späteren Ausbildung des Embryos werden diese Falten einfach wieder ausgeglattet und nehmen dann, wie es scheint, an der Ausbildung der Rückenhaut einen gewissen Antheil." This is exactly what the trophic folds of the embryos of *P. novae-britanniae* do. In the latter, however, the anterior trophic extension or head-fold predominates considerably, through all stages, over the posterior or tail-fold. There is thus a temptation to suggest that, in addition to the superficial resemblance, there is a genetic relation between the trophic organ or trophic folds here described and the amniotic folds of Insects. And this I do tentatively suggest, on the same principle which led Hubrecht to reject the prevailing grossly mechanical explanation of the amnion of the higher Vertebrates, and to trace it back to a primitive trophic organ, the *trophoblast* (Hubrecht 9).

LECITHALITY OF THE OVUM.

It is perhaps not always realised that the acquisition of yolk is as radical an innovation as that of any other kind of trophic organ for the nutrition of the embryo. The origin of yolk has been the subject of as much controversy as any other problem of embryology. Even now there seems to be no prospect of arriving at an agreement, not so much as to the origin of yolk in any concrete example, but rather as to the general principles which govern the acquisition and loss of yolk. The acquisition of yolk is an observed phenomenon within the limits of many groups of animals. The loss of yolk in any specified case is always an assumption or hypothesis.

I will not attempt to discuss this very difficult subject about which hardly any two zoologists hold similar opinions, but will merely point out how the question is affected by the phenomena of development observed in *P. novae-britanniae*. In

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[1] The figures of the embryos of Lepisma given by Heymons should be compared with those of the embryos of *P. novae-britanniae* accompanying this paper, so far as external appearance is concerned. According to Heymons, the amniotic cavity in Lepisma never completely closes during the period of its existence but has a permanent external opening, the amniotic pore (Amnionporus). [Richard Heymons. Entwicklungsgeschichtliche Untersuchungen an *Lepisma saccharina* L. Z. f. w. Z. Bd. 62, 1897, p. 583.]

P. capensis the egg, as shown by Sedgwick, is large and contains vesicular protoplasm. Sedgwick very naturally supposed that this indicated a loss of yolk which had formerly filled the vacuoles at present occurring in the egg—especially in view of the yolky egg of *P. novae-zealandiae.* The view that the egg of *Peripatus capensis* exhibits a stage in the process of acquiring yolk instead of being a stage in the loss of yolk, could be sustained with equal force. There is no means at present known of deciding between these two views in this particular case. Both of them seem to be equally possible. In the egg of *P. novae-britanniae* however, as well as in those of the Neotropical species of Peripatus, this difficulty is not present, since *there is no reason whatever to suppose that there has been a secondary loss of yolk in these cases.*

Yolk may be defined as reserve nutrient matter derived from the maternal organism and deposited in the egg in a sub-solid form. Fat is an analogous reserve food-stuff stored up by various animals for use in times of low-feeding or of cessation of feeding, and derived from foreign ingested nutrient matter.

As has been described above, in the late embryos of *P. novae-britanniae* at a time when they are approaching the period of birth, large and small globules of reserve nutrient matter—the eosinophile globules—make their appearance in the endoderm.

Whatever the chemical constitution of these globules may be, whether allied to fat or to lecithin, the fact remains that they are yolk-like globules deposited in the endoderm of the late embryos and derived, like true yolk, from the maternal organism. It thus appears possible that the early appearance of yolk in eggs which contain yolk is only a special case of the nutrition of the embryo at the expense of the maternal organism, and that reserve nutrient matter of a like nature, so far as function (i.e. nutrition of foetus) is concerned, may appear at a much later stage in the development.

The fact of these eosinophile globules making their appearance in the endoderm is of interest since the seat of yolk in eggs is essentially at the vegetative pole which later gives rise to the endoderm.

Thus it will be seen that within the limits of the genus Peripatus we are confronted with a problem with regard to the lecithality of the ovum, which is exactly analogous to that presented by the Mammalian ovum. I suppose many embryologists take it for granted that the yolkless condition of the ova of the higher Mammals is quite a secondary condition. It is therefore interesting to note that one of those best fitted to judge does not hold this opinion. I refer to Professor Hubrecht.

As for Peripatus all I can say, with the limited experience which I have had of this remarkable genus, is that it appears to me to substantiate the principle upon which Prof. Hubrecht's views are based.

PHYLOGENETIC CONSIDERATIONS.

The fundamental differences in the early development of the four known subgeneric groups of Peripatus which at first appear to be so unaccountable, may, by their very diversity, afford a clue to the phylogeny of Peripatus.

This subject has been already speculated upon by Kennel.

With the knowledge available at the time Kennel wrote, he said that it seemed certain that within the limits of the genus Peripatus the method of embryonic development had assumed two divergent directions whose extreme points are represented in the Neotropical and New Zealand species respectively.

The starting point, according to Kennel, was to be sought for in an ancestral form which discharged its small yolkless eggs directly into the water. The eggs would develop into free-swimming larvae which fed themselves independently. Concomitantly with the adaptation to a terrestrial life and the modification of organisation (e.g. development of tracheae) which rendered oviposition in water impossible, the oviduct assumed the rôle of a brood-chamber, as indeed in many other animals, e.g. *Salamandra atra.*

At first, says Kennel, it may well be assumed that the intra-uterine development was only slightly different from the free development; the embryos and larvae would be nourished by the uterine secretions as in *Paludina vivipara,* until finally all larval structures required for a free life completely disappeared. This condition is represented in *P. capensis,* although there is here, according to Kennel, no longer any identity with the ancestral form.

The rest of Kennel's conclusions on this subject are necessarily coloured by his interpretation of the embryonic vesicle of the Neotropical species, as being a uterine and not an embryonic structure (see above, p. 31). This does not however affect the principle of his views. Referring to the two divergent methods of development mentioned above, he says that in the one direction the nutrition of the embryo (at the maternal expense) would be relegated to earlier and earlier stages and limited to a shorter time, until finally a considerable quantity of nutritive yolk was collected in the egg itself, as in *P. novae-zealandiae.* In the other direction the embryos became practically parasitic and became applied[1] to the mucous membrane of the uterus. This is indeed true of the Neotropical species and of *P. novae-britanniae.* In both cases the embryonic vesicle in life is obviously closely pressed against the uterine wall, in the former without the intervention of an egg-membrane, and in the latter with the egg-membrane separating the ectoderm of the trophic organ (i.e. the trophoblast) from the uterine epithelium. As far as our present methods enable us to judge, Peripatus must have had an aquatic ancestor, and its viviparous habit must have been preceded by an oviparous habit. Assuming the latter to be true, namely, that Peripatus had an oviparous ancestor, it is quite certain, to my mind, that the oviparity of *P. oviparus* Dendy, is a secondarily acquired habit and not in any way to be confused with the primitive deposition of alecithal ova.

The accumulation of yolk in the egg of *P. novae-zealandiae* would lead by a comparatively simple gradation to a secondarily acquired habit of oviposition on *terra firma,* the egg being provided with sufficient yolk for the nutrition of the embryo and surrounded by a protecting envelope or egg-shell. It is therefore a most interesting fact that this step has been taken by the Victorian species of Peripatus, recently described by Dendy as a distinct species, *P. oviparus* (Dendy 3).

In *P. oviparus,* according to Dendy's discovery, the yolky eggs are normally laid, and Dendy has succeeded in hatching out at least one embryo from such a deposited egg.

In *P. novae-zealandiae* the eggs are sometimes abnormally discharged, as observed by Hutton, but such precocious eggs do not develop further, so far as is known.

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[1] Kennel says they sucked on to the mucous membrane.

TABLE OF COMPARISONS.

In the following table I have collected fourteen characters relating to the sexual and reproductive characters of the four known subgenera of Peripatus. It is thought that the presentation of these facts in a compressed form may be acceptable to the reader. (For other external characters, see the early part of this memoir.)

It is necessary to add a few explanatory notes to the table.

i. I do not know whether the egg-membrane of *P. novae-britanniae* corresponds with the chorion or with the vitelline membrane of the Cape and Australian species. I think it corresponds with the chorion. It is possible that specially directed investigations might result in finding a thin vitelline pellicle below this membrane in the unsegmented ovum, or even during the early segmentation stages. It is certainly not present in my Stage III.

ii. The egg-membrane persists beyond Stage X, but I have not found it in my oldest embryos. In *P. capensis* the chorion persists until birth (Sedgwick), as also in *P. leuckarti* (Steel).

iii. In *P. novae-zealandiae* the young are white at birth, but the antennae are slightly tinged with purple (Hutton).

In *P. capensis* the young at birth are either quite white or of a diffuse reddish colour; only the antennae are green (Sedgwick).

iv. With regard to the mode of fecundation. At a meeting of the Linnaean Society of New South Wales, which I attended in Sydney in 1896, I heard Mr Steel describe copulation as occurring in *P. leuckarti,* but for some unaccountable reason the observation is not recorded in the paper by him which I have cited more than once. Its occurrence in *P. novae-britanniae* is rendered especially probable by the presence of the external muscular male papilla. Finally, it is *a priori* probable that it occurs in all, except in Peripatopsis, on account of the presence of a pair of specially differentiated receptacula seminis.

v. Crural glands could not be included in the above table because, while they occur in *P. leuckarti,* they are absent from *P. novae-zealandiae.* As mentioned already, there are none in *P. novae-britanniae.*

vi. Steel has observed that the young of *P. leuckarti* measure 5 mm. at birth, and during the first 12 months the rate of growth was rather less than 1 mm. a month. He estimates that a female takes upwards of two years to reach maturity, and thinks it probable that the birth of young does not commence until the mother is three years old.

vii. It will be observed that the embryos of *P. novae-britanniae* and of the subgenus Peripatus s. str. are born in a more complete condition than are those of the other two subgenera. In other words, the viviparity is more complete. I should think the less complete viviparity of the latter forms is not a primitive feature.

	Egg, diam. in mm.	Egg-Membrane	Egg, Contents	Ovarian ova	Nutrition of Embryo	Uterine Embryos, Ages	Young at birth, Colour. Length in mm.	Receptacula seminis	Receptacula ovorum	Accessory Glands of ♂	Ductus ejaculatorius	Spermatophores	Mode of Fecundation	Appendages in ♀ and ♂
Peripatoides (Australasian)	1·5	Double. Chorion thick, persistent	Yolk	Exogenous	Lecithal	Varying	White 5. Steel	Present	Absent	Open by paired apertures between genital pore and anus	Convolute	Long, thread-like	Probably by copulation	Equal
Peripatopsis (Cape)	·5	Double. Chorion dense, persistent	Vesicular protoplasm	Exogenous	Ectodermal	Uniform	White 10–15. Sedgwick	Absent	Absent	Open into Ductus ejaculatorius	Flexed	Minute, oval	Hypodermic injection	Equal
Paraperipatus (New Britain)	·1	Single, extensile persistent	Granular protoplasm	Exogenous	Trophic vesicle with external sessile embryo	Successive	Pigmented 15	Present	Absent	Open into median pygidial bulbus and then by median dorsal pore to exterior	Median	Absent	Probably by copulation	Less in ♂
Peripatus, s. str. (Neotropical)	·04	Single, undergoing early resorption	Granular protoplasm	Endogenous	Trophic vesicle with internal stalked embryo	Successive	Pigmented 20–22. Kennel, Sedgwick	Present	Present	Open by paired apertures beside the anus	Convolute	Long, thread-like	Probably by copulation	Less in ♂

Breeding-period, Period of Gestation, etc.

The production of embryos probably takes place all the year round in *P. novae-britanniae*:—this is also probably the case with the Neotropical Peripatus, and Hutton found that *P. novae-zealandiae* produces young all the year round.

P. leuckarti according to Fletcher breeds through about $\frac{3}{4}$ of the year, the most prolific period being the six months from October to March. As a general rule it does not breed during the winter months (May—August), and in this respect differs markedly from the New Zealand species.

There is no means of determining the period of gestation except by periodic observations. In *P. leuckarti* Fletcher estimates it at 6—7 months. In *P. capensis*, as shown by Sedgwick, the period of gestation is 13 months; longer than in any Mammal. The fertilised ova pass into the oviduct in April and the young are born in May of the following year (Sedgwick). The period of incubation observed by Dendy in a deposited egg of *P. oviparus* was 17 months. That is to say, one of the eggs laid in his vivarium in Melbourne hatched out after an interval of a year and five months.

In *P. novae-britanniae*, where the embryos are born in strict succession, only the one nearest the vagina in each uterus being ready for birth at one time, it is possible that the period of gestation for a given embryo is even shorter than in *P. leuckarti*. It would also appear probable that the extraordinarily long period of gestation in *P. capensis* is in correlation with the uniformity of the ages of the uterine embryos.

CLASSIFICATION.

It is not to be expected that a new species of Peripatus would throw any fresh light on the systematic position of this delightful creature. Nevertheless a few remarks on this subject may not be out of place. Its relationships being obviously divided between the Annelida and the Arthropoda, its place in a separate Class of equal value with either of these groups would seem to be clear enough. Hatschek in his Lehrbuch regards the Onychophora as of equal value with the Arthropoda. The point upon which I wish to say a few words is with regard to the name of the Class to which Peripatus belongs rather than its position in the system. There is an objection to the name Prototracheata (or Protracheata as it was originally written). This was applied to one of Haeckel's theoretical groups, and the name was adopted by Moseley after his discovery of the tracheae. It is a good name and has done good service in embodying a notable conception. The objection to it arises from the fact that there are reasons for supposing that tracheae have had a polyphyletic origin. If the name be accordingly rejected on this account, shall a new name be invented or shall an old name be re-established? Assuming that the latter course be adopted, which old name should be revived, Malacopoda or Onychophora?

In an interesting paper on the classification of the Arthropoda, Kingsley (12) says he prefers to use the name Malacopoda rather than Onychophora because it is older than the latter, having been introduced by Blanchard in 1847. It is certainly the older name, but it was not given by Blanchard but by de Blainville in 1840. This example illustrates the fatuity of adopting ordinal names simply on the ground of priority rather than on that of efficiency.

De Blainville's name was little more than a *nomen nudum.* It was H. Milne-Edwards who discovered the divarication of the nerve-cords in 1842[1]. But Grube's memoir on Peripatus, besides being the best work which had appeared on the subject prior to Moseley's discovery of the tracheae, is intrinsically a work of abiding merit.

Therefore, in my opinion, Grube's name, Onychophora, should take precedence of all existing names for the Class to which Peripatus is regarded as belonging.

In conclusion I have to acknowledge with gratitude the uniform kindness of Mr Adam Sedgwick, F.R.S., in lending me specimens of *P. novae-zealandiae, capensis,* and *balfouri* for comparison, and in giving me the benefit of his experience of Peripatus. My thanks are also due to Mr J. P. Hill, B.Sc., for specimens of *P. leuckarti.*

CAMBRIDGE,
May 17, 1898.

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[1] Milne-Edwards (quoted by Grube) suggested the name Pleuroneura. Guilding had suggested Polypoda.

12. KINGSLEY, J. S. The classification of the Arthropoda. Tufts College Studies, I., 1894, p. 15. Reprinted from Ann. Nat., vol. XXVIII., 1894, pp. 118 and 220.

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APPENDIX.

1. References to the following authors have been added during the correction of the proofs:—E. L. Bouvier p. 3, L. Camerano p. 3, R. Heymons p. 33.

2. The occurrence of histolytic changes in the gastral epithelium of Peripatus, as described in the foregoing pages, is interesting in comparison with analogous phenomena which have been observed among the Myriapoda and Insecta as well as in other groups. I have found the use of the term *gastrolysis* to be convenient in this connection, as *sarcolysis* has been used in describing the fatty degeneration of the muscles of Insects. [C. de Bruyne. Recherches au sujet de l'intervention de la Phagocytose dans le développement des Invertébrés. Archives de Biol. xv. 1898, p. 181.]

3. Gastrolysis has been observed in the mid-gut of the scolopendroid genus Cryptops by Balbiani during the winter season. The epithelial cells had, at almost all points, detached themselves from the tunic of the gut and become transformed into an amorphous mass of granulations and refringent globules, which filled the cavity of the gut. The muscular tunic of the gut also underwent degeneration. "Ce processus de régression du tube digestif des Cryptops pendant la saison froide est à rapprocher des observations de Semper sur la chute de l'épithélium des Gastéropodes pulmonés pendant l'hibernation, et de celles de Sommer sur la mue de l'épithélium de l'intestin chez le Macrotoma plumbea [a Podurid]. On peut lui comparer aussi les phénomènes décrits par Kowalevsky touchant la destruction de l'appareil digestif chez les larves des Muscidés au moment de leur transformation en pupe." [E. G. Balbiani, Études sur le tube digestif des Cryptops. Archives de Zool. expér. (2) T. VIII. 1890, p. 72.]

4. In the case of Peripatus, it is to be noted that during the gastrolysis, as described in the text, the tunic of the gut remains whole and intact.

5. Compare also the desquamative catarrh described in the stomach, intestine and pyloric appendages of Salmonidae by Gulland. [G. Lovell Gulland. The minute structure of the digestive tract of the Salmon, and the changes which occur in it in fresh water. Anat. Anz. XIV. 1898, p. 441.]

6. Further reference may be made to the paper by C. Rengel, Ueber die Veränderungen des Darmepithels bei *Tenebrio molitor* während der Metamorphose. Z. f. w. Z. Bd. 62, 1897, p. 1.

7. On the subject of eosinophile granulations and their relation to fat and yolk, see N. Bogdanoff, Ueber das Vorkommen und die Bedeutung der eosinophilen Granulationen. Biol. C. B. XVIII. 1898, p. 26.

EXPLANATION OF THE PLATES.

PLATE I.

FIG. 1. Adult female from dorsal aspect. × 2.

FIG. 2. Sketch of male. × 4.

FIG. 3. Enlarged view of portion of the back of the animal to show the interruption of the papilliferous ridges in the middle line; also the single row of papillae on each ridge. [In the Neotropical species the ridges usually carry a single row of papillae but they are not interrupted in the middle line. In the Cape and Australian species there is a median interruption but the papillae occur irregularly and in several rows (Sedgwick). The two species *P. tholloni* and *P. tuberculatus* recently described by Bouvier seem to be intermediate in this respect.]

FIG. 4. Enlarged view of portion of the ventral surface. The papillae of the ventral surface differ from those on the dorsal surface in that they occur more irregularly, often in more than one row on the ridges. Among the more numerous smaller papillae are numbers of much larger papillae placed with considerable regularity in transverse rows and having a tubercular appearance when viewed with a lens. Similar tuberculiform papillae have been described by Bouvier on the *dorsal* surface of *P. tuberculatus.* The ventral organs are rendered prominent by their brown pigment.

FIG. 5. Anterior end in $\frac{3}{4}$-ventral view, showing the characters of the jaws, the lips and the oral papillae. The modified appendages which carry the jaws are well shown and the fact that the jaws are homodynamous with the claws of the ambulatory appendages is well illustrated. The figure also shows the dorsal fleshy protuberance known as the "tongue" with its median row of chitinous denticles. Only the basal portions of the antennae are indicated. The oral papillae are characteristically flat-topped as if a slice had been cut off.

FIGS. 6 *a* and 6 *b*. Free ends of the antennae of individuals of different ages to show intercalation of new rings between the older rings during the free life of the animal. Fig. 6 *a* relates to a specimen 14·75 mm. in length, while Fig. 6 *b* relates to one 54·75 mm long. The former had 33 rings in each antenna and the latter about 50.

FIG. 7. Ventral view of an ambulatory appendage of the 4th or 5th pair. The external opening of the enlarged segmental organ is seen to occupy the centre of a prominent tuberculiform structure which lies in the centre of the third spinous pad and causes an interruption in the continuity of the latter. The absence of primary papillae at the base of the "foot," i.e. at the insertion of the "pes" on to the "crus," is to be noted. In *P. capensis* there occurs a pair of primary papillae, the basal papillae, in that position.

FIGS. 8 *a* and 8 *b*. Dorsal views of feet to show variation in the relative positions of the primary papillae. In Fig. 8 *a* the dorsal papilla lies near the anterior papilla. In Fig. 8 *b* the dorsal papilla is median.

FIGS. 9 *a* and 9 *b*. Views of the posterior extremity of a female from the ventral and lateral aspects. The generative orifice with its tumid lips lies posterior to the last pair of legs. The anus is quite terminal.

FIGS. 10 *a* and 10 *b*. Similar views of the posterior extremity of a male, showing the backwardly directed penis-like projection at the apex of which occurs the generative orifice.

PLATE II.

FIG. 11. Ventral view of the 4th, 5th and 6th legs of the left side of an individual (I) in which each of these legs carried a peripheral nephridiopore. × 10.

FIG. 12. Dissection of female from above [specimen IV]. The posterior portion of each uterus is occupied by a pigmented embryo nearly ready for birth.

a. anus. *a. l. u.* ascending left uterus. *a. r. u.* ascending right uterus. *d. l. u.* descending left uterus. *d. r. u.* descending right uterus. *r.* rectum. *r. s.* receptacula seminis. *s. g.* ramifications of slime-glands.

FIG. 13. Posterior portion of same. The terminal portions of the two uteri have been cut across and the right uterus turned aside to the left, while the left uterus with the cohering ovarial organs remains in contiguity with the rectum.

i. intestine. *n. c.* ventral nerve-cords beneath which the uteri have to pass before reaching the vagina.

Other letters as in Fig. 12.

FIG. 14. Further view of same dissection. The uteri are partially unravelled. The ovary with the receptacula seminis as well as the greater portion of the ascending right uterus have been removed. Some of the uterine loops caused deep indentations in the wall of the gut.

int. intestine cut across to show the left uterus passing below it.

FIG. 15. Ovary and adjacent structures from another female (VII). The ovary is attached to the pericardial septum. The ascending uteri loop round a bend of the descending right uterus. Only one of the proximal oviducal coils is shown; the other was concealed below the right uterus. This specimen measured 37 mm. in length; the uterine complex extended forwards 14·5 mm. from posterior end of body. The terminal portions of the uteri did not contain embryos.

FIG. 16. Same removed from body. From a preparation in Canada balsam. The ovary, 1·5 mm. in length, is attached throughout its whole length to the floor of the pericardium, with the exception of a short erect posterior portion with which the infundibula communicate. The follicular character of the ovary is plainly indicated. The largest of the three embryos shown in the uterus to the right of the figure belongs to my Stage III and its length, including the chorionic membrane, was 1·1 mm.

i. infundibula. *o.* ovary. *p.* pericardial septum (i.e. floor of pericardium). *r. s.* receptacula seminis.

FIG. 17. Ovary and adjacent organs of young virgin female. This specimen (XI) was 17 mm. in length. Only a portion of the ovary is represented. The receptacula seminis were empty. The different appearance of that portion of each oviduct which precedes the receptaculum seminis from the succeeding portion is to be noted. Besides communicating with each other indirectly through the receptaculum seminis, these two portions of the oviduct, namely, the proximal or infundibular portion and the distal or uterine portion, communicate directly together by a short passage from one lumen to the other below and behind the

receptaculum seminis. This arrangement will be rendered intelligible by taking into consideration the mode of origin of the receptaculum seminis, as given on p. 11.

i. infundibulum. *i. o.* common orifice of the infundibula putting latter in communication with the ovary. *r. s.* receptaculum seminis. *t. p.* peritoneal investment. *u.* uterus.

Fig. 18. Transverse section through the ovary of a female embryo belonging to my Stage XI, to illustrate the exogenous growth of the ova. The ovary is attached in a sessile manner to the pericardial septum above which (in the figure to the right) the heart is seen in section, and below (at the upper left-hand corner of the figure) a portion of the wall of the rectum.

Fig. 19. Dissection of adult male (V). The coiled vasa efferentia are succeeded by the uncoiled vasa deferentia which pass backwards to the posterior region of the body and then bend under the nerve-cords to meet in the mid-ventral line below the pygidial bulbus. The right genital duct passes below the intestine. Through a short portion of its course the rectum is held in position by a paired ligament (see Fig. 20). The convolute portion of the left pygidial gland is removed. The posterior extremity of the body is represented as being slightly tipped up to show the terminal organs.

a. anus. ♂ penis. *l. s. v.* left seminal vesicle. *l. t.* left testis. *l. v. d.* left vas deferens. *p. b.* pygidial bulbus. *p. g.* pygidial gland. *p. o.* median dorsal orifice of pygidial glands. *r. s. v.* right seminal vesicle. *r. t.* right testis. *r. v. d.* right vas deferens. *v. n. c.* ventral nerve-cord.

Fig. 20. Semi-diagrammatic section through a male (XII) taken immediately in front of the last pair of legs in the region where the nerve-cords (united by a commissure) approximate to one another before passing dorsally to meet together in the supra-rectal commissure. The rectum is held up by paired ligaments. The vasa deferentia meet below the nerve-cords in the median ductus ejaculatorius which is innervated (as is also the vagina) by a special pair of genital nerves whose roots are seen to project from the two ventral nerve-cords. The chitinous intima of the ductus ejaculatorius commences (or ends) slightly posterior to this point. The heart lying in the pericardium is shown dorsally.

d. e. commencement of ductus ejaculatorius. *p. g.* pygidial gland. *r.* rectum.

Fig. 21. Similar section through same individual passing through the supra-rectal commissure. Above the latter lies the pygidial bulbus. The section is taken behind the last pair of legs.

d. e. ductus ejaculatorius. *r.* rectum.

Fig. 22. Similar section through the anal segment, behind the supra-rectal commissure, to show the 5 ectodermal involutions mentioned in the text, namely 2 dorsal, 2 ventro-lateral and 1 median ventral lying over the ductus ejaculatorius. The ventral involution lies in the angle made by the insertion of the penis into the body-wall and is the ventral organ of the anal segment.

d. e. ductus ejaculatorius immediately in front of the point at which it becomes emancipated from the body-wall to project freely as the penis. *e. o.* ectodermal organs. *p. b.* pygidial bulbus. *r.* rectum.

PLATE III.

Fig. 23. Stage III in side view and optical section. The embryo is enclosed within the chorion (or egg-membrane) and consists of a large oval vesicle, the trophic vesicle, the wall of which is of uniform thickness except at the posterior ventral end of the vesicle where there is a much thickened area, the embryonic tract. Actual length of entire embryonic vesicle about 1 mm.

Fig. 24. Posterior portion of an embryonic vesicle at a stage intermediate between Stage III and IV, in side view and optical section. Chorion omitted. The embryonic tract no longer abuts upon the posterior extremity of the vesicle, since the latter has begun to grow backwards to form the caudal extension of the trophic vesicle. Total length 1·45 mm. This embryo succeeded the preceding in the same uterus (specimen IV).

Fig. 25. Stage IV. Portion of embryonic vesicle with embryonic tract, from the left side, showing the primitive (posterior) and cranial (anterior) grooves. The portion between these grooves, in comparison with the next stage, occupies the position of the future ventral surface of the embryo. Apparently the invagination which occurs in the next stage to form the definitive ventral surface proceeds from, or at least involves, the deeper posterior portion of the cranial groove. This embryo was taken from the same individual (VII) to which Fig. 16, Plate II relates. Total length 2·75 mm. Chorion omitted.

Fig. 26. Stage V. Similar view showing appearance of a transverse groove in the middle of embryonic tract. This is the commencement of the formation of the ventral surface, or, in other words, it is the commencement of the ventral flexure, *in situ*, of the embryo. The embryo is not seen strictly in side view but in $\frac{3}{4}$ side view, so that the cranial groove which separates the procephalic lobes is to be seen. This embryo comes from the same individual (IV) as those represented in Figs. 23 and 24. I have a permanent preparation in Canada balsam of this embryo. Chorion omitted.

Fig. 27. Stage VI. Frontal view of an embryo in which the transverse groove seen in the preceding stage has taken a crescentic form owing to the forward free growth of the primitive streak. The latter now projects forwards like a tongue. The anterior portion of the trophic vesicle, or the trophic head-fold, is more extensive than the posterior portion, or trophic tail-fold. Embryo from specimen II. Total length 3·25 mm. Chorion omitted.

Fig. 28. Enlarged frontal view of the embryonic tract of the same embryo. The centre of that portion of the embryo proper, which lies in front of the crescentic groove, is occupied by the cranial groove which is bounded by the first pair of somites, the outlines of which can be seen by transparency. The somites of the second pair lie at the outer sides of those of the first pair, while those of the third pair occupy a similar position with regard to those of the second pair. The dotted line indicates the plane through which the section represented in Fig. 51 was taken.

Fig. 29. Stage VII. At this stage the primitive streak or caudal end of the embryo has by its continued growth become directed oblique-transversely, thus occasioning a superficial asymmetry in the entire embryo. The crescentic form of the embryonic tract, which is characteristic of the preceding stage, is still discernible. Owing to its oblique growth it is very difficult to describe the embryo in detail at this stage, and I have not attempted it. The overlapping of the mesodermal somites causes great complication. The features which

call for special notice are the caudal region of the embryo, the first pair of somites which have increased greatly in size, and lastly the relation of the embryo to the trophic vesicle.

Embryo from specimen IV. Total length 4·25 mm.

Fig. 29 *a*. Another embryo of the same stage with primitive streak directed quite transversely and so concealing all the somites, except those of the first pair, which occupy the procephalic lobes. This embryo immediately succeeded that shown in Fig. 27; when lying in the uterus the posterior end of its trophic vesicle abutted on the anterior end of the latter. Chorion omitted. From specimen II. Total length about 5 mm.

Fig. 30. Stage VIII. Frontal view. The caudal end of the embryo has grown to such an extent as to cause a double flexure in the embryo whereby the region of the primitive streak becomes directed backwards and a partial restoration of symmetry is the result. In embryos at this and the preceding stage, the two regions which can always be definitely recognised are the anterior and posterior extremities of the embryo. This is due to the characteristic shape of the caudal end and to the large size of the procephalic lobes with their contained somites of the first pair. Embryo from specimen II. Total length about 5 mm. Chorion omitted.

Fig. 31. Enlarged view of the same embryo from the left side. It is clearly shown here how the trophic vesicle occupies the dorsum of the embryo, and is therefore essentially a dorsal structure. The dorsal sides of the procephalic lobes are confluent with the wall of the vesicle. The margin of the body is lobed by the outgrowing appendages, only those of the left side of the embryo being seen, except that the right procephalic lobe shows through from the other side by transparency. The lobe, which closely hugs the left procephalic lobe, is the future manducatory appendage of the left side. This is followed by the future oral papilla of the same side. These two lobes can already be distinguished from the succeeding appendicular lobes. The recurved caudal region can be seen by focussing down, and it is indicated by a dotted line.

Fig. 32. Embryo belonging approximately to the same stage as preceding. It lies in an acute bend of the uterus. The anterior portion of the trophic vesicle, or head-fold, is considerably larger than the posterior portion, or tail-fold. The latter has apparently shrunk away somewhat from the chorion. From specimen VII. As in other species, so in *P. novae-britanniae*, the uterus is constricted at intervals, but the intervals are not regular and the constrictions are not always adapted to the position of the embryo. It is not uncommon to find an embryo tightly squeezed by a uterine constriction. On the other hand, it is still more common to find two or more embryos placed end to end without any intervening constriction.

Fig. 33. Stage IX. The caudal and abdominal regions have now increased so much in their independent growth that the caudal extremity lies in front of the head. It is only the cephalic half of the embryo which is in direct continuity with the trophic vesicle. All that portion of the posterior part of the body which in the figure is seen to lie in front of the head is free from the trophic vesicle and only lying upon it as on a cushion. The cephalic extremity, with the procephalic lobes from which the antennae have begun to bud out, still occupies its primary position, and, when lying in the uterus, points in the direction of the vagina. The small circles, some distance behind the antennae, represent the manducatory appendages showing through by transparency. Chorion omitted. Total length upwards of 4 mm. Although the total length of the embryonic vesicle is somewhat reduced in this stage, the size of the embryo itself is much greater. This is a natural consequence of

the fact that, *pari passu* with the growth of the embryo, a decrease in the size of the trophic vesicle supervenes. From specimen II.

Fig. 33 *a*. Another embryo closely similar in point of age to the preceding. This figure is inserted chiefly for the purpose of elucidating the preceding figure and the remarks made upon the latter. It shows the independence of the posterior abdominal region. The trophic vesicle is only directly connected with the anterior abdominal and cephalic regions. The knob-like or funnel-like stomodoeum (the dark-shaded body behind the antennae) projects vertically into the trophic cavity. The embryo is doubled up by a ventral abdominal flexure, and the caudal end projects far in front of the cephalic end. The trophic vesicle is restricted to the anterior moiety of the embryo of which it forms the back. Thus in this region the wall of the trophic vesicle is the dorsal side of the embryo. The trophic cavity is continued into the free posterior moiety of the embryo, but its proportions are so narrowed that the dorsal side of the embryo in this region is not inflated as it is in the anterior region. The ventro-lateral margins of the body are thickened by the appendicular outgrowths which contain mesoderm and by the delaminating nerve-cords. The latter appear as distinct parallel ridges bounding the sides of the body. Between the neural ridges the ventral body-wall is as thin as the wall of the trophic dilatation, so that between the neural ridges there is a wide longitudinal groove which is seen very clearly by focussing deeply through the trophic wall. This explanation will account for the appearance of a notch in the figure at the point of flexure of the embryo. The parallel neural ridges are shown in the anterior region, but only the left ridge can (from this aspect) be traced round the bend and along the recurved abdominal region; the right neural ridge becomes quite concealed beyond the bend. Only the appendages of the left side are indicated, although those of the right side showed through by transparency. (See Fig. 7 in the text for illustration of the internal groove between the neural ridges.) From specimen IV.

Fig. 34. This is an exceptional embryo which in some respects is less advanced than the preceding, and in other respects more advanced. Thus the antennae have not yet budded out from the procephalic lobes and the lips have not commenced to enclose the manducatory appendages, but the trophic vesicle has almost entirely disappeared from the region of the trunk, and appears as a relatively enormous lobe springing from the head. Near the point of abdominal flexure of the embryo there is still a trace of the posterior portion of the trophic organ. The curious way in which this posterior remnant of the vesicle is bent up is due to the fact that at that point the embryo was caught in a sharp bend of the uterus like that shown in Fig. 32.

In addition to the abdominal flexure there is the same caudal flexure which has been noticed in previous embryos. Chorion omitted. From specimen III.

Fig. 35. Stage X. In this stage the embryo has advanced considerably from the condition observed in Stage IX. The caudal flexure has disappeared, or, in other words, the tail has straightened out, and the point at which the abdominal flexure occurs has receded backwards, so that the posterior end of the body now lies a long distance behind the head. Meanwhile a cephalic flexure has occurred, so that the anterior end of the embryo is bent backwards and does not point towards the vagina. The trophic vesicle is much reduced relatively to the size of the embryo, but a long and very remarkable prolongation of the vesicle extends beyond the head, covering over the ventral surface of the embryo. The first appendage seen behind the antenna is the oral papilla. The embryo is shown removed from the uterus, but enveloped by the chorion. From specimen IV. × 12.

FIG. 36. Portion of uterus containing an embryo of about the same stage as the preceding, but varying considerably in appearance. For some reason or other the cephalic flexure has not taken place, so that the antennae still point towards the vagina (i.e. away from the ovary) as in earlier stages. The trophic vesicle is still more reduced than in the preceding embryo. There is no prolongation of the vesicle overlapping the ventral surface, but merely a prominent lobe in front of the head. The antenna is seen to arise from the prominent procephalic lobe behind which is the oral papilla of the left side. The manducatory appendages, being already enclosed, are not to be seen. Behind the base of the procephalic lobe is to be seen a small knob-like structure projecting dorsally and slightly backwards into the interior of the embryo. This is the stomodoeum. The abdominal flexure has not receded back so far as in the preceding embryo. From specimen VII. × 12.

FIG. 37. Enlarged view of the head of the embryo shown in Fig. 33; from the ventral side. The vestibule leading into the stomodoeum is so deep that the latter cannot be seen in this view. The antennae arise by a narrow base from the procephalic lobes; at the sides of the latter are to be seen the optic vesicles. Behind the procephalic lobes, the lips are beginning to surround the manducatory appendages, and behind these are the oral papillae.

FIG. 38. Dorsal view of same. The stomodoeum is seen to lie immediately below the dorsal integument; its lumen is seen in optical section; the lines radiating from it no doubt represent the retractor muscles. From its position with relation to the procephalic lobes it will be readily inferred that it projects dorsally and forwards. At a later stage (Fig. 36), as we have seen, it projects dorsally and backwards, and at a still later stage, as in the adult, it projects backwards. Thus is illustrated what I have described as the rotation of the stomodoeum. At an earlier stage than the present the stomodoeum projects straight forwards (see next Plate).

PLATE IV.

As the chief object of the figures on this plate is to assist in the elucidation of the embryos represented on Plate III, it was not thought necessary to fill in the histological details. The outlines were drawn with the camera lucida from sections 5μ thick cut transversely to the long axis of the embryonic vesicle. The layers are indicated by different tints, the dark tint denoting ectoderm, and the lighter tint the mesoderm and endoderm. Where the endoderm is clearly distinct from the mesoderm, it is differentiated from the latter by a still lighter tint.

The trophic vesicle in the fresh embryo is distended with nutrient fluid contents, and, after preservation, its walls appear more or less collapsed according to the relative rapidity with which the diffusion between the contents of the cavity and the preserving fluid has taken place.

FIGS. 39, 40. STAGE III.

FIG. 39. Posterior region of embryonic tract with primitive streak and primitive groove.

FIG. 40. Anterior region of primitive streak (seven sections from preceding) with overlying cranial groove. The thickened ectoderm of the embryonic tract passes gradually into the simple trophic ectoderm. In this embryo the wall of the trophic vesicle had collapsed, so that its cavity appears much reduced.

Figs. 41—45. Stage IV.

Fig. 41. Posterior region of embryonic tract behind the primitive streak. The section involves the hinder end of the mesodermic proliferation. Shortly behind this region the thickened cap-like plate of embryonic ectoderm ceases, and the wall of the trophic cavity consists simply of trophic ectoderm and trophic endoderm.

Fig. 42. Hinder portion of primitive streak (five sections intervening between this and preceding).

Fig. 43. Middle portion of primitive streak with shallow primitive groove. This is not quite the deepest portion of the groove.

Fig. 44. Middle region of the embryonic plate in front of the primitive streak, between the latter and the cranial groove. The solid plate of mesoderm occupies the whole width of the embryo between the thickened embryonic ectoderm and the endoderm.

Fig. 45. Anterior region of embryonic plate. The mesodermic plate is here seen to be dividing into paired mesodermic bands which are still united together across the middle line by a narrow bridge. The separation of the mesoderm into paired bands coincides with the depression caused by the deepening by the cranial groove. At this stage the stomodoeal involution cannot be distinguished from the cranial groove.

Figs. 46—50. Another embryo of the same stage, being the one shown in Fig. 25.

Fig. 46. Posterior end of primitive streak. The mesodermic mass attains the surface of the embryo and appears as a plug between the two portions of the embryonic ectoderm which meet together behind this point. The embryonic vesicle is seen lying within the chorion which is omitted from most of the drawings.

Fig. 47. Middle region of primitive streak with groove. This is practically identical with Fig. 43.

Fig. 48. Anterior end of primitive streak. This section passes through the deepest part of the primitive groove which forms at this place, at a later stage, the proctodoeal involution.

Fig. 49. Region of cranial groove. This groove extends over some seven or eight sections; its depth varies slightly at different points.

Fig. 50. Anterior region of embryo in front of the cranial groove. A solid tongue of ectoderm reaches the endoderm and completely divides the mesodermal bands from one another. In comparison with the next stage this tongue may represent the delamination of the stomodoeum, or it may merely be related to the base of the cranial groove. In front of the region represented by this section the embryonic plate rapidly dwindles out, and only the trophic ectoderm and endoderm remain.

Figs. 51—57. Stage VI. Sections through the embryo represented in Figs. 27 and 28.

Fig. 51. Section passing through the middle of the primitive streak which has begun to double over the ventral surface of the embryo and become independent of the trophic vesicle. The embryonic ectoderm is coextensive with the mesoderm which, at this stage, is rapidly breaking up into hollow somites. Beyond the dorsal edge of the somites (on the lower side of the figure) the embryonic ectoderm passes sharply into the trophic ectoderm which can be easily distinguished in all sections by the character of its cells. Beyond the frontal or ventral edge of the somites the thickened lateral ectoderm passes into the low ectoderm which now occupies the ventral surface of the embryo proper. The primitive groove occupies the median ventral line of the primitive streak, its position being apparently reversed from that of previous stages in consequence of the recurvature of the free growing end of the embryo. Thus in previous stages the primitive groove faced outwards, now it faces inwards. The section may have been slightly oblique since two somites are seen on the left side of the figure, namely, somites 3 and 4, while only somite 4 is seen in section on the right of the figure. The primitive streak as here figured is essentially identical with that of *P. capensis* as figured by Sedgwick in his Stage C. It is quite solid and consists of a mass of proliferating cells in which may be distinguished an outer portion or mes-ectoderm and an inner core or mes-endoderm, the latter proceeding from the former. The chorion is shown in the figure.

Fig. 52. Section passing through the plane in which the outgrowing caudal region unites with the main body of the embryo. This region lies posteriorly to the preceding with relation to the cephalic end of the embryo, but a little reflection will show that the superincumbent caudal portion of the embryo is morphologically anterior to the free primitive streak of Fig. 51. We have in fact got beyond the primitive streak. The somite to the right of the figure is the anterior portion of the fifth somite (counted, of course, from the head); that to the left is the posterior portion of the fourth somite. This obliquity may be merely due to an accident of cutting or it may be partly due to a slight inequality in growth. The irregular cavities in the mes-endodermic mass are portions of the trophic cavity and their appearance is due to the fact, that, so far as the caudal portion of the embryo is concerned, the section cuts the caudal mesoderm tangentially.

Fig. 53. Section passing through the tail-swellings with nascent somites. This section is posterior to the preceding, that is to say, nearer the posterior end of the trophic vesicle, but it is easy to understand that the nascent caudal somites are approaching the trunk-somites. The conditions here portrayed are at first rather puzzling, but they are due to the fact mentioned in the text that the flexure of the embryo occurs *in situ*. The trunk-somite to the right of the figure is the anterior tip of the sixth somite; that to the left is the middle of the fifth. Behind this region the tail-swellings gradually flatten out until finally the embryonic region is passed over and we find as before merely trophic ectoderm and endoderm.

Fig. 54. Section passing tangentially through the posterior portion of the "head-swellings." It shows the transition from the thin ectoderm of the ventral abdominal surface into the thickened ectoderm of the cranial groove and cephalic region generally and also the entrance to the stomodoeum. On the right of the figure, somites 3 and 4 are seen in section, and to the left somites 2 and 3. This section passes through the posterior margin of the cephalic region which forms the anterior limit of the crescentic groove shown in Figs. 27 and 28.

FIG. 55. Section passing immediately in front of preceding showing the minute lumen of the stomodoeum enclosed within the thickness of the ectoderm at the base of the cranial groove. Only ectoderm is shown in the figure.

FIG. 56. Section passing slightly anterior to preceding showing the solid anterior end of the stomodoeum lying below the cranial groove. The somites on the right are 1, 2 and 3; those on the left, 1 and 2.

FIG. 57. Section through anterior region of embryo in front of the stomodoeum. The embryo proper is as usual restricted to the ventral (upper in the figure) moiety of the trophic vesicle. As before, the embryonic ectoderm merges into the trophic ectoderm at the level of the outer and dorsal margins of the somites. The figure gives a good impression of the relatively enormous capacity of the trophic vesicle. Somites as in preceding.

FIGS. 58—65. Stage VIII. Sections through the embryo represented in Figs. 30 and 31.

FIG. 58. Through middle of procephalic lobes with first pair of somites, in front of stomodoeum. The outline of the trophic vesicle is rendered diagrammatically. At the outer angles made by the procephalic lobes with the trophic vesicle, the embryonic ectoderm passes into the trophic ectoderm.

FIG. 59. Section somewhat posterior to preceding passing through the stomodoeum which in this stage has a well-defined lumen and runs straight from behind forwards as a caecal tube below the cranial groove. The section cuts the lobes which give rise to the manducatory appendages, tangentially. The shallow groove on the outer side of the procephalic lobe (only shown on the right of the figure owing to slight obliquity) occupies the position of the optic vesicle and is no doubt to be interpreted as the optic groove.

FIG. 60. Section through the posterior end of the procephalic lobes showing the stomodoeum fused with the ectoderm; also passing through the second pair of somites.

FIG. 61. Section immediately behind the procephalic lobes (on the left one of them is cut tangentially) through the external opening of the stomodoeum. On the left is somite 2; on the right somites 2 and 3. In somite 2 on the left there is a short canalicular portion of the somite bounded by the somatic mesoderm and opening into the cavity of the somite. This presents, in the preparations, the appearance of being a vestigial segmental organ.

FIG. 62. Section through the third pair of somites. On the right a small portion of the 4th somite is involved in the section. The segmental tubules of the third pair of somites have commenced to form and one of them is shown to the right of the figure, as a small tube enclosed in the somatic mesoderm, and shut off from the main cavity of the somite. In front of this point the tubule opens freely into the latter; behind it ends blindly.

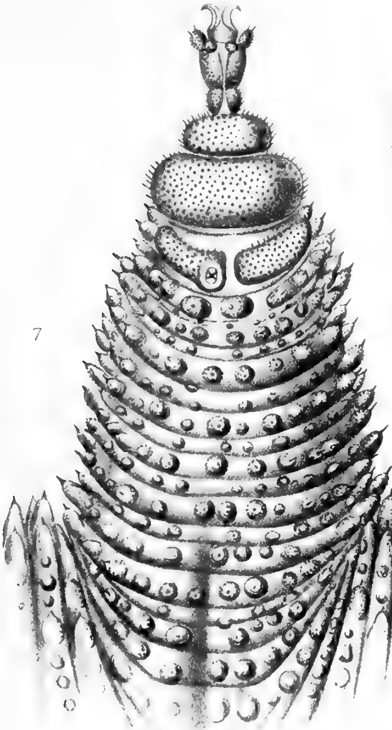
The trophic ectoderm is indicated by the dotted lines.

FIG. 63. Threefold section of embryo due to the double flexure—abdominal and caudal. Trophic ectoderm is indicated by dotted lines. The lower section is through the caudal region, that on the left through the abdominal region and that on the right through the anterior region at the level of the fifth somite.

The trophic ectoderm accompanies the abdominal flexure but not the caudal flexure. It enables the dorsal side of the embryo to be distinguished.

Fig. 64. Similar section farther back. In the middle of the thickened ventral surface of the caudal portion of the section is shown the proctodoeal involution.

Fig. 65. Section through the plane of junction of the abdominal and anterior regions. It passes through the angle of flexure. The ventral surfaces are seen to be united, the flexure being a ventral one. Trophic ectoderm denotes the dorsal side of the embryo and is indicated by dotted lines. The lower independent portion of the section passes through the region of the primitive streak which is now much reduced from the condition shown in Fig. 51. It now resembles the original condition seen in Figs. 42 and 47. In fact having nearly served its purpose it is on the way to disappear.



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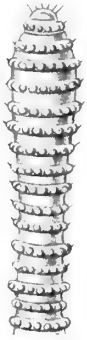

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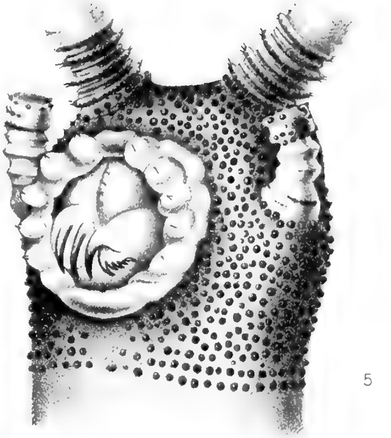

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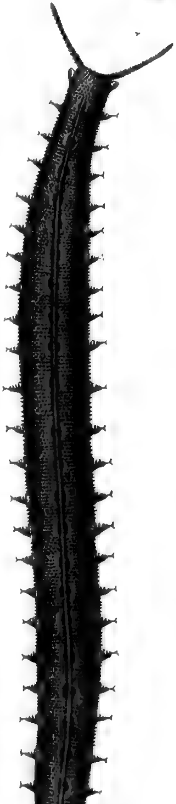

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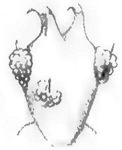

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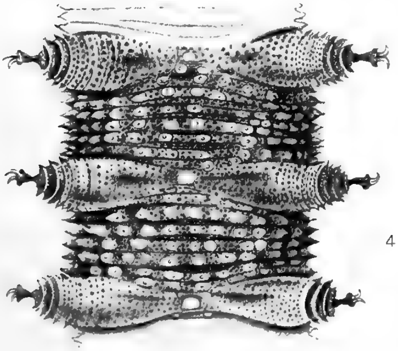

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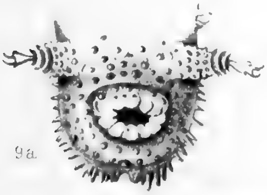

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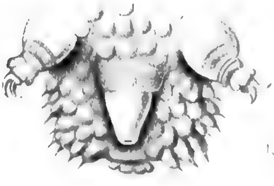

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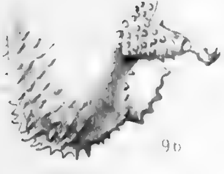

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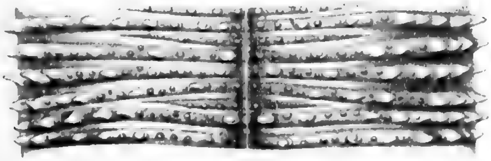

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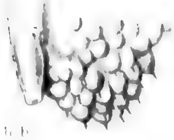

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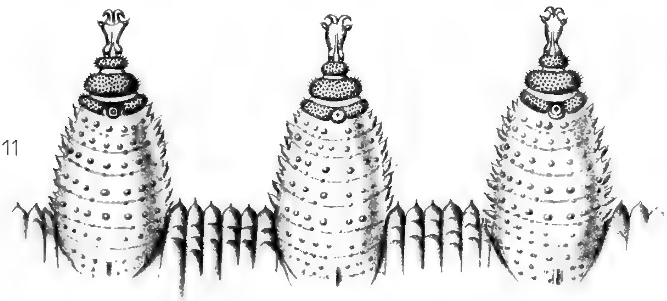

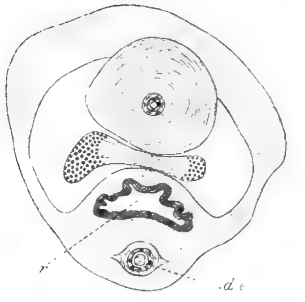

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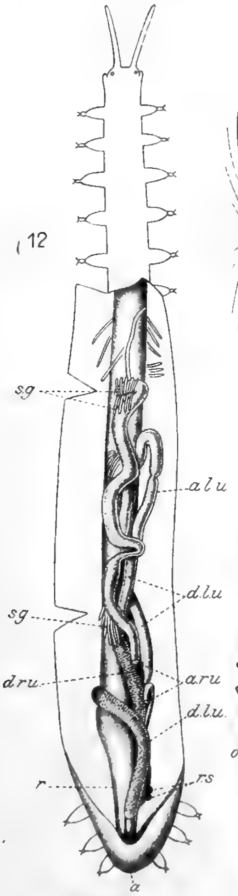

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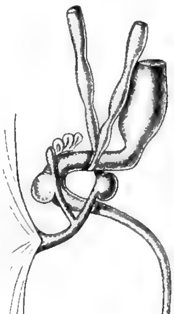

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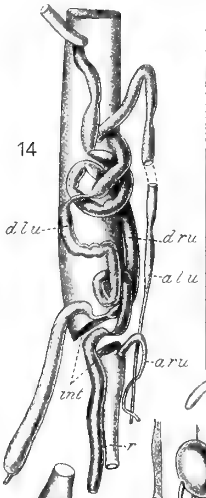

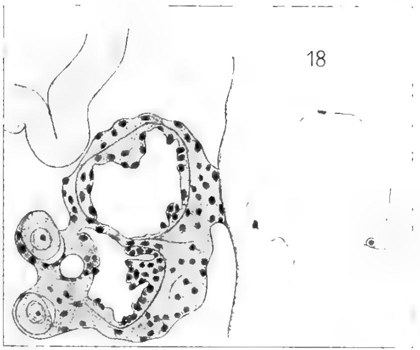

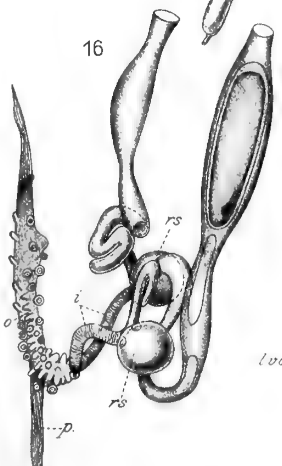

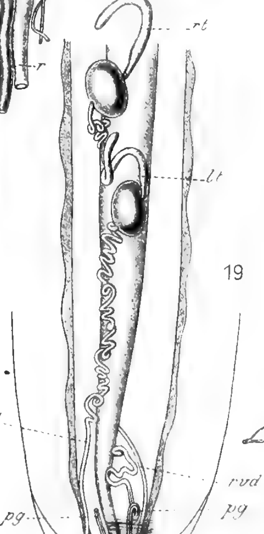

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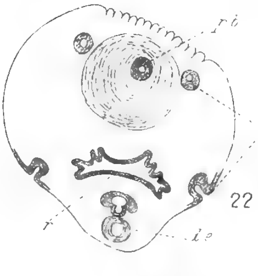

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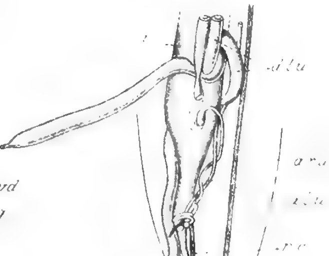

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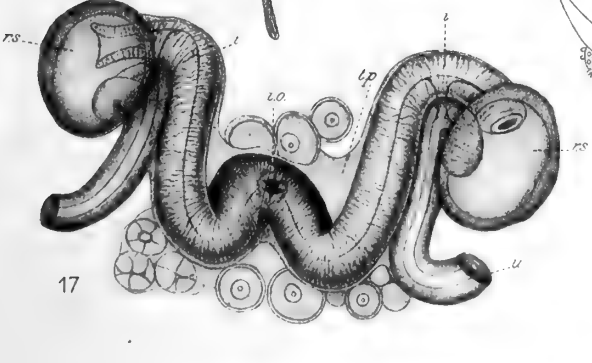

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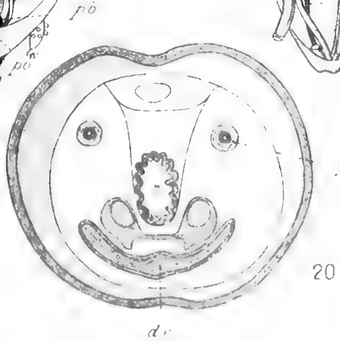

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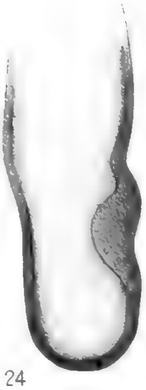
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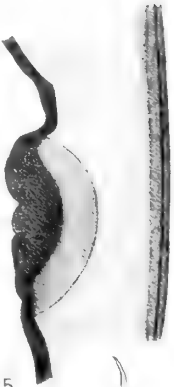
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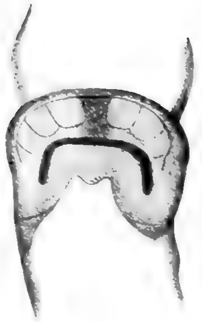
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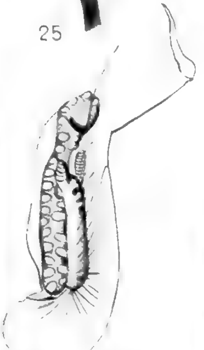
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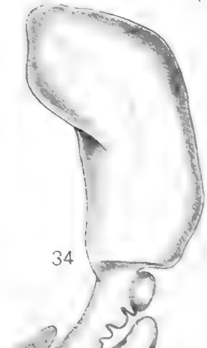
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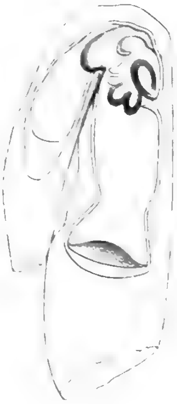
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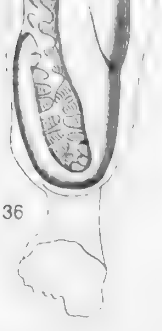
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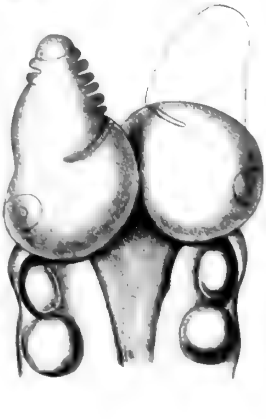
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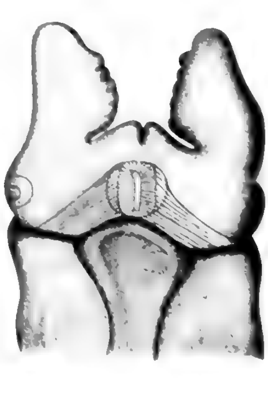
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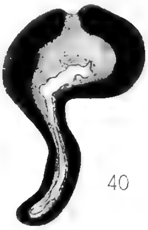
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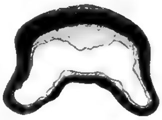
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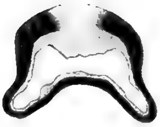
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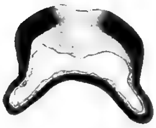
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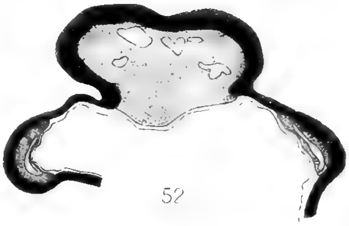
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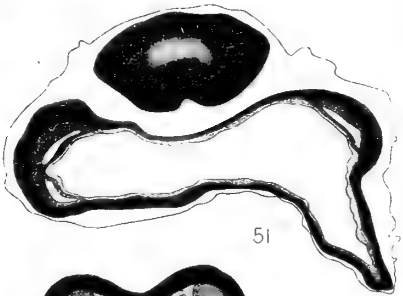
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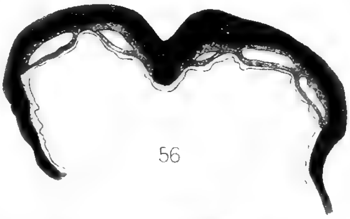
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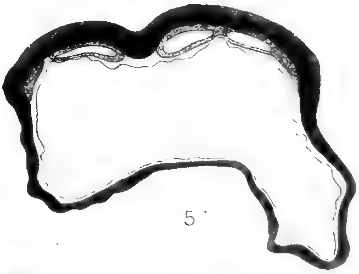
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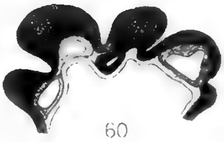
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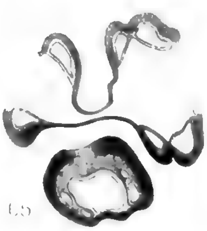
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Edwin Wilson, Cambridge.

METAPROTELLA SANDALENSIS, n. sp.

BY DR PAUL MAYER.

THE Caprellidae which I recently received from Mr A. Willey, who requested me to describe them, all belong to the same species. There are 9 males, 5 females and 2 young individuals. Unfortunately almost all the legs had fallen off and the flagella of the superior antennae were broken.

The largest male measured fully 9 mm., not including legs and antennae; the flagellum of the superior antenna, so far as it was present, had 11 segments.

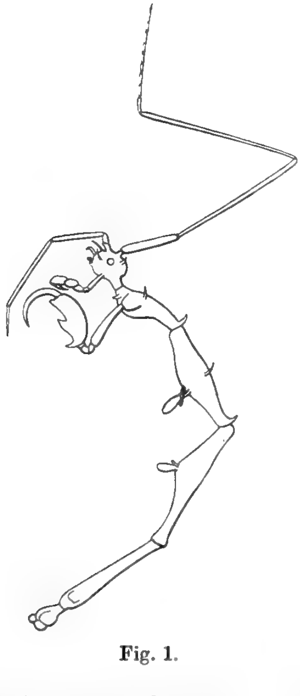

Fig. 1.

The species is new and belongs to the genus *Metaprotella*, Mayer (Mayer, Die Caprelliden des Golfes von Neapel, Nachtrag, 1890, p. 24). It may be named *sandalensis* after the place in which it was found, namely, Sandal Bay, Lifu.

Apart from the character of the mouth-parts, the most distinctive feature of the genus *Metaprotella* is the fusion of the last thoracic segment with the preceding segment (Fig. 1). In the arrangement of the spines, this species closely resembles *M. haswelliana*;

thus, the head carries a pair of spines dorsally and another spine on each side at the point of insertion of the mandibles; further on segment 2, there is a pair of dorsal spines and an unpaired spine at the hinder margin of the segment; the same applies to segment 3; finally in the male there is a pair of robust spines placed latero-ventrally near the anterior margin of segment 2. These latero-ventral spines of the second segment are reduced to mere knobs in the female.

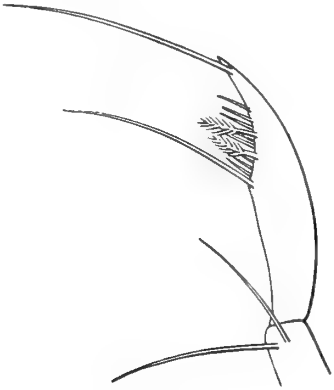

Fig. 2.

The mandibular palp carries at the end between the two long bristles 8 or 9 short simple setae, and two short feathered setae (Fig. 2).

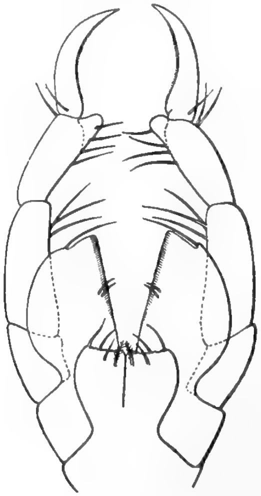

Fig. 3.

The palp of the maxillipede (Fig. 3) has an inwardly directed process at the distal end of the penultimate segment as in *M. haswelliana* and *M. excentrica.* For the rest, the mouth-parts are typically those of *Metaprotella.*

The rudimentary legs of the third and fourth segments are about half as long as the branchiae; they are slender, and provided at the end with one long and about six short setae—the latter somewhat damaged in the specimens.

The form of the first and second legs of an adult male is shown in Figs. 4 and 5, with regard to which it should be noted that the blunt teeth on the palmar margin of the hand of the second leg (grosse Greifhand) vary considerably in number and appear also to be liable to fall off.

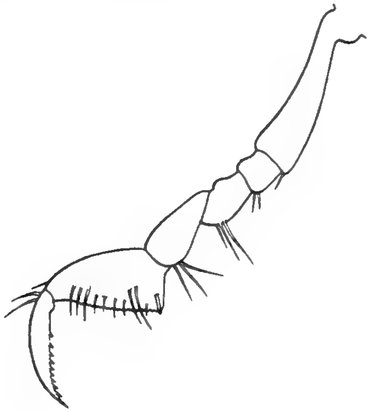

Fig. 4.

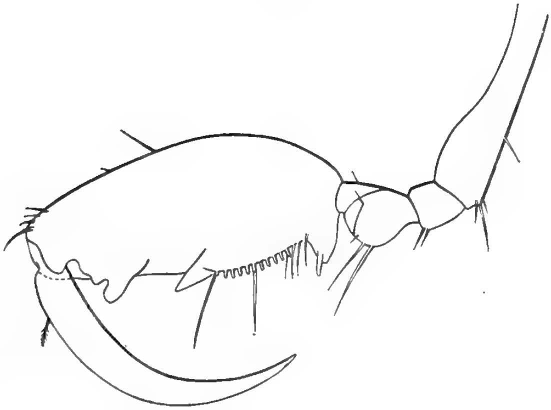

Fig. 5.

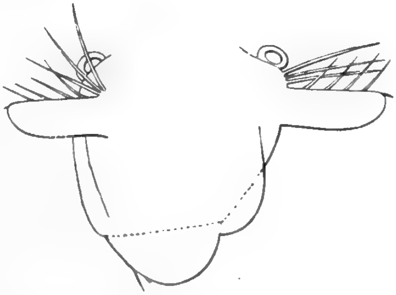

Fig. 6.

The abdomen of the male (Fig. 6) has only one pair of rudimentary appendages.

Habitat. Sandal Bay, Lifu, Loyalty Islands. They were taken, as Willey writes me, "chiefly from the tests of transparent Ascidians which attach themselves in great numbers to the native fish-baskets in from 10 to 15 fathoms of water."

The habitat of the new species is interesting. The other species of the genus *Metaprotella* have hitherto been found in Port Jackson (Australia), and also between Ceylon and the mainland of India and at the Philippine Islands. On the whole, as far as known, in the Tropics, compared with the higher latitudes, not only Caprellidae are rare but also the individuals are relatively small. This rule seems to hold good in the case of Lifu. As for the Equator, I stated years ago (*op. cit.* p. 99) that very likely in shallow water, on account of its high temperature, no Caprellidae whatever may live, and I should be very glad if investigators travelling in those regions or living there would state this assertion to be well founded.

Zool. Station, Naples. *March*, 1898.

EXPLANATION OF THE FIGURES.

FIG. 1. Adult ♂. × 8. The 3 last pairs of thoracic legs by which the animal hooks on to the Ascidian test, fallen off.

FIG. 2. Tip of the mandibular palp. × 260.

FIG. 3. Maxillipedes. × 180.

FIG. 4. First leg—only the larger setae indicated. × 57.

FIG. 5. Second leg—apparently somewhat shrunken. × 57.

FIG. 6. Abdomen of ♂ somewhat compressed. × 260.

ON A LITTLE-KNOWN SEA-SNAKE FROM THE SOUTH PACIFIC.

By G. A. BOULENGER, F.R.S.

With Plate V.

During his stay at Lifu, Loyalty Islands, Dr Arthur Willey was so fortunate as to secure two examples of a very rare marine Snake, which he has presented to the British Museum, where the species to which they belong was unrepresented. Although three descriptions of it have appeared, under as many different names, our knowledge of this Snake is a very meagre one, and it is therefore with great pleasure I accepted Dr Willey's proposal of drawing up an account, accompanied by figures, of the specimens obtained by him.

AIPYSURUS ANNULATUS.

Emydocephalus annulatus, Krefft, Proc. Zool. Soc. Lond., 1869, p. 322, and Snakes of Austral. p. 92 (1869).

Emydocephalus tuberculatus, Krefft, ll. cc. pp. 322, 93.

Aipysurus chelonicephalus, Bavay, Mém. Soc. Linn. Normand. xv. no. 5, 1869, p. 34.

Aipysurus annulatus, Boulenger, Cat. Snakes, iii. p. 304 (1896).

Eye as long as its distance from the mouth. Snout short, rounded, twice as long as the eye; rostral as deep as broad, bearing a conical, spine-like tubercle suggesting the egg-wart or rostral callosity of some reptilian and batrachian embryos[1]; nasals longer than the præfrontals; frontal hexagonal, longer than broad, as broad as the supraocular, as long as its distance from the rostral; parietals as long as the frontal, sometimes divided by a longitudinal suture; supraocular undivided; nasal forming a suture with the single præocular; two postoculars; temporals $2+2$; two upper and two lower labials, the second extremely large, formed by the fusion of several shields; first upper labial in contact with or narrowly separated from the præocular; two or three pairs of chin-shields, the anterior extra pair, if present, small, detached from the first pair of lower labials. The upper head-shields may be rough with small granules. Scales in 17 rows, feebly imbricate, nearly as long as broad, rough with several small tubercles. Ventrals 139—141; subcaudals 31. The coloration is different in the two specimens, both males:—

A. (Total length, 760 millim.; tail, 110.) Annulate black and yellow, the black annuli broader than the yellow ones and often running together on the middle of the back, and with some black spots between them on the belly; head yellow with a wide-meshed black network.

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[1] Which is, however, absent in the sea-snakes as well as in all known Ophidians.

B. (Total length 690 millim.; tail 105.) Blackish brown, speckled with yellow on the sides and beneath, here and there with small yellow spots showing, in their arrangement, traces of the annuli described in the preceding specimen; head yellow, spotted and speckled with black.

This species appears to have been described, almost simultaneously, by Krefft and by Bavay. The specimens obtained at Lifu by Dr Willey are unquestionably referable to Bavay's species, established on examples from the same locality and agreeing in the conical shape of the rostral shield. As to the Snakes, of unknown origin, described by Krefft, Mr E. R. Waite, of the Sydney Museum, has been so kind as to supplement, at my request, the insufficient account of them given by that author. Mr Waite agrees with me that *Emydocephalus annulatus* and *E. tuberculatus* are "undoubtedly the same," and he adds the following notes on their head-shields: "Rostral a little deeper than broad, with a groove on each side running from the mouth to the nasal[1]. Frontal slightly longer than broad, not so long as its distance from the snout. Nasal broadly in contact with the single præocular. Three pairs of chin-shields, first smallest, the last separated by a shield."

These notes, together with a sketch of the head, upper and side views, taken from one of the types (that of *E. tuberculatus*), show a remarkable agreement with Dr Willey's specimens, except for the absence of the conical tubercle on the rostral shield. However, the fact that the degree of development of this tubercle varies in the Lifu specimens according to Bavay ("plus ou moins prononcée selon les individus") renders it doubtful whether this character by itself can be regarded as indicating specific difference, and I think it advisable to consider, provisionally at least, the specimens with and those without the tubercle as pertaining to a single species. This view is further substantiated by the remarkable agreement in the number of ventral and subcaudal shields, viz. 135—144 + 30—36 in Krefft's two specimens, and 144 + 36 in Bavay's type; whilst our two specimens show 139—141 + 31. As regards coloration, our specimens represent *A. annulatus*, Krefft (A) and *A. tuberculatus*, Krefft (B), whilst *A. chelonicephalus*, Bavay, appears to be exactly intermediate between the two.

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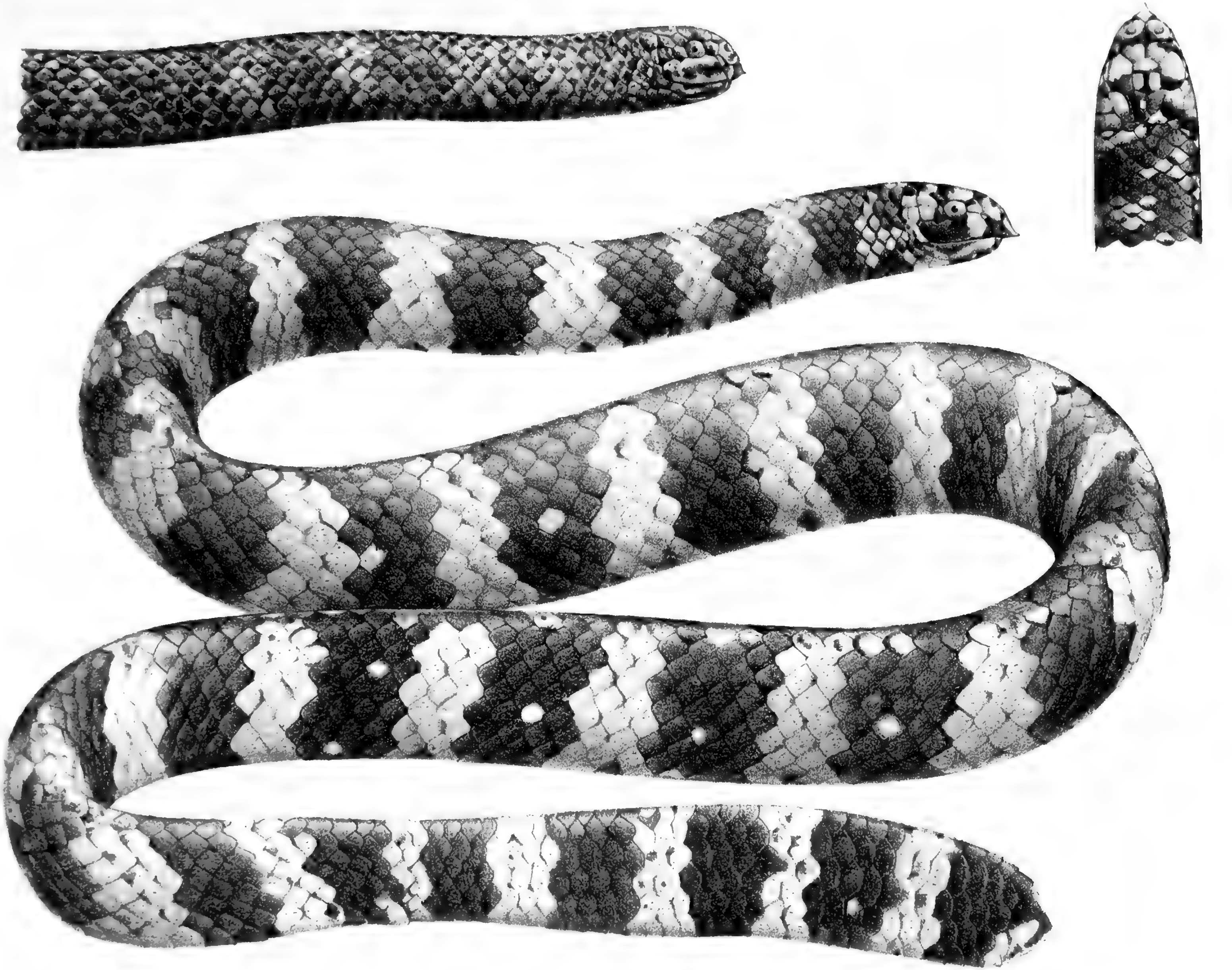
[1] A trace of this groove is observable in our specimen B.

EXPLANATION OF PLATE V.

Aipysurus annulatus. Natural size, with upper view of head; and side view of head and anterior part of body of smaller specimen (B).



J. Green ad nat. lith.

West, Newman imp

BOULENGER. AIPYSURUS ANNULATUS.

REPORT ON THE CENTIPEDES AND MILLIPEDES OBTAINED BY DR A. WILLEY IN THE LOYALTY ISLANDS, NEW BRITAIN, AND ELSEWHERE.

By R. I. POCOCK,

OF THE BRITISH MUSEUM OF NATURAL HISTORY.

With Plate VI.

In addition to a few specimens too immature or too damaged for identification, Dr Willey's collection contains representatives of twenty-one species, of which no fewer than thirteen prove to be undescribed, three of them being representatives of new genera. This percentage of new forms is not unexpectedly large, considering the little that was previously known of the 'Myriapod' fauna of the islands in question.

The fauna of New Britain shows affinities with that of the Oriental and Australian regions as defined by Sclater and Wallace. Of the centipedes, *Scutigera maculata, Cupipes amphieurys* and *Ethmostigmus platycephalus,* and of the millipedes, the species of *Rhinocricus,* constitute the Australian and Austro-Malayan element; whereas the Oriental element is represented by such forms as *Mecistocephalus punctifrons, Gonibregmatus anguinus, Otostigmus punctiventer* and *Eucratonyx hamatus.* Of the remaining forms recorded in this paper, *Ethmostigmus granulosus, Otostigmus angusticeps,* and *Trigoniulus pulcherrimus* belong to genera extending throughout the Oriental and Australian areas, while the new genus of millipedes, *Aschistodesmus,* is related to genera of equally wide distribution.

Of the new species here described the only one that calls for special comment is the centipede belonging to the genus *Gonibregmatus.* This genus was established by Newport, in 1844, upon a single dried female specimen in the British Museum, from the Philippine Islands. Nearly fifty years elapsed before the genus was rediscovered, when Dr Max Weber procured one, also a female, in the island of Saleyer, to the south of Celebes. This specimen proved to be specifically distinct from the Philippine species described by Newport. Although owing to scarcity of material but little was known of the mouth parts, Mr Cook recently established a family for the reception of the genus. That his conclusion was fully justified is borne out by an examination of the jaws, made possible upon the material Dr Willey was fortunate enough to obtain in New Britain, an examination which further shows the significance of Newport's describing the mouth as adapted for sucking.

In all the centipedes known up to the present time the mandibles or gnathites (jaws) of the first pair consist on each side of a bisegmented skeletal piece, that of the right side being independent of and disconnected from that of the left. But in *Gonibregmatus* each mandible consists of an outer and of an inner branch, the former corresponding to the normal biting mandible of the rest of the class. The inner branch is united to its fellow of the opposite side, though the junctional suture persists, and the plate that results from the union constitutes physiologically a lower lip or labium designed presumably to prevent the escape of fluids issuing from wounds inflicted by the outer branches of the appendage. The mouth lies some distance behind the tip of this lower lip or labium and of the upper lip or labrum, and these two structures constitute the upper and lower walls of a channel which is closed at the sides by the outer branches of the mandible; the mandibles, labium and labrum thus form a kind of proboscis along which the fluid tissues of prey flow or are sucked backwards to the mouth.

CLASS. CHILOPODA (Centipedes).

ORDER. SCUTIGEROMORPHA.

FAMILY. SCUTIGERIDAE.

(1) *Scutigera maculata*, Newp.

Ann. Mag. Nat. Hist. XIII., p. 96, 1844; Tr. Linn. Soc. XIX., p. 359, 1845.

LOC. New Britain.

The specific identity of the two specimens obtained by Dr Willey in New Britain must be regarded as doubtful. Both are of small size and more or less damaged.

This species has been formerly recorded from Australia.

ORDER. SCOLOPENDROMORPHA.

FAMILY. SCOLOPENDRIDAE.

GENUS. *Scolopendra*, Linn.

(2) *Scolopendra metuenda*, Pocock.

Ann. Mag. Nat. Hist. (6), XVI., p. 423.

LOC. Narowol, (Eddystone) Solomon Islands.

The type and hitherto only known example of this species was obtained in New Georgia, in the Solomon Islands, by the officers of H.M.S. 'Penguin.'

GENUS. *Cormocephalus*, Newport.

(3) *Cormocephalus violacescens* (Gervais).

Cormocephalus violaceus, Newport. Tr. Linn. Soc. XIX., p. 424 (1845). (Not *violaceus*, Fabr.)

Scolopendra violacescens, Gervais. Ins. Apt. IV., p. 275 (1847).

Cormocephalus brevispinatus, L. Koch. Verh. zool. bot. Ges. Wien. 1867, p. 248 (*teste* Haase).

Cormocephalus purpureus, Pocock. Ann. Mag. Nat. Hist. (6), XI., p. 127 (1893).

The name *violaceus* applied by Newport to this species is inadmissible for it, having been previously given by Fabricius to a South African member of the same genus. Gervais's name *violacescens* can consequently stand. I proposed the name *purpureus* for the species upon discovering that *violaceus* had to be transferred, but forgetting that there were already a couple of other names in use.

Dr Willey obtained examples of this species in the Loyalty Islands (Lifu and Uvea). It was recorded from New Zealand by Newport, and from Gayndah and Rockhampton in Queensland by Haase.

GENUS. *Cupipes*, Kohlrausch.

(4) *Cupipes amphieurys*, Kohlr.

Cupipes amphieurys, Kohlrausch. Arch. Nat. 1882, p. 79.

Cupipes quadrisulcatus, Meinert. Amer. Phil. Soc. p. 187, 1885.

LOC. New Britain—a single specimen. Previously recorded from Ponape in the Caroline group.

GENUS. *Otostigmus*, Porat.

(5) *Otostigmus punctiventer* (Tömösv.).

Branchiostoma punctiventer, Tömösvary. Termes. fuzetek. IX., p. 66, pl. III., figs. 17, 18.

Otostigma punctiventre, Haase. Abh. Mus. Dresden, p. 72.

Colour olive green or nearly black, with metallic purple or bronze reflections; head, maxillipedes, first and last tergites tinted with chestnut red; legs a greenish or pale purple, paler at the base or indistinctly annulate; antennae greenish.

Head and maxillipedes punctured; coxal processes of maxillipedes with 3–3 or 4–4 teeth, the external on each side strong and separated, the internal fused.

Antennae 18–22 segments, whereof the basal two are naked.

Tergites from the 5th bisulcate, from the 9–11 marginate; from about the 5th or 6th covered with fine spinules, which increase in coarseness in the posterior half of the body; external portion of tergites distinctly though not very strongly wrinkled.

Sternites bisulcate in their anterior half, with a stronger or weaker posterior median impression; punctured and beset with short scattered setae.

Anal tergite and *sternite* spicular like the rest; the former mesially impressed posteriorly, the latter emarginate: *pleurae* elongate, armed with 5, 6 or 7 spines, 2 apical, 2 or 3 external, and 2 or 1 dorsal: anal legs long and slender, femur armed with about 14 spines, 3 (one apical), 3, 3, 5 or 4; protarsus with a spur. Rest of the *legs* also with protarsal spur. Length 50 mm., of anal leg 14·5, of antennae 15·5.

LOC. New Britain. Several specimens.

Haase's description of *O. punctiventer* from Sarawak, Borneo, applies closely to these specimens, making slight allowances for differences in the state of preservation of the examples examined.

(6) *Otostigmus angusticeps*, sp. n.

Colour a uniform green, head slightly rufescent: anal legs banded with darker green.

Head oval, elongate, rather coarsely but sparsely punctured antennae with 19 segments, of which the basal two or three are naked.

Precoxal plates of maxillipedes armed with 3–3 teeth, the two inner fused, the outer isolated.

Tergites smooth, punctured, not spicular, and not noticeably wrinkled, from the 5th bisulcate, from the 9th marginate.

Sternites also smooth, strongly and completely bisulcate, with an anterior and posterior median impression.

Anal somite: tergite posteriorly impressed: sternite broad: pleurae elongate, with two apical spines and one external spine near the base of the process.

Legs moderately long, femur armed with 11 strong spines arranged in four rows 3, 3, 2, 3: tarsus unspined. Protarsal segment of the remaining legs spined.

Total length 41 mm.: of anal leg 11, of antennae 12.

Loc. New Britain.

Differs from the preceding species in the smoothness of the dorsal and ventral surface, the completeness of the sulci on the sterna, the fewer spines and absence of protarsal spur on the anal legs.

Genus. *Ethmostigmus*, Poc.

(7) *Ethmostigmus platycephalus* (Newport).

Heterostoma platycephalus, Newp. Trans. Linn. Soc. xix., p. 415 (1845).

Loc. New Britain. Previously recorded from Halmahera, New Guinea, Tahiti, Duke of York Island, etc.

(8) *Ethmostigmus granulosus*, sp. n.

Colour a tolerably uniform olive brown, with metallic reflection; lower surface olive yellow, antennae olive green at the base, distally covered with fulvous pubescence; maxillipedes and anal pleurae castaneous; legs olive green with pale yellowish basal and tarsal segment.

Antennae with 20 segments, whereof the basal 3–4 are naked.

Head and tergal plates finely punctured; the middle and posterior tergal plates very finely but not very closely granular, the granulation thicker at the posterior end of the body than at the anterior end; tergal plates from the 5th bisulcate, from the 6th marginate: sternal plates very obsoletely bisulcate.

Anal pleurae long and slender, surpassing the middle of the femur and as long as the femur of the anal leg, armed with 1 lateral spine; 2 larger adjacent apical spines, above which there are usually 2, and below sometimes 1 smaller spine.

Anal sternite narrowed and emarginate posteriorly; its posterior width less than its length and only a little more than half its basal width.

Anal legs longish and slender, the femur nearly four times as long as broad, armed with only 8 spines, including the apical process, arranged from above downwards as follows: 3, 2, 1, 2; protarsus unspined. Protarsus of pre-anal leg and of all in front of it with a single spur.

Measurements in millimetres. Total length of body and head 78, of antennae 22, of anal leg 24, width of body 8, of head 6, of anal tergite 5.

Loc. New Britain. Two examples.

This species differs from previously described forms in the fine granulation of its tergal plates. Apart from this feature it may be recognised from the preceding species by having only 8 spines on the anal legs.

Dr Willey also obtained an example apparently referable to this species from Narowol, in the Solomon Islands, and the British Museum has others from the Duke of York Island, which Mr Butler confounded with specimens of *E. platycephalus*, describing the two as *Heterostoma brownii.* The type of *brownii*, however, seems to be cospecific with that of *H. platycephalus*.

ORDER. GEOPHILOMORPHA.

FAMILY. DICELLOPHILIDAE, Cook.

GENUS. *Mecistocephalus*, Newport[1].

Proc. Zool. Soc. 1842, p. 178.

(9) *Mecistocephalus punctifrons* (Newport),

loc. cit.

Loc. New Britain.

(10) *Mecistocephalus lifuensis*, sp. n.

Colour yellow, head and maxillipedes castaneous.

Head-plate sparsely punctured, a few larger punctures amongst the smaller; two posterior grooves prominent; basal plate, maxillipedes and 1st tergite also sparsely punctured. Each *maxillipede* armed internally with 5 tubercular teeth.

Sterna, except the posterior, marked with median groove, which at the anterior end of the body is Y-shaped. Sternite of anal segment broad at the base, triangularly pointed posteriorly.

Pleurae moderately inflated, furnished with only about 20 large scattered pores.

51 pairs of legs. Length 34 mm.

Loc. Lifu (Loyalty Islands).

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[1] This genus of Newport's was primarily based upon the following species: *ferrugineus*, *maxillaris*, *punctifrons* and *guildingii*. The first of these, *ferrugineus*, was subsequently, that is to say, in 1847, taken out as the type of *Pachymerium*, and carries with it the second species, *maxillaris*. This left the two following species *punctifrons* and *guildingii* to represent *Mecistocephalus*, and the former was practically selected as the type by Wood (1869), and Meinert (1870). Thus by the process of elimination *punctifrons* will stand as the type of *Mecistocephalus*, of which *Lamnonyx* of Cook will be by this method a synonym.

In possessing 51 pairs of legs this species resembles *L. gigas* of Haase (Abh. Mus. Dresden, No. 5, p. 105, Pl. VI. fig. 111) recorded from New Guinea, but apart from its much smaller size, *gigas* attaining a length of 105 mm., *L. lifuensis* certainly differs in having the anal pleurae but little inflated and the pores large, few in number and not close-set. Haase describes these organs in *gigas* as follows:—"*pleurae posticae valde efflatae, rotundatae, poris perminutis plurimis perforatae.*" Mr Cook, it may be added, has recently established the genus *Megethmus* for *M. microporus* of Haase (Proc. U. S. Nat. Mus. XVIII., p. 74, 1896).

FAMILY. GONIBREGMATIDAE, Cook.

Proc. U. S. Nat. Mus. XVIII., p. 16, 1895.

GENUS. *Gonibregmatus*, Newport.

Newport, Proc. Zool. Soc., 1842, p. 181; Linn. Trans. XIX., p. 434, 1845.
Pocock, Max Weber's Zool. Ergebnisse, etc., Vol. III. pt. 2, pp. 317–319, 1894.

Sub-frontal plate of *head* hairy; produced downwards into a triangularly pointed prominence which supports the labrum at its apex; *labrum* consisting of a small semicircular plate of which the whole of the free margin is pectinate; that is to say, armed with fine, close-set spinules. (Figs. 1 *c*—1 *d*.) *Laminae fulcientes* irregularly hammer-shaped, with a slender posterior process which nearly meets its fellow of the opposite side in the middle line. Closely pressed against the laminae fulcientes and lying in the hollow formed by the labral process in front lie the mandibles. Each of these is composed of two branches, an outer and an inner; the former are in front of the latter, broad at the base, pointed at the apex, with the outer margin bristly, the inner or biting margin pectinate; the inner and posterior branches of the mandibles meet in the middle line throughout their length, though apparently without actual fusion, forming together a broadly triangular plate, the distal portion of which is membranous. (Figs. 1 *e*—1 *g*.)

Maxillae forming a plate, the free part of which is composed of a pair of rounded unsegmented plate-like, hairy lobes. (Fig. 1 *h*.)

Maxillipedes of 1st pair robust, coxa produced posteriorly, the rest of the segments thickly hairy or bristly, the claw strong.

Maxillipedes of 2nd pair with coxal plate twice as wide as long, the rest of the appendage slightly overlapping the head at the sides, with long, powerful claws. (Fig. 1 *c*.)

Head-plate about as long as wide, with very distinct and large frontal plate.

Antennae broad at the base, distally parallel-sided, segments more or less moniliform. *Prebasal plate* small, transversely lanceolate; *basal plate* wider than head.

Tergal plates with a pair of impressions, one at each side, rugose mesially.

Sternal plates with the pores apparently arranged in irregular transverse areas.

As many as five *pleural sclerites* above the stigmatiferous sclerite; *stigmata* vertically linear.

Anal pleurae inflated, finely porous, encroaching upon the antepenultimate segment; anal tergite narrow, sternite wider than long; no anal pores. Anal appendages of male two segmented; legs of male not inflated. (Figs. 1 *a*—1 *b*.)

This interesting genus was previously only known from a couple of specimens, each the representative of a particular species. Consequently up to the present time no detailed information respecting the mouth-parts was forthcoming.

Dr Willey, however, was fortunate enough to obtain several specimens of a third species in New Britain. I have therefore taken the opportunity to make the necessary dissection of the jaws and to supplement the diagnosis of the genus and family by describing them.

When establishing the family, Mr Cook, judging from the other structural features of *Gonibregmatus*, ventured to prophesy that the mouth-parts of this genus would prove to be peculiar. Examination has amply justified the prediction; for in the formation of its mandibles, which seem to retain a primitive bi-ramous character, *Gonibregmatus* stands alone in the class Chilopoda.

(11) *Gonibregmatus anguinus*, sp. n.

Pl. VI, Fig. 1.

Colour a uniform yellowish brown, with a bright red transverse band on the head. Number of pairs of legs 129 ♀, 115 ♂.

Length of ♀ up to 130 mm., of ♂ from 70–115 mm.

Loc. New Britain.

It is needless to describe this species in greater detail, since it appears to differ from the two previously established species of the genus in the characters set forth in the subjoined table:—

(*a*) Prescutum of anal somite distinct, separated from the tergite behind it by a deep transverse groove; 161 pairs of legs in ♀.........*cumingii*, Newport, Philippine Islands.

(*b*) Prescutum of anal somite either completely fused with the tergite or separated from it by a shallow suture; 129–131 pairs of legs in ♀.

(*a′*) Suture between prescutum and tergite persists as a shallow curved groove ....*anguinus*, sp. n. New Britain.

(*b′*) Suture between prescutum and tergite practically obliterated... *insularis*, Poc. Island of Saleyer.

When comparing *G. cumingii* and *G. insularis* on a previous occasion, I pointed out what at the time appeared to be two differential characters for *cumingii*, namely, the overlapping of the head-plate in front by the maxillipedes and the forward extension of the anal pleurae nearly to the posterior extremity of the fourth somite from the end. Both of these characters I now believe to be due to shrinking of the sclerites owing to drying.

FAMILY. EUCRATONYCHIDAE, nov.

Eucratonyx, gen. nov.

Pl. VI, Figs. 2—2 *c*.

Antennae broad at the base, attenuated apically.

Head covering maxillipedes, frontal plate distinct, suture weak; basal segment almost as wide as the head, but not covering the pleurae of the maxillipedes; prebasal plate either concealed by the head or appearing as a transversely linear sclerite.

Labrum not coalesced, undivided, appearing as a broad transverse plate the edge of which is sinuous, slightly convex at the sides, broadly and shallowly emarginate in the middle; armed with about thirty spinules, horny and close-set in the middle, transparent and directed inwards at the sides. (Fig. 2.)

Mandibles with the cutting edge toothed anteriorly (internally), pectinate posteriorly (externally) [apparently with only one pectinate and one dentate lamella]. (Fig. 2 *a*.)

Maxillae with external branch two-jointed; internal branch large and lobate. (Fig. 2 *b*.)

Maxillipedes of 1st pair with their coxae united by a narrow bridge; claw strong and pectinate. Coxal plate of second maxillipedes about twice as wide as long; chitinous lines distinct.

Tergites strongly bisulcate. *Sternites* with pores arranged in an irregular posterior transverse series, a few scattered pores in the middle and fore part of the plates. Stigma-bearing sclerite in contact with tergite.

Anal pleurae moderately inflated, covered but not closely with fairly large pores; anal legs long, moderately thick, clawless.

Type, *Eucratonyx meinerti* (Poc.).

This species was described originally under the genus *Himantarium* (Journ. Linn. Soc. XXI., p. 289, pl. XXIV., fig. 1; also Ann. Mus. Genova, XXX., p. 42, 1891). It certainly, however, differs in many important characters from *H. gabrielis*, the type of the last-named genus. Nor am I able to bring it into line with any of the families of Geophilomorpha established by Mr Cook. I am consequently compelled to create a new family for its reception. Tested by Cook's analytical table of the families of this group the *Eucratonychidae* fall alongside the *Schendylidae* under section D, but the size of the head and basal plate as compared with the prehensors (2nd maxillipedes), the distribution of the sternal pores, etc., seem to prohibit such a reference.

(12) *Eucratonyx hamatus*, sp. n.

Pl. VI, Fig. 2 *c*.

This species and *E. meinerti* may be distinguished as follows:

(*a*) Pleurae of the prehensorial maxillipedes showing very visibly at the sides of the basal plate; claws of legs in anterior half of the body weaker and but little curved. Number of legs from 103 (♂) up to 119 (♀); length of ♀ up to 112 mm. ....*meinerti*, Poc. Burmah, etc.

(*b*) Pleurae of prehensorial feet almost entirely covered by the basal plate; claws of anterior legs very stout, the distal half bent at right angles to the basal half, sometimes with a process running out from the base to the apex; number of legs ♀ 123; length of ♀ 43 mm............*hamatus*, sp. n. New Britain.

CLASS. DIPLOPODA (Millipedes).

ORDER. POLYDESMOIDEA.

FAMILY. PLATYRRHACHIDAE.

GENUS. *Acisternum*, Silvestri.

Ann. Mus. Genova, XXXVI., p. 191, 1896.

(13) *Acisternum flavisternus* (Poc.).

Max Weber's Zool. Ergebnisse, III., pt. 2, p. 346, pl. XIX., fig. 16.

LOC. Tjibodas in Java.

The type specimens of this species were also obtained at Tjibodas.

In the synoptical table of the species of *Platyrrhachidae* taken by Max Weber (*loc. cit.*, p. 344) it is stated with regard to this species, "Sternal areas unarmed." This is an error; for the sternal areas in the fore part of the body, that is from segments 3 to 10, are armed with tuberculiform spines. These are fairly strong on the 4th and 5th segments, but decrease in strength posteriorly and practically die out at the posterior end of the body. In *Acisternum monticola*, Poc., the type of the genus, the sternal spines persist to the posterior end of the body, though they become very small.

Parazodesmus, gen. nov.

Pl. VI, Figs. 3—3 *b*.

First tergite broadest across the middle, where it is furnished with a depressed rectangular keel.

Keel-bearing portion of the other segments covered, but not very closely, with rounded tuberculiform granules. Three rows of tubercles conspicuous, those of the anterior row as large as those of the posterior. Keels of medium size, depressed, anterior border basally shouldered and, like the posterior border, granular, lateral border tri- or quadri-tubercular, posterior angle produced but not spiniform.

Pore dorsal, behind the middle of the keel, and about equidistant from the lateral and posterior borders. Caudal process with margin convex and lightly notched. *Sternal plate* with two tubercles. *Sterna* granular, not spined. *Copulatory feet* with basal portion straight, apical portion strongly curved upwards towards the sternal process and giving off *five* slender processes, four long and one short.

This new genus is very nearly related in many of its features to *Zodesmus*, of which the only known species is *tuberosus*, Poc., from the Ki Islands (Ann. Mag. Nat. Hist. (6) XI., p. 131, pl. IX., figs. 3, 3*b*). The two may be distinguished as follows:—

(*a*) Tubercles of anterior row smaller than those of the posterior; pores about one diameter from the lateral border and two from the posterior border of keels; caudal process more quadrate, with posterior border lightly convex; terminal portion of copulatory apparatus curved inwards, ending in three prongs. ....*Zodesmus.*

(*b*) Tubercles of anterior row as large as of posterior row; pores in middle and at anterior end of body about two diameters from the lateral margin; caudal process longitudinally oval, terminal portion of copulatory organ bent upwards and backwards, ending in five prongs. ....*Parazodesmus.*

(14) *Parazodesmus verrucosus*, sp. n.

Colour black or deep chocolate brown, keels flavous, cylindrical part of the segments pale above with a median dark spot; caudal process entirely dark; legs dark with flavous coxa and trochanter; sternal area dark, ventral portion of cylindrical half pale, antennae dark brown.

Antennae about equalling the width of the 1st tergite in length.

First *tergite* with its antero-lateral border evenly convex. Second tergite with its keels projecting below those of the 3rd, their lateral margins convex and five-tubercular. Anterior border of keels of the middle segments of the body transverse, anterior angle square, posterior angle acute, posterior border concave and directed slightly forward, posterior border of only the last four keels projecting backwards.

Hairs on *legs* clavate.

Male smaller than female; antennae longer than width of first tergite. The first two processes of the copulatory organ given off close together on the outer side of the terminal portion of the organ, the first (proximal) straight, directed backwards parallel to the axis of the foot, the second semicircularly curved inwards, upwards and backwards, the remaining three rising from a common base, the terminal pair long, subequal and subsimilar curved, the fifth one arising as a short backwardly directed process from the outer side of the base of the outer.

♀ length 36 mm., width 6 mm.

Loc. Narowol, Solomon Islands.

Specifically this species may be distinguished from *Zodesmus tuberosus* as follows:—

(*a*) Moderately convex; antennae, legs and sternal areas flavous, cylindrical half of segments a uniform chocolate brown....................................*tuberosus*, Poc.

(*b*) More strongly convex; antennae and legs with the exception of the two basal segments, fuscous; sterna also fuscous, cylindrical half of segments pale above, with median brown spot. ....*verrucosus*, sp. n.

FAMILY. STRONGYLOSOMATIDAE.

Aschistodesmus, gen. nov.

Pl. VI, Figs. 4—4 *c*.

Resembling *Strongylosoma*, but differing in the entire absence of transverse sulcus upon the dorsum of the keel-bearing portion of the segments. *Caudal process* nearly parallel-sided, oblong, with truncate, lightly emarginate posterior border, tubercles not apparent. *Sterna* grooved longitudinally and transversely, with backwardly directed tuberculiform spines at the bases of the legs.

(15) *Aschistodesmus maculifer*, sp. n.

Colour of head, antennae and segments entirely black, with a median yellow spot on the posterior portion of the dorsum of the keel-bearing portion of the segments; sterna and legs flavous.

Head smooth, antennae with segments from the second to the sixth gradually but only slightly increasing in length and thickness. Dorsum of all the segments smooth and polished; groove not sculptured. *Keels* conspicuous but small, with thickened margin, posterior angle produced, anterior strongly convex. Lateral surface smooth, without crest above the stigmatiferous tubercles. *Legs* with femur and tarsus the longest segments, femur about as long as patella and tibia taken together, and a little longer than the tarsus. Anal sternite with its median process a little surpassing the lateral tubercles.

Male with an undivided tuberculiform prominence upon the sternum of the 5th segment. Tarsi of legs of anterior nine segments with hairy pad. Copulatory organ (as in figure) broad and spatulate, its lower surface strongly convex from side to side, the external border deeply notched, a spiniform process behind the notch, internal border sinuate, the external surface anteriorly produced into a broad curved process bearing two slender nearly filiform processes; upper surface bearing two short hooked processes, one external, the other internal.

Measurements in millimetres. Total length 27 mm., width 3 mm.

Loc. New Britain.

ORDER. SPIROBOLOIDEA.

GENUS. *Rhinocricus*, Karsch.

(16) *Rhinocricus cristovalensis*, sp. n.

Pl. VI, Fig. 5.

Colour (in alcohol) a tolerably uniform olive brown, paler below, dorsum of segments marked by a median black longitudinal band with a yellow or red stripe on each side of it, the latter only about half the width of the former; these stripes traceable from about the 5th to the penultimate tergite; legs and antennae ochre yellow.

Female; *head* punctulate and striolate, frontal sulcus complete; eyes composed of 35 ocelli arranged in 6 transverse rows; antennae about as long as the head. *Somites* finely punctulate and striolate; transverse sulcus nearly obsolete dorsally, the area of the dorsum in front of the sulcus irregularly marked with transverse striae which inferiorly assume a longitudinal direction and are continuous with the normal longitudinal striae, which at the anterior end of the body extend nearly up to the pore; a faint longitudinal sulcus extending from the pore to the posterior margin. *Scobina* extending to about the 28th segment; the posterior border of the tergite just above it shallowly emarginate.

Anal tergite rectangularly produced, not surpassing the valves; valves lightly compressed, with borders but little thickened; and sternite rectangularly produced.

Legs with a single seta on each segment except the tarsus, which is supplied with about six.

Male smaller and thinner than female; antennae longer than head; coxae of 3rd, 4th, and 5th legs a little produced; distal segments of these legs and of the following pair swollen beneath; tarsi of legs in anterior half of body padded. *Copulatory organ* as in figure. (Fig. 5.)

Number of segments 42–43.

♀ length 51 mm., width 5·5 mm.; ♂ length 43 mm., width 4·5 mm.

LOC. Maranta, San Cristoval.

(17) *Rhinocricus gazellensis,* sp. n.

Pl. VI, Fig. 6.

Colour a uniform black or olive brown throughout, except the anterior margin of the segments which shows as a pale band when the scobina is exposed.

Head smooth on labral portion, punctulate and striolate, sometimes rather coarsely wrinkled above; median sulcus strong above and below, weak in the middle. *Eyes* composed of above 46 ocelli arranged in seven transverse rows.

Somites smooth, polished, or at most finely punctulate dorsally; the transverse sulcus obsolete, scarcely traceable below the pore, represented above it merely by a shallow groove, the longitudinal striae extending up to or a little above the pore. *Scobina* traceable to about the 38th segment; posterior border of segments not bisinuate, furnished with a series of larger and smaller short, spaced, squamiform, clavate pectinate hairs. Anal somite small; tergite rectangularly produced, transversely impressed; valves posteriorly prominent, a little compressed towards the margin; sternite semicircular.

Male; legs of third pair with coxae and succeeding two segments produced; coxae of fourth also a little produced; tarsus of legs in anterior portion of body padded. Copulatory apparatus like that of *R. cristovalensis,* but the median process of the anterior sclerite is shorter and the process of the anterior lateral sclerite longer.

Number of segments 49–50.

Length of ♀ 77 mm., width 6 mm.

LOC. Gazelle Peninsula, New Britain.

(18) *Rhinocricus biincisus*, sp. n.

♀ *Colour* olive black, the posterior rim of the segments pale, and the entire posterior portion reddish laterally; antennae and legs reddish yellow.

Transverse groove obsolete above the pore on all the segments except the anterior eight. Scobina large, the border of the tergite above it distinctly sinuate.

Anal valves not prominent.

Number of segments 54.

Length 80 mm., width 7 mm.

Loc. Gazelle Peninsula, New Britain. A single ♀.

The three species of *Rhinocricus* here described may be distinguished by the following table:—

(a) Back ornamented with a pair of red or yellow bands separated by a median dorsal blacker band; dorsum of segments transversely striate, the transverse sulcus just traceable dorsally; anal valves as under (a'); legs pale.. *[illegible]*.

(b) Back without longitudinal bands and without transverse striae.

  (a') Anal valves produced considerably beyond the tergite; body and legs and antennae black, tergites not bisinuate posteriorly, scobina small. ....*gazellensis*.

  (b') Anal valves scarcely at all produced beyond the level of the tergite; scobina large; tergites noticeably bisinuate; legs and antennae reddish yellow...*biincisus*.

GENUS *Spirobolus*, Brandt.

(19) *Spirobolus carneipes*, sp. n.

♀ *Colour* (in alcohol) a nearly uniform pale olive green, posterior border of segments with a narrow yellow band in front of which there is a darker stripe, anal segment olive black; legs clear reddish pink.

Head and segments densely punctulate throughout; transverse sulcus obsolete dorsally but traceable above the pore; pores small, apparently situated upon the sulcus.

Number of segments 44.

Length about 50 mm.; width 6 mm.

Loc. Isle of Pines.

This species has not been described at any great length on account of the closeness of its resemblance to *S. caledonicus*, Pocock (Ann. Mag. Nat. Hist. (6) xi, p. 258, 1893) from New Caledonia. The latter, however, has the legs entirely black and the head and segments smooth and polished. The two following species from New Caledonia are doubt also fall into the genus *Spirobolus* as now restricted, namely, *S. insulanus* and *S. albidicollis,* Porat (Ann. Soc. Ent. Belg. XXXII., pp. 251–253, 1888), and both are evidently related to *S. carneipes* and *S. caledonicus.* The four species, however, seem to be separable by the following features:—

(*a*) Segments not transversely banded, usually marked dorsally with a pair of red or yellow longitudinal stripes; legs pale. ....*insulanus.*

(*b*) Segments transversely banded, without longitudinal stripes.

  (*a′*) Segments mostly smooth and polished, at least not rugose: legs and antennae uniformly black. ....*caledonicus.*

  (*b′*) Segments coriaceous or rugose.

    (*a″*) Legs and antennae yellowish brown, ringed with black; first tergite mostly whitish....................................*albidicollis.*

    (*b″*) Legs and antennae a uniform reddish pink; 1st segment not whitish. ....*carneipes.*

S. detornatus, Karsch. (Zeits. Naturwiss. 54, p. 57, 1881), from Viti Levu, probably also belongs to this section. If so it will apparently differ from those species enumerated above in having the face divided by a deep sulcus and thickly marked laterally with oblique striae.

GENUS. *Trigoniulus.*

(20) *Trigoniulus pulcherrimus,* sp. n.

Colour (in alcohol); dorsum of segments occupied by a broad blood-red band divided in the middle line by a narrow black stripe, sides of the segments occupied by a broad black stripe; lower portion of segments also blood-red; first tergite and anal somite black; lower half of head pale, upper half black; antennae palely fuscous; legs entirely pale yellow.

Head and first tergite smooth; the rest of the segments with their posterior portion elevated and smooth or nearly smooth dorsally, striate laterally and inferiorly but not more than half-way up to the pore; the groove separating the anterior and posterior parts of the segments marked dorsally from pore to pore with a series of subcircular impressions; below the pore on each side the groove is impressed with the ends of the striae, which pass backwards on to the anterior portion of the tergites.

Pore situated upon or perhaps a little behind the groove. *Anal tergite* forming a blunt obtusely-angled point not surpassing the valves; valves lightly compressed; sternite with posterior border transverse.

Number of segments 46.

Length 30 mm., width 2·8 mm.

Loc. New Britain.

This species is very noticeable for its bright black and blood-red colouring.

ORDER. COLOBOGNATHA.

GENUS. *Bdellotus*, Cook.

(21) *Bdellotus bivittatus*, sp. n.

Head, antennae and first segment black; the rest of the segments black and polished, but marked dorso-laterally with two parallel white bands extending from the anterior to the posterior end of the body; the median dorsal black band about as wide as the lateral white bands; margins of tergites below the pores narrowly white; anal somite black; legs infuscate.

Number of segments 65.
Length 11 mm., width 8 mm.
LOC. Lifu, Loyalty Islands.

In its banded coloration the species calls to mind *Bdellotus formosus*[1] (Pocock), the type of the genus *Bdellotus*, from Java; but the latter has a single median dorsal white line and the first and last tergites are also white, whereas *B. bivittatus* has a median dorsal black band and the first and last tergites black.

EXPLANATION OF PLATE VI.

FIG. 1.	*Gonibregmatus*	*anguinus*,	sp. n. ♀.	× 2.
1 a.	,,	,,	,,	last segment of ♂ from above to show persistence of suture (*a*), between the anal tergite (*b*), and the prescutum (*c*).
1 b.	,,	,,	,,	last segment of ♂ from below showing biarticulated genital appendages (*a*).
1 c.	,,	,,	,,	labrum.
1 d.	,,	,,	,,	dentate margin of labrum.
1 e.	,,	,,	,,	mandibles from behind showing outer branches (*a*) and inner branches forming labial plate or lower lip (*b*).
1 f.	,,	,,	,,	left mandible from the front; outer branch (*a*), with pectinate edge and labium (*b*).
1 g.	,,	,,	,,	enlargement of portion of pectination.
1 h.	,,	,,	,,	maxillary lobes of left side from the front.
1 i.	,,	,,	,,	maxillary lobes and maxillipede of left side from below (behind).
FIG. 2.	*Eucratonyx*	*meinerti*	(Poc.)	labrum.
2 a.	,,	,,	,,	right mandible from below (behind).
2 b.	,,	,,	,,	maxillae and maxillipede of right side from below (behind).
2 c.	,,	*hamatus*	sp. n.	claw of one of the anterior legs.

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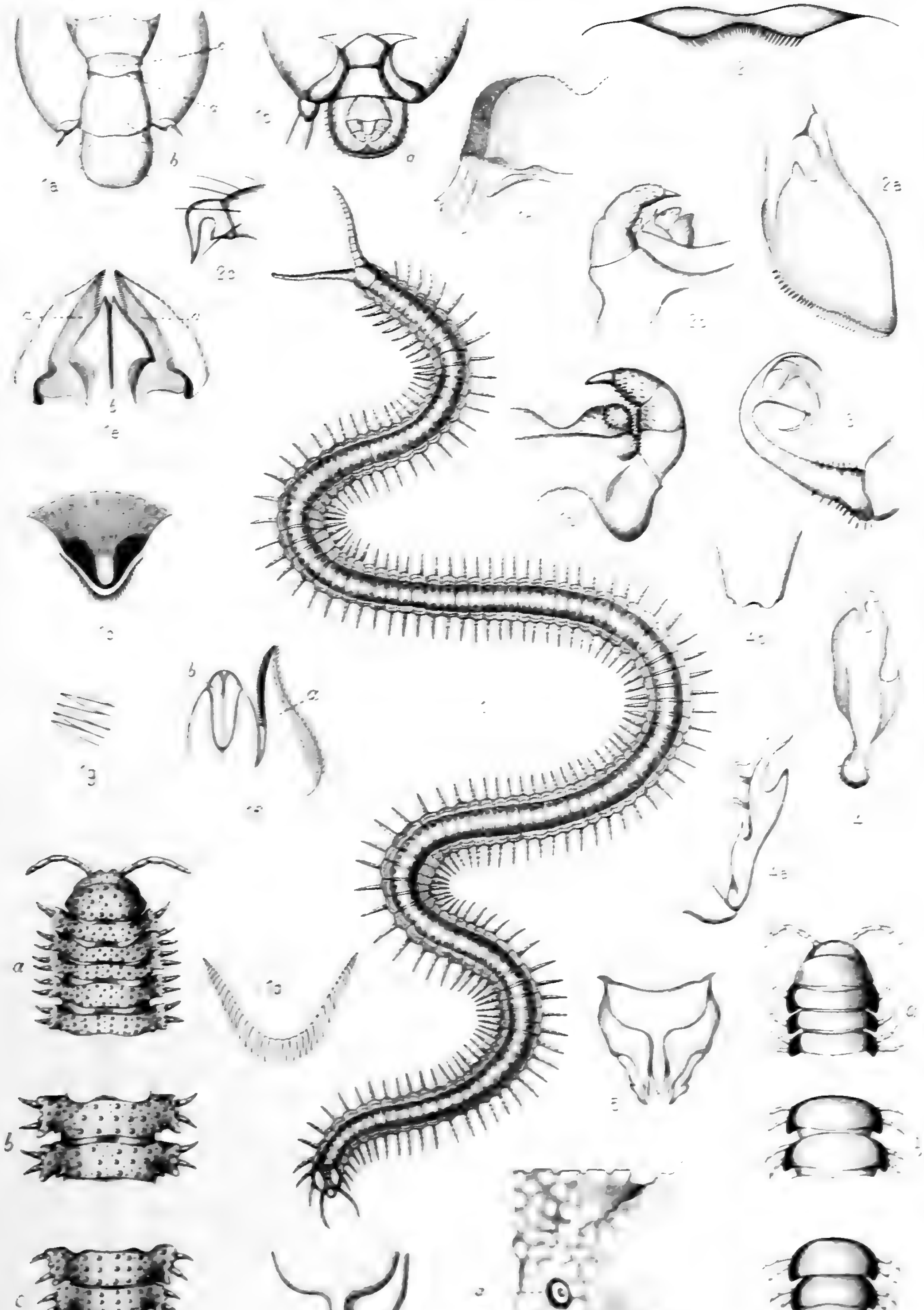
[1] Max Weber's *Zool. Ergebnisse*, III. pt. 2, p. 338, pl. xx. Fig. 5, 1894.

Fig. 3. *Parazodesmus verrucosus*, gen. et sp. n. copulatory foot, external view.
3 a. ,, ,, ,, ,, dorsal side of anterior end of body (*a*), of two median segments (*b*), of posterior end (*c*).
3 b. ,, ,, ,, ,, upper side of left keel of segment 13 to show marginal armature and position of pore (*a*).

Fig. 4. *Aschistodesmus maculifer*, gen. et sp. n. left copulatory foot from below.
4 a. ,, ,, ,, ,, right copulatory foot from the outside.
4 b. ,, ,, ,, ,, caudal process.
4 c. ,, ,, ,, ,, dorsal side of anterior end of body (*a*), of two median segments (*b*), of posterior end (*c*).

Fig. 5. *Rhinocricus cristovalensis*, sp. n. copulatory apparatus (anterior aspect).

Fig. 6. *Rhinocricus gazellensis*, sp. n. copulatory apparatus (anterior aspect, portion of right half omitted).



F.O. Pickard Cambridge del.

POCOCK. MYRIAPODA.

Edwin Wilson, Cambridge.

ACCOUNT OF THE PHASMIDAE, WITH NOTES ON THE EGGS.

BY D. SHARP, M.A., F.R.S.

With Plates VII—IX.

THE specimens of this family of Orthoptera brought back by Dr Willey represent upwards of twenty species. Some of the species are represented only by individuals that are not full-grown, and I find that it is not desirable to deal with these, as we at present know but little of the post-embryonic development, so that it is difficult to determine what relations of colour, form and wing-development the young may bear to the adult. In the case of *Eurycantha horrida* I have identified the young with some probability of accuracy, and we have therefore figured some stages of the development. From what we find in the case of this species we may conclude that great changes in the external characters occur in the course of the development. Even when the difference between the sexes is very great in the adult state it is difficult if not impossible to distinguish the sexes in the young by external signs. Hence it is not at present desirable to describe and name new species from specimens that are not adult.

The species brought back from New Britain and Lifu in the adult state are six in number from Lifu, and eleven from New Britain. The Insect-fauna of these islands has not hitherto been the subject of any important study, and our knowledge of that of New Guinea is only small, so that it is scarcely a matter for surprise that a large proportion of the species—14 of the 17—appears to be unknown. Dr Willey was necessarily limited in his activity to a few spots on the coasts of the islands, and we may therefore conclude that many more species of these curious insects are existent in the two islands in question.

Under these circumstances it is not worth while to attempt any conclusions as to the geographical distribution. I may however remark that 53 species of Phasmidae are now known from Australia[1] and that they appear to have but little close

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[1] Rainbow, *Rec. Austral. Mus. III.*, No. 2, 1897.

relation with those procured by Dr Willey; and it seems probable that a closer relationship with those of the islands to the West may be established. I may also remark that a great many of the Phasmidae recorded in the older works on entomology are said to come from Amboyna. I think this locality should not, without confirmation, be adopted as the real habitat of the species, as I doubt whether we can conclude more than that the ships bringing the specimens to Europe traded with that port. The uncertainty as to these old records will I fear delay any satisfactory conclusion as to the distribution of Malayan Phasmidae, at least until the Ceram and Amboyna fauna has been thoroughly investigated.

The young of Eurycantha. The adults of this genus are extremely remarkable; the number of spines on the body and the enormous size and curious armature of the hind legs of the male being especially conspicuous (Pl. VIII, Fig. 9). Dr Willey brought back a series of specimens in various pre-adult stages which I at first thought must represent more than one species, but which after comparison I believe to be stages in the growth, or instars[1], of *E. horrida.* Although probably no quite newly-hatched specimen is present, yet it is clear that most of the conspicuous characters of the species are acquired during the post-embryonic growth; almost the only resemblance between the youngest specimen and the adults are that both are broader and shorter than is usual in Phasmidae. The number of segments in the antennae is of great importance in the classification of the family; our series of *E. horrida* indicates a remarkable change in this feature during life. The youngest specimen we have has only nine segments on the antenna, whereas the adult has upwards of forty[2]. Nevertheless in the young the antennae are proportionally rather longer than in the adult, so that we have present the phenomenon of a great increase in number of segments, accompanied by an arrest of growth in comparison with other parts. Although our series is not sufficiently good to enable me to state with certainty the manner in which the change occurs, it would seem to be due to many of the segments of the young antenna dividing at once into a considerable number—about six—of smaller segments (Pl. VIII, Fig. 8).

The median segment of Phasmidae. It is commonly stated that the third thoracic segment in Phasmidae is formed by the union of the first abdominal segment with the metathorax. This view is stated by Brunner v. Wattenwyl[3], and is adopted by Heymons[4]. The adult insect so far as its structure goes does not exhibit positive evidence in support of this view so far as the sternum is concerned. On looking at the metasternum it is easy to imagine that one can detect in it a sufficiently complex structure to justify the view above alluded to; but on comparing it with the mesosternum exactly the same parts seem to be also present there (Fig. 10). As there can be no question of an abdominal sternite being added to the mesothorax, the view that one is added to the metathorax should be confirmed by observation of the development.

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[1] For definition of this term refer to *Cambridge Nat. Hist.* v. p. 158.

[2] Only one antenna of the adults is intact, and this has 49 segments.

[3] Brunner v. Wattenwyl, *Morph. Bed. Segm. Orthopt.* Wien, 1876.

[4] Heymons, *SB. Ak.* Berlin, 1897, p. 367.

The ovipositor and female genital appendages. The genital structures in Phasmidae have been too much neglected by entomologists: they have been avoided for the purposes of distinction of species, and their morphology has scarcely been inaugurated. The structures in the male are remarkable for their simplicity, the intromittent organ of the male being apparently a crumpled sac with five or six more or less vaguely defined sclerites in it. In the female the genital appendages are of great importance for distinguishing the species. The two species, *Anchiale stolli* and *A. confusa*, much resemble one another externally and appear to have been confounded by entomologists for upwards of a century; yet the female genital appendages distinguish the two satisfactorily, and the distinction is placed beyond doubt by a comparison of the eggs of the two forms. The ovipositor in certain other forms of Orthoptera —Locustidae and Gryllidae—has been shown to be formed by six gonapophyses, which appear as separate parts in the early stages of the post-embryonic development and subsequently become intimately combined to form the long, projecting ovipositor. Of these six gonapophyses four, according to Dewitz[1], are appendages of the ninth segment and are really only a single pair secondarily divided; the other two are appendages of the eighth segment. In the female Phasmidae, six appendages are frequently present but they are never combined to form an organ for the deposition of the egg; they remain isolated finger-like processes (occasionally becoming so elongate as to be whip-like), and a part of their functions seems to be to hold the egg in the peculiar external uterus in which it remains till the female releases it, or till it is pushed out by the descent of another egg from the ovaries (Pl. IX, Fig. 16). These uncombined appendages appear to be homologous with the gonapophyses of the Locustidae as studied by Dewitz. One pair, the inferior, is separate and is anterior to the others in its attachment to the body. If we use Brunner's enumeration of the ventral sternites this pair of appendages belongs to the eighth segment, the ventral plate of which is prolonged to cover the genital appendages and to support the egg. The other two pairs are placed farther back and are merely prolongations of a large ninth abdominal sternite (Pl. IX, Fig. 25 c), as is well shown in the figure of the parts of an immature female of the genus Myronides (Fig. 26 b). The tenth sternite is very large, and is more or less deeply divided at the tip.

The male genitalia are very little known. Owing to the fact that so little material for study is available in the European fauna, nothing appears to have been published as to the organs of copulation. I have examined them in a very decayed male individual of *Anchiale confusa*, and find them to be remarkable from the existence of a very large sac which is covered by the pouch or receptacle formed by the ninth ventral plate; this membranous sac is formed by the ventral wall of the body, and when distended is found to consist of two imperfect pouches, portions of which are thickened and chitinised so as to form sclerites. Five or six of these indurated parts exist; they are quite asymmetric, and no two of them are at all similar; some of them are secondary projections from the wall of the sac, while others do not project at all. The hinder margin and the free angles of the tenth dorsal abdominal plate are also armed

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[1] Dewitz, *Zeitschr. wiss. Zool.* xxv. 1875, p. 174.

with teeth and tubercles in various species, and these apparently afford good specific characters (Pl. IX, Figs. 18, 19).

The egg. A correct account of the structure of the eggs of two or three species of Phasmidae has been given by Leuckart[1]. As his account includes no reference to the incomplete egg or the mode of its growth the following observations may have some value. Phasmidae are insects of extreme interest; they appear to be the nearest living representatives of an Insect-fauna that was predominant in the carboniferous epoch; they exhibit an astonishing variety of grotesque forms, looking as if they were constructed of vegetable matter (so that some of them are called walking-leaves, others stick-insects) and they attain a size that is much above that of insects generally. They are exclusively vegetarian in diet, and are amongst the most inactive of insects. The climax of their peculiarities is found in the extremely perfect structure of their eggs and the resemblance of these eggs to seeds. The egg of a Phasmid has not only a general resemblance in size, shape, colour and external texture to a seed, but the anatomical characters of certain seeds are reproduced on the external surface, there being a hilar area, a hilar scar, and a capitulum corresponding to the micropylar caruncle of such seeds as those of the Castor-oil plant (*Ricinus communis*). The hilar area on the inner face of the capsule is, in shape, like the embryo of a plant (Pl. IX, Fig. 28). Moreover naturalists who have examined these eggs declare that the minute structures of this curious egg-capsule cannot be distinguished histologically from plant-structures. I think these resemblances, in the eggs I have examined, have no bionomic importance for the species. We have figured and described several of the eggs brought back by Dr Willey, and I have also added descriptions of two or three other interesting eggs obtained elsewhere.

In the examination of these eggs I have received much kind assistance from Dr Willey, and I think it may be of interest to state a few points we have ascertained as to their structure and the mode of their formation. I have examined the ovaries in *Eurycantha horrida* and in *Anchiale confusa* from specimens of these species brought back by Dr Willey in spirit and in a specimen of *Hermarchus pythonius* brought from Rotuma by Mr J. Stanley Gardiner. As these ovaries contain eggs in various stages of development it is possible to form an idea as to their mode of growth that may to some extent approximate to what actually occurs.

The capsule proper of the egg, or outer shell, is called chorion by Leuckart (who distinguishes an exochorion and an inner layer or endochorion); inside the chorion there is an inner membrane, the vitelline membrane or oolemn. The other important parts are the operculum, capitulum and micropylar area. All the parts of the egg are to the least detail formed in the ovarian tube. The operculum is present as a distinct part from a very early date, and so is the capitulum in those eggs in which it exists. When the egg is about half-grown the future exochorion forms merely a coat of quite soft matter which appears to appertain as much to the ovarian tube as to the egg; it can be removed with ease by a brush, and the egg is then found to consist of a yolk surrounded by two membranes similar in thickness. Of these the outer one subsequently becomes the inner wall of

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[1] In Müller's *Arch. Anat. Physiol.* 1855, pp. 214—220.

the capsule. In this membranous stage the micropylar area is quite distinct on the endochorion and exhibits a very similar shape to that seen in the completed egg.

The exochorion subsequently becomes hard and very perfectly attached to the endochorion. It differs in the egg of every species I have examined, being in some cases very thick (Leuckart says 1/6 of a millimetre in *Cyphocrania violascens*), but in other species it is quite thin (Gigantophasma). This secondary product is very vegetable-like.

The vitelline membrane is free from the endochorion except at the micropyle, where the two are firmly connected; another striking peculiarity of this membrane is that it is considerably thicker under the operculum than it is elsewhere.

Capitulum. This peculiar structure, placed on the middle of the operculum, is present in the eggs of the majority of species of Phasmidae but is entirely absent from others. It differs in every species, but when present is always a well-developed structure, and there are, so far as I know no forms in which it is present in an atrophied or rudimentary state; it is always either well developed or entirely absent[1]. It consists of two parts, one of which is truly a part of the operculum; the capitulum itself is a less rigid body, superposed on the operculum and sometimes nearly concealing it (Pl. IX, Fig. 31). The part continuous with the operculum may form a stalk more or less elongate, and then projects to a greater or less extent into the soft body or capitulum proper, to which it forms a sort of core. The capitulum is present at an early stage of the formation of the egg, and if the half-grown egg of *Anchiale confusa* (Fig. 30) be looked at in the egg-tube it appears as if the capitulum is another less-grown egg attached to the larger egg. I think this will prove to be really the case and that the capitulum proper will be found to be the contents of another egg-chamber that have become subsidiary to the larger egg.

The species known to me in which the capitulum is entirely wanting are *Brachyrtacus celatus, Eurycantha horrida,* and *Hermarchus pythonius* (Figs. 32, 36, 41). I believe that the capitulum is also absent in the egg of *Acanthodyta spiniventris*, but this is not certain, as I speak only from my recollection of a single much damaged egg of which the operculum is now lost.

No function can be assigned to the capitulum in its formed state. It has, as was pointed out by Leuckart, no connection with the micropyle apparatus; it is not adapted to facilitate the admission of air to the egg, but must rather prevent such access. If it discharge any important function this is probably confined to a comparatively early period of the growth of the egg.

Operculum. This structure is present in all the known eggs of Phasmidae; it is a lid that fits very accurately to the truncate anterior extremity of the egg; its margin is surrounded by the margin of the capsule, and it is owing to the perfect fit between the two that the operculum retains its position. In the completed egg the operculum has no continuity with the capsule proper, neither have I been able to

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[1] The egg of *Oyphocrania violascens* as figured by Leuckart, l. c. pl. x. figs. 19, 20, exhibits a small knob on the middle of the operculum. I think this is not a capitulum. The only mention of *Cyphocrania violascens* made by Westwood in his Catalogue of Phasmidae is as a synonym of *Acrophylla violascens;* this has been since referred by Stål to Tropidoderus, an insect now considered but distantly related to Cyphocrania. I do not know this insect or its egg.

demonstrate a continuity between the two parts at an earlier stage. The operculum it should be remembered is not seated on the chorion, but the latter is (apparently) quite absent from the anterior pole of the egg, where it is replaced functionally (as a covering and protecting body) by the operculum. In a comparatively early stage of the egg-growth, before there is any exochorion so that only the membranous endochorion is present, the operculum may be demonstrated as an independent structure placed on the yolk, and enclosing a smaller body of yolk. The egg itself may, at this stage, be entirely emptied of its yolk without affecting the opercular mass of yolk (Fig. 38). The exochorion of the operculum is formed subsequently, just as the exochorion of the capsule is formed subsequently, but there is no union between the two. The manner in which the operculum is formed is obscure; two methods may be suggested; 1, autotomy of the pole of the egg; 2, adhesion of the mass of matter from the adjacent nutrient chamber, to form as it were a very imperfect second egg. On this latter view the egg and operculum may be considered as the equivalent of an egg and a mass of matter added from another egg-chamber, and in that case when a capitulum is also present the egg would consist of egg-proper + opercular mass of nutrient matter + capitular mass of nutrient matter[1].

The fact that the vitelline membrane is thicker about the opercular area where the chorion is absent suggests that the missing part of the latter may possibly be added to the former, and thus account for the thickness. But on the other hand it is quite probable that the extra thickness may arise in course of the process of autotomy, if that be the method by which the operculum is formed.

The egg of a Phasmid, provided as it is with a separate and perfectly fitting operculum, is a very remarkable object. Hitherto it has appeared to me very difficult to imagine how it could have been produced by a gradual process of evolution. From the imperfect study I have now made I think it probable that the Phasmid egg will be found to consist of an egg proper and of one or two imperfect eggs mechanically coadapted by pressure arising from the enormous distention of the egg-tube. It appears to me reasonable to suppose that it might have been thus produced in a gradual manner in the course of time.

The observations on the spirit specimens may be thus summarised:

1. The ovarian tube contains nutrient matter divided segmentally into separate masses, and the lower part of the tube is constricted so as to form chambers in each of which there is a mass of nutrient matter.

2. The mass of matter in the lower chamber grows enormously so as to cause extreme distension of the egg-tube, and the whole mass of matter in the chamber (or very nearly the whole) is found to be covered with two membranes (endochorion and oolemn), the outer one of which is deficient at one pole of the egg where the (as yet membranous) operculum is situate.

3. The exochorion accumulates between the wall of the egg-tube and the outer

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[1] I think it probable that some other curious forms of Insect-eggs (e.g. those of Cynipidae and some Hemiptera Heteroptera) may prove to be compound eggs of this nature; that is to say, formed by the combination of the more or less separate growths of more than one egg-chamber.

of the two egg-membranes and subsequently becomes perfectly adherent to the latter so that in the completed egg the two cannot be separated.

4. All the details of structure of the egg are completed in the chamber where the formation commenced.

I have arranged the genera in the order adopted by Brunner in his valuable "Revision du système des Orthoptères[1]."

ORTHOPTERA.

FAMILY. PHASMIDAE.

TRIBE. Lonchodides.

GENUS. *Myronides.*

Myronides. Stål, Recensio Orthopterorum, III. Stockholm, 1875, p. 8.

This genus was established by Stål for two species from the Moluccas, and very little has since been added to it. In New Britain however the genus appears to be represented by numerous species. The chief character to distinguish it from Lonchodes is the longer median segment. Stål has not given any particulars as to the sexual distinctions, but I anticipate that the males and females are very different, so that direct observation will be required to match them. *M. binodis* is a very interesting form, as the peculiar nodes at the apex of the metanotum evidently represent wings in a rudimentary or vestigial condition (Pl. VII, Fig. 2).

SECT. I. VERY SLENDER INSECTS [MALE ONLY KNOWN].

(1) *Myronides filum*, n. sp. Pl. VII, Fig. 1.

♂. Perangustus, olivaceo-testaceus, antennis fuscis, mox ante apicem albidis; capite anterius tuberculis duobus distantibus, acuminatis armato, posterius subquadrituberculato; metanoto posterius utrinque vix gibboso, processu minuto instructo.

Operculo subgenitali abdominis haud convexo, apice rotundato medio leviter emarginato; lamina subanali profunde canaliculato, cercis liberis, sat elongatis; lamina supra-anali profunde emarginata; processu apicali interne tuberculis acutis circiter 16—24 instructo.

Long. corp. 76 mm.; antenn. 53 mm.; cap. post antenn. 3 mm.; pronoti 3 mm.; mesonoti 19 mm.; metanoti 6 mm.; segm. med. 4½ mm.; abdominis 39 mm.; femor. ant. 24 mm.

Var. fusco-nigricans.

Loc. New Britain.

There are no tuberosities or asperities on the surface of the body, and the two teeth at the apex of each femur are very minute. The first joint of the antenna is straight-sided and rather narrow.

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[1] *Ann. Mus. Genova*, XXIII. 1892—3.

If I am right in considering the two dark specimens as the same species, it is possible that this insect is dimorphic in colour; there are at any rate no intermediates in our small series.

(2) *Myronides binodis*, n. sp. Pl. VII, Fig. 2.

♂. Perangustus, testaceus, antennis ad apicem pallidioribus; capite anterius mutico, vertice obsolete quadrituberculato; metanoto posterius utrinque gibboso.

Operculo subgenitali convexo, medio prominulo, apice late emarginato.

Although at first sight similar to *M. filum* this species is very easily distinguished by the absence of processes on the front of the head, by the binodose metathorax, by the different proportions of the metanotum and median segment, and the prominent male operculum. The curious short sacs attached to the metathoracic gibbosities clearly represent the wings, though they have the texture of the integument in general.

Long. corp. 76 mm.; antenn. 53 mm.; cap. post antenn. 3 mm.; pronoti vix 3 mm.; mesonoti 19 mm.; metanoti 8 mm.; segm. med. 4¼ mm.; abdominis 38 mm.; fem. ant. 23 mm.

Loc. New Britain.

SECT. II. BROADER INSECTS [FEMALE ONLY KNOWN].

(3) *Myronides bituber*, n. sp.

♀. Corpore granuloso, fusco-testaceo, pedibus testaceis fusco-variegatis, antennarum apice albido; capite processubus duobus acuminatis, magnis armato; abdomine carinato, carina anterius obsoletescente, segmento sexto medio bituberoso.

Long. corp. 120 mm.; antenn. 60 mm.; capitis (pone antenn. acetab.) 5 mm.; pronoti 5 mm.; mesonoti 26 mm.; metanoti 9½ mm.; segm. med. 5½ mm.; abdom. 59 mm.

Loc. New Britain. One specimen.

Although at first similar to the other species here described this may be readily distinguished by the pair of peculiar tuberosities on the dorsum of the sixth abdominal segment.

Egg (Pl. IX, Fig. 33): 3 mm. long; capsule covered with numerous large pores, and with a scanty coarse but slightly elevated reticulation; micropylar area not extending to the operculum, and moderately distant from the opposite pole, rather narrow; micropylar scar very obscure. Operculum bearing a black sessile capitulum, and surrounding this a slightly elevated ring. Described from eggs deposited by the female in New Britain while in Dr Willey's possession.

(4) *Myronides simplex*, n. sp.

♀. Angustus, cylindricus testaceo-griseus, antennis pedibusque subvariegatis, illis ad apicem albidis, apice ipso minute fusco, articulo primo ovale; capite superne processubus duobus distantibus, mediocriter elevatis, acuminatis; tarsorum anticorum articulo primo superne alte carinato; abdomine segmento sexto dorsali in medio utrinque tuberculo vix perspicuo armato: femoribus subtus versus apicem minute bidentatis.

Long. corporis 104 mm.; lat. corp. vix 5 mm. Long. antenn. 60 mm.; capitis post antenn. 5 mm.; pronoti 4½ mm.; meson. 25 mm.; metan. 8 mm.; segment. med. 6½ mm.; abdominis 55 mm.; femor. ant. 24 mm.

Loc. New Britain.

Readily distinguished from *M. bituber*, by the smaller processes on the head, and by the tuberosities on the abdomen being almost entirely absent. The male is unknown. The surface is uneven, the inequalities forming on the prothorax indefinite tubercles.

(5) *Myronides sordidus*, n. sp.

♀. Robustus, griseo-testaceus, antennis mox ante apicem albidis, corpore superne sparsim irregulariter granuloso; capite anterius processubus duobus distantibus sat elongatis, acuminatis, apicibus versus antennas directis; antennarum articulo basale sat lato, margine interno curvato; tibiis anterioribus intus acute carinatis, carina versus basin altiore; lamina supra-anali acuminata, carinata.

Long. corp. 104 mm.; antenn. 62 mm.; tib. ant. 27 mm.; cap. post antenn. 4 mm.; pronot. 4½ mm.; mesonoti 27 mm.; met. 10 mm.; segm. med. 5½ mm.; abdom. 53 mm.

Loc. New Britain.

Only one individual of this species was obtained. It is closely allied to the typical species of the genus—*M. pfeifferi*—but is smaller, and the legs are somewhat differently formed. The two teeth on each femur are minute.

Egg (Pl. IX, Fig. 34): an egg taken from the ovipositor of the specimen after preservation for a year or more in spirit, much resembles that of *M. bituber* but with strongly-marked distinctions; the texture of the capsule is different; the capitulum is not sessile, but is elevated on a short stalk, and the ring surrounding it is strongly elevated and irregularly serrate (Fig. 34 *a*). The micropylar scar is linear and the micropylar orifice is exposed and surrounded only by a small obscure ring.

(6) *Myronides ramulus*, n. sp. Pl. VII, Fig. 3.

♀. Sordide testaceus, irregulariter fusco-subvittatus, parce, obsolete granuloso; capite mutico: abdomino segmento decimo margine posteriore utrinque biacuminato; lamina supra-anali acuminata; operculo compresso-carinato; appendices inferiores et mediani aequilonges, elongati.

Long. corp. 106 mm.; antenn. 52 mm.; capitis post antenn. 4½ mm.; pronoti 4 mm.; mesonoti 26 mm.; metan. 10½ mm.; segment. med. 5 mm.; abdominis 56 mm.

Var. fusco-subvariegato, haud discrete vittato.

Loc. New Britain.

In this species the granulation of the surface is more distinct on the metasternum. As it and *M. binodis* both have the head unarmed it is possible they may be the sexes of one species. There is no trace of the rudimentary wing-sacs in *M. ramulus*.

In addition to the type specimen and the variety, Dr Willey found a nymph evidently near the last ecdysis, being of about the full size. The stripes are very distinct in it.

GENUS. *Brachyrtacus*, n. g.

♀. Antennae elongatae, multiarticulatae, corpus inerme apterum, pedes simplices, segmentum medianum vix discretum, sat breve, metanoto multo brevius; abdomen in processu subacuminatum prolongatum; cerci minuti.

♂. Incog.

This genus very much resembles Hyrtacus Stål, but has a shorter head and a longer median segment. Few Phasmids are so destitute of conspicuous characters. The elongate, terminal, ovipositor exists in but few genera and will aid those who have not access to an exponent of Hyrtacus in recognising this form.

In addition to the median segment there are only eight dorsal abdominal plates and the elongate terminal process. The latter structure is doubtless formed by the fusion of the ninth plate and the lamina supra-analis; in Eurycantha the two parts remain distinct.

The genus Hyrtacus is Australian, and only two species are referred to it as yet. Stål made the elongate head of *H. tuberculatus* one of the chief characters of the genus. *B. celatus* has a head of only the length of ordinary Lonchodides, and I have therefore been obliged to treat the New Britain insect as a distinct genus.

(7) *Brachyrtacus celatus*, n. sp. Pl. VII, Fig. 4.

♀. Pallide fuscus, lividus, inornatus; subtiliter punctatus; capite canaliculato.

Long. corp. 70 mm.; antenn. 47 mm.; capitis post antenn. 2 mm.; pronoti $2\frac{3}{4}$ mm.; mesonoti $16\frac{1}{2}$ mm.; metan. $6\frac{1}{2}$ mm.; segm. med. 2 mm.; abdom. 40 mm. (lam. supra-analis cumque abdominis segm. ult. 9 mm.); femor. ant. 17 mm.

LOC. New Britain.

The three specimens found by Dr Willey are extremely similar. An immature nymph of the male sex renders it probable that the male will be found to closely resemble the female in size and form. The colour of this nymph is pale green.

Egg (Pl. IX, Fig. 32). The egg of this species is remarkable for its long slender form; at first sight it might be supposed to be the egg of a Locustid, but the operculum is quite definite and the micropylar area is well-marked; there is no capitulum. We have only one specimen, it has been damaged by fracture just across the micropylar scar so that the details of the structure are obscured.

TRIBE. Clitumnides.

GENUS. *Eurycantha.*

Eurycantha. Boisduval, Voy. de l'Astrolabe, Zool. Ent. p. 647.

The remarkable insects composing this genus appear to be peculiar to New Guinea and the neighbouring islands.

(8) *Eurycantha horrida.* Pl. VIII, Fig. 9.

Eurycantha horrida. Boisd., Voy. de l'Astrolabe, Zool. pl. 10, f. 2. Westwood, Cat. Phasm. p. 63.

A fine series of this insect was procured by Dr Willey in New Britain. In the adult state it varies but little; the antennae are usually more or less deficient as to their terminal joints; the proper contingent appears to be about 48.

Several specimens that I believe to be young of this species were procured (Figs. 7, 8); if so, it appears to be variable in colour in early life; most of these young are similar in colour to the adults except that they are not quite so dark; two specimens are of a pallid stone-grey colour, maculated with darker fuscous marks. It is possible, however, that one or both of these specimens may be of another species; Kaup has described a second Eurycantha as occurring in New Guinea. The young specimens are in various stages of development, and they at any rate show that the armature of spines on the body and legs is developed gradually during the process of growth. The number of joints of the antennae is apparently the same throughout the later period of development, though the distinctness of their segmentation is less marked in the young, and in the very young there is a major segmentation into 7 or 8 joints, without any distinct segmentation of either of these into a larger number of joints (Fig. 7 *a*). The genital appendages of the female are also developed gradually, so that it is very difficult to distinguish the two sexes in the young.

Egg (Pl. IX, Fig. 41). Dr Willey kept specimens of this species alive and was able to observe that the eggs are dropped one at a time. On August 11th he noticed an egg in the ovipositor which was still in that position next day; on the 13th he found one egg was deposited: on Aug. 14th the same female had another egg ready for deposition, and this was still *in situ* the following day but was deposited on the 16th, and on the same day another egg was in the ovipositor and was deposited on the 17th: on the 18th the same specimen laid three eggs, and another on the 19th. The egg is large, 8 mm. long. It is of a grey colour, irregularly mottled with black and the whole surface of the capsule is covered with fine raised lines. The hilar area is broad and short, oval, the scar is broad and widely open in front. There is no trace of any capitulum on the operculum but the central area is slightly pinched together, and has a slightly different texture when highly magnified (Figs. 41 *a*, 41 *b*).

TRIBE. Acrophyllides.

GENUS. *Acanthodyta*, n. g.

Antennae breves, circiter 20-articulatae; thorax et abdomen spinosa; pedes mediocriter elongati, femoribus omnibus fere inermibus, marginibus superioribus et inferioribus omnium tantum minutissime spinulosis; tegmina nulla; alae utriusque sexus brevissimae. Segmentum medianum elongatum, metathorace longius. Maris cerci robusti. Feminae cerci minuti haud exserti, lamina supra-analis valde prolongata; segmentum dorsale ultimum sub-prolongatum.

This genus, tested by Brunner's Tables[1], runs down to Acrophyllidae, Platycraniae, and may be placed next Arrhidaeus.

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[1] "Revision du système des Orthoptères," *op. cit.*

(9) *Acanthodyta spiniventris*, n. sp. Pl. VIII, Fig. 11 ♀.

Testacea, vel fusco-testacea; alis minimis, parte posteriore sanguineo-tincta; corpore lateraliter et superne spinoso; pedibus fere inermibus; capitis fronte bituberculata.

♂. Cerci elongati, intus curvati.

Long. corp. 55 mm.; antenn. 17 mm.

♀. Lamina supra-anali ultra anum longe producta, acuminata; appendices antero-inferiores elongati, lineares, duri, ultra cercos extensi, apicem abdominis ventris attingentes; operculum subgenitale elongatum, apicem versus attenuatum, apice obtuso, lamina supra-anali brevius; appendices mediani, elongati sublineares, cercos attingentes; appendices superiores nulli. Cerci breves sat lati, ad apices obtuse attenuati, margine externo ciliato-setoso.

Long. corp. 86 mm.; antenn. 20 mm.; capit. post antenn. 5 mm.; pronoti 5 mm.; mesonot. 18 mm.; metanot. (partis alas ferentis) 4 mm.; segm. med. (cumque parte posteriore metanoti haud discreta) 5½ mm.; abdominis 50 mm.; femor. ant. 29 mm.; tibia. ant. 38 mm.

Loc. Lifu.

Only one pair of the mature Insect was found. The male is much darker than the female in colour. A female nymph well advanced in growth has the spines of the upper surface represented only by minute acute tubercles.

Egg (Pl. IX, Fig. 40): an egg of this species was found in the ovipositor, but was damaged by extraction so that it has lost the operculum. The micropylar area extends the whole length of the egg and is at the farther extremity very distinctly divided into two processes that probably correspond with the attachment of membrane on the inner surface of the capsule.

GENUS. *Graeffea.*

Graeffea. Stål, Recensio Orthopterorum, III. 1875, p. 40.

The Insects of this genus appear to be peculiar to the Polynesian islands, where they are said to be sometimes very injurious by consuming the foliage of the food-plants of the human inhabitants.

(10) *Graeffea lifuensis*, n. sp. Pl. IX, Fig. 21.

♀. Testacea; prothorace subtiliter, irregulariter granuloso; alis brevibus, parte membranacea sanguinea.

G. coccophagae peraffinis; cercis longioribus, lamina supra-anali medio longiore, acuminata; segmento mediano magis elongato.

Long. corp. 118 mm.; antenn. 23 mm.; fem. anter. 34 mm.; cap. post antenn. 6 mm.; pronoti 6 mm.; meson. 20 mm.; metan. 5½ mm.; segm. med. 6 mm.; abdom. 63 mm.; cerc. 7½ mm.; tegm. 7 mm.; alar. 14 mm.

The genital operculum is not convex, it is pointed and elongate, extending a little beyond the point of the lamina supra-analis. The superior and inferior genital appendages extend backwards to just the same point; the inferior are slender and filiform; the median and superior are short, as they merely form the divided extremities of a broad process; the median pair does not extend quite so far back as the lateral pairs.

Loc. Lifu: two specimens.

I have not seen the egg, but judging from the shape of the uterus I suppose it will prove to be elongate and slender. The uterus in this species is very different from what it is in Anchiale.

Only one or two species of this genus have been described, but judging from specimens in the British Museum there are several closely allied species, or forms, in the Polynesian islands. *G. coccophaga* was found in Rotuma in both sexes by Mr Stanley Gardiner, it is less elongate than *G. lifuensis* and has shorter legs. *G. coccophaga* is the species that is reputed to be at times very injurious, by consuming the foliage and soft parts of trees from the produce of which the human natives draw part of their sustenance.

GENUS. *Gigantophasma*, n. g.

Antennae 30 articulatae, maris femoribus paulo longiores, feminae femoribus aequales. Maris, alae magnae; femina omnino aptera. Cerci maris sat magni, laminati, feminae maximi. Ocelli nulli. Segmentum medianum metanoto brevius, feminae segmento secundo abdominali toto, maris segmenti secundi dimidio, aequale. Maris metanotum in partes duas divisum. Segmenta abdominalia feminae lateraliter plus minusve lobo-dilatata. Pedes multidentati. Fem. operculum subgenitale ultra apicem abdominis extensum, lamina supra-analis nulla.

The position of this genus is uncertain. According to Brunner's tables, the male would come into Acrophyllidae (supposing that we consider the posterior division of the metanotum to be part of the median segment) and might be placed near Monandroptera. The female on the other hand would come into Clitumnidae near Medaura. The very large cerci induce me to place this curious form in Acrophyllidae, near Monandroptera, a genus about which little appears to be known. The female has a considerable general resemblance to *Hermarchus pythonius*, though differing greatly by the abnormal development of the cerci.

The male is of interest from the extremely definite division of the metanotum into two parts. The posterior of these is less distinct in some other forms, and in them is apparently counted as part of the median segment. Gigantophasma apparently shows clearly that the metanotum really consists of two parts. This is seen less clearly in various other Phasmidae.

(11) *Gigantophasma bicolor*, n. sp. Pl. VII, Fig. 6 ♀.

Fem. Fusco-viridis, superne a pronoti margine posteriore usque ad segmentum abdominis sextum viridis, segmentis late fusco-marginatis; abdominis segmentis 2—7 lateraliter plus minusve lobo-dilatatis, segmentis 8—10 parvis; femoribus posterioribus superne ad apicem lamina elevata ad apicem spinigera; tibiis rude spinosis.

Long. corp. ind. minor. 163 mm.; antenn. 43 mm.; cap. post antenn. 9 mm.; pronot. 8 mm.; mesonot. 30 mm.; metanot. 17 mm.; segm. med. 9 mm.; abdominis 88 mm.; cerci 9 mm.; femor. ant. 42 mm.

Lat. segm. med. 12 mm.; abdom. segm. 16 mm.; cerc. 6 mm.

Long. corp. ind. major. 180 mm.

Mas. Gracilis: testaceo-viridis, subfuscescens; abdomine segmentis 5 et 6, tenuiter lobo-dilatatis, lobis fuscescentibus; femoribus posterioribus spinis 5, elongatis, armatis.

Long. corp. 95 mm.; antenn. ultra 40 mm.; cap. post antenn. 4¼ mm.; pronot. 4 mm.; mesonot. 15 mm.; metanoti partis alas ferentis 5¾ mm.; pars poster. 4 mm. segm. med. 4 mm.; abdom. seg. secundi 9½ mm.; abdom. 58 mm.; cerc. 4½ mm.

Var. *depictus*. This species varies a good deal in colouration, and also in the form of the cerci, the length of the legs, and of the ovipositor, and even in the shape of the abdominal segments and their lateral expansions. In one individual the fuscous marks bear at the back of each thoracic and abdominal segment a pallid mark forming an inner margin to the fuscous marks; although I do not think this is a distinct species it may be well to give it a name.

Loc. Lifu.

Egg (Pl. IX, Fig. 35). The egg of *G. bicolor* is small in proportion to the size of the insect, being scarcely 3¾ mill. long including the capitulum. It is less remarkable in structure than usual with Phasmid eggs. The surface of the capsule is densely and finely rugose. The lines limiting the micropylar area are not elevated, the micropylar scar is strongly elevated, forming a slightly curved transverse line, concealing the micropylar orifice. The capitulum is large without any trace of a stalk, and bearing a deep pit at the top. The shell of the egg is thin.

The egg in this species is variable like the insect itself: and it is possible that these forms may be "incipient species," but the material at my disposal is too small to allow me to form any decided opinion.

(12) *Gigantophasma pallipes*, n. sp.

Fem. Viridi-testacea, antennis pedibusque pallidis; abdominis segmentis 2—7 lateraliter plus minusve lobo-dilatatis, segmentis 8—10 parvis: femoribus intermediis et posterioribus, tibiis posterioribus ad apicem, absque lamina elevata.

Long. corp. (cum ovipos.) 187 mm.; (cetera fere ut in *G. bicolore*).

Loc. Lifu: a single specimen.

Independently of the pale colour—which is perhaps of little importance as a specific character—this Insect differs from all the specimens of *G. bicolor* by the absence of the elevated laminae on the middle and posterior femora and tibiae, and by the longer basal joint of the posterior tarsi, the upper margin of which is not curvate. The ovipositor extends 12 mm. beyond the tip of the abdomen.

Dr Willey brought back a specimen which is probably the male of this species (Pl. VII, Fig. 5), as it has pallid legs and antennae: the small lateral lobes of the abdomen possess a metallic, golden, reflection, and the cerci are shorter and broader than they are in the male of *G. bicolor*, and the spines on the hind femora are more numerous (Pl. IX, Fig. 22).

[*Hermarchus pythonius*. Although this species was not obtained by Dr Willey, we figure the egg (Fig. 36) taken from the ovaries of a specimen brought by Mr Stanley Gardiner from the island of Rotuma. The sculpture of the capsule is remarkably coarse and the operculum, which is destitute of a capitulum, has a very deep circular depression round the central part. We also figure an egg-tube (Fig. 37) with the egg still incomplete though of large size: and the opercular pole of a less grown egg, in which the operculum can be distinguished with a mass of nutrient matter situate within it (Fig. 38).]

[*Cyphocrania hanitschi*, n. n. Dr Willey brought back eggs of a Phasmid which has been exhibited in a live state in the gardens and Museum at Singapore, as described in the report of Dr R. Hanitsch for 1897.

The Insect (probably undescribed) is allied to *C. goliath* Gray, and as the egg is remarkable for the large size of the capitulum we figure it. Pl. IX. Fig. 39. The micropyle is exposed and is readily perceived in consequence of the very slight elevation of the ring of the scar, Fig. 39 *a*.]

GENUS. *Anchiale.*

Anchiale. Stål, Recensio Orthopterorum, III. 1875, p. 36.

Only one species of this genus appears at present to have been recognised, but it is very closely allied to the Malaysian Cyphocrania.

(13) *Anchiale stolli*, n. n. Pl. IX, Fig. 16.

Elongata: mesothorace discrete tuberculato, tuberculis subacutis: cercis latis: alis fusco-brunneis, hyalino-maculatis.

Mas.; antennis elongatis (articulis 1—22 = 54 mm.): longe hirsutis, ocellis valde prominulis fere conjunctis; cercis ovalibus, angulo apicale per-obtuso: lamina supra-analis abrupte tectiformis, margine interno acute quinque dentato.

Long. corp. 106 mm.; pronot. 4½ mm.; mesonoti 16 mm.; metanoti 8½ mm.: segm. med. 5½ mm.; abdominis 68 mm.; cerci 4½ mm.; lat. 2½ mm.; tegm. long. 13 mm.: alae 60 mm.

Fem.; antennis brevibus (articulis 1—22 = 32 mm.), breviter pubescentibus: ocellis subobsoletis; cercis elongato-ovalibus, acuminatis; operculo obtuse acuminato ad apicem abdominis extenso, medio carinato: processubus genitalibus inferioribus elongatis, apicem laminae subanalis fere attingentibus; proc. medianis brevioribus, paulo ultra proc. superiores extensis; his latis, liberis, acuminatis.

Long. corp. 170 mm.: pronoti 9 mm.: mesonoti 25 mm.; metanoti 10 mm.: segm. med. 10 mm.; abdom. 100 mm.; cerci 6¼ mm.: lat. 3 mm.: tegm. 30 mm.: alae 70 mm.

Loc. New Britain.

The species in the female sex is apparently dimorphic in colour, the tints being either those of young and green, or old and withered vegetation. I have only seen one individual of the male sex: it has six small teeth on the inflexed terminal portion of the last dorsal segment (Pl. IX, Fig. 19).

Egg (Fig. 27): 4½ mm. long, 3½ broad, of a slaty-grey colour, indefinitely mottled with paler grey, surface shining, a little irregular or uneven, not sculptured or porous. Micropylar area elongate, raised; micropylar scar large, almost horse-shoe shaped; capitulum pallid, rather small, placed on a short black base; operculum without sculpture, the middle part—in which the capitular stalk is placed—somewhat depressed after the fashion of a dish or plate.

This egg is remarkable on account of the absence of sculpture on the capsule; the stalk of the capitulum forms a conical process the terminal part of which projects into the pallid membranaceous top of the capitulum.

It is possible that Stoll's[1] figure of the male[2] and female[3] of "Le spectre à aîles tachetées" may have been taken from this species. The locality he gives was, however, "Amboina," and the form of the cerci does not agree. His figure has been universally applied by synonymists to the following species, viz. *A. confusa*.

(14) *Anchiale confusa*, n. n. Pl. IX, Fig. 17.

Cyphocrania maculata. Westwood, Cat. Orthopt. Phasmidae, p. 111 [nec Serville].

Fem. Elongata; mesothorace obsolete parceque granoso; cercis latis, alis fusco-brunneis, hyalino-maculatis.

Antennis brevibus, parce pubescentibus, ocellis subobsoletis; cercis brevibus, rotundatis; operculo minus obtuso, paulo ultra abdominis apicem extenso, medio carinato; processubus genitalibus inferioribus elongatis apicem laminae sub-analis attingentibus; processubus medianis inferioribus fere aequalibus; proc. superioribus elongatis, gracilibus.

Long. corp. 156 mm.; pronoti 7½ mm.; mesonoti 27 mm.; metanoti 8 mm.; segm. med. 9 mm.; abdom. 94 mm.; cerci 4 mm.; lat. 2¼ mm.; tegm. 27 mm.; alae 62 mm.

Loc. New Britain.

This species was met with by Dr Willey in two examples of the female sex, and an extremely decayed male. It is readily distinguished from *A. stolli* by the almost smooth thorax, and the more elongate, middle and superior (lateral) genital filaments; as well as by the rounded apices of the cerci. The male has three large, instead of six small, teeth on the inflexed margin of the last dorsal plate of the body (Pl. IX, Fig. 18).

This species is the *Cyphocrania maculata* of Westwood, according to specimens in the British Museum. Westwood was, however, in error in considering this to be the species designated by Stoll, Serville and others as *C. maculata.* Stoll did not at first give his species any name, but Serville and others took his figure as the type of their species, and if their assignment of a name on such grounds be attended to at all we must give a new name to Westwood's Insect. The name *Phasma necydaloides*, subsequently assigned by Stoll to his species, was then pre-occupied by Linnaeus.

The figure of *Platycrana necydaloides* in the *Voyage au Pôle sud* may possibly have been taken from a specimen of this or an allied species. It exhibits the thorax as entirely smooth. It is from the island of Warou.

Egg (Pl. IX, Fig. 29): 4½ mm. long, 3½ broad; slaty-black, densely covered with rugose sculpture. Micropylar area, narrow and compressed so as to be strongly raised, and to form a sort of band extending from the operculum to near the other pole of the egg: the micropylar scar coarse but not very distinct on account of the coarse, uneven, neighbouring sculpture, almost V-shaped. Capitulum small, pallid, placed on a short black stalk, obconic so as to be with the stalk almost funnel-shaped.

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[1] Stoll (Caspar), Afbeeldingen Spooken, etc. Amsterdam, 1787.

[2] Pl. IV, Fig. 11.

[3] Pl. III, Fig. 8.

Numerous eggs of *A. stolli* and *A. confusa* were deposited by specimens kept alive by Dr Willey. He noticed that when an egg is deposited another one immediately replaces it in the ovipositorial uterus. The generic resemblances between the eggs of *A. stolli* and *A. confusa* is very evident, but the specific distinctions are so strongly marked as to support the suggestion of Kaup that the eggs may possibly afford the best way of distinguishing closely-allied species of Phasmidae.

TRIBE. Phasmides.

GENUS. *Cacomorpha*, n. g.

Corpus parum elongatum, maris alatum, feminae omnino apterum; pedibus parum elongatis, femoribus dilatatis fimbriatis, tibiis marginibus undulatis, tarsis margine interno sulcato. Antennis elongatis, 20-articulatis, articulis discretis; metathorace utrinque lobo singulo fimbriato, pendente (Fig. 23); metanoto breve; segmento mediano illo duplo longiore (in femina haud discreto); corpore subtus membranaceo, laevigato, metanoto utrinque loba libera ciliata; lamina subgenitali in utroque sexu breve, haud prominula.

This genus is evidently allied to Cotylosoma (C. Waterhouse, *Ann. Nat. Hist.* XV. 1895, p. 498) but that genus has tegmina and short wings in the female, and the side of the breast has five free lobes. Cacomorpha should no doubt be placed in Brunner's group Prisopi, but it is scarcely possible to assign a definite position in the present system of Phasmidae to these curious Insects. The antennae are much longer than the femora but possess only 20 joints. The tibiae are smooth beneath but have no apical area, though the Prisopi are placed by Brunner in the tribe Phasmidae, which is characterised by the possession of an apical area to the tibiae, and by being winged in both sexes. Prisopus is an American genus and has a short mesothorax, thus departing strongly from Cacomorpha. The sexual characters are peculiar, there being no genital appendages covered by the short, flat lamina subgenitalis of the female.

(15) *Cacomorpha aberrans*, n. sp. Pl. VIII, Fig. 12 ♀.

Corpore testaceo, fusco-variegato; subtus pallido, laevigato membranaceo; capite brevi inerme; mesonoto granulato; cercis sat elongatis sublineares.

♂. Tegmina parva, alae magnae; abdomine sublineari, laevigato, tantum ad apicem rugoso.

Long. corp. 38 mm.; antenn. 20 mm.; capitis post antenn. 2 mm.; pronoti 2½ mm.; mesonoti 5½ mm.; metanoti 2¼ mm.; segm. med. 5 mm.; abdominis 20 mm.; femor. ant. 9 mm.

♀. Aptera, supra rugosa, abdomine lato.

Long. corp. 50 mm.; metanoti 2 mm.; segm. med. 5 mm.; abdominis 26 mm.; lat. abdominis 7 mm.

In the male the lamina supra-analis is not visible, in the female it forms a minute bifid process. The cerci are similar in the two sexes.

LOC. Lifu: one male, two females.

The specimens were brought to Dr Willey by natives, the species is certainly not aquatic, there being no water on Lifu except in wells. In all probability it lives closely appressed to the stems of bushes. Wood-Mason's idea that the lobes in Cotylosoma are tracheal gills seems to me to have no foundation whatever.

TRIBE. Phylliides.

GENUS. *Phyllium auct.*

Only two genera are recognised in this tribe, Phyllium and Chitoniscus Stål, the latter being found in the Fiji islands. Dr Willey met with a species in Lifu which is exactly similar in appearance to *Chitoniscus feejeeanus,* but has the nervuration of Phyllium.

(16) *Phyllium brachysoma,* n. sp. Pl. VIII, Fig. 13.

♀. Minor, viride; pedibus brevibus, femoribus parum dilatatis, anterioribus lobo interno parvo, intus rotundato, margine interno obscure tridenticulato.

Long. corp. 52 mm.; tegm. long. 32, lat. 12½ mm.; long. femor. ant. 9½ mm.; lobo interno long. 6, lat. 3 mm.

LOC. Lifu. Two female specimens.

This is the smallest Insect of the genus; it is in appearance allied to *Chitoniscus feejeeanus,* but is readily distinguished by the shorter form, and especially by the shorter legs, the front femora being in *C. feejeeanum* 11½ mm. long. There are only three distinct teeth on the lobe of the front femur, but near the apex, there are two other very minute denticles; there are no serrations between the denticles. The most marked difference between the two species is however to be found in the nervuration. In *C. feejeeanus* (Pl. VIII, Fig. 14) the radial vein diverges from the ulnar vein quite at the base, while in *P. brachysoma* the two run parallel and contiguous. As *C. feejeeanum* is known only by the very brief description given by Westwood (Proc. Ent. Soc. Lond. ser. 3, II. 1864, p. 17), we have figured the tegmen. *P. brachysoma* agrees fairly well with *P. scythe* in the nervuration, but it has the mesothorax short as in Chitoniscus, so that if Stål's genera are considered valid, *P. brachysoma* should form a third.

(17) *Phyllium,* sp. Pl. VIII, Fig. 15.

Dr Willey brought a young nymph from New Britain which probably represents a new species of this interesting tribe, it being destitute of a lobe at the back of the front femur. *P. (Chitoniscus) feejeeanus* has been recorded as living in New Britain[1], but I cannot identify this young individual as belonging to that species.

The sexes of Phyllium are in the adult state extremely different in form and in the condition of the wings, which are quite atrophied in the female but well developed in the male. The males are very rare and little is known as to the development of the sexual distinctions. In the nymph figured, the form is that of a female, but the hind-wings are as far advanced in development as the tegmina, so that I feel quite uncertain whether this nymph may be of the male or female sex.

N.B. *Phibalosoma novae-britanniae,* Wood-Mason, Ann. Nat. Hist. (4) xx. 1877, p. 75, was not procured by Dr Willey.

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[1] Wood-Mason (Ann. Nat. Hist. xx. 1877, p. 75) described *P. novae-britanniae,* but subsequently (J. Asiat. Soc. Bengal, XLVI. pt 2, p. 351) considered this Insect to be *P. feejeeanum* Westw.

EXPLANATION OF PLATES VII—IX.

PLATE VII.

Fig. 1. Myronides filum, male; nat. size.
,, 2. ,, binodis, male, metanotum and median segment.
,, 3. ,, ramulus, female; nat. size.
,, 4. Brachyrtacus celatus, female; nat. size.
,, 5. Gigantophasma pallipes, male; nat. size.
,, 6. ,, bicolor, female; nat. size.
6*a*. Extremity of body, to show outline of cerci and genital operculum.

PLATE VIII.

Fig. 7. Eurycantha horrida, young (probably male). $\times \frac{9}{8}$.
7*a*. Antenna more magnified.
,, 8. ,, ,, young female. $\times \frac{13}{12}$.
8*a*. Antenna more magnified.
,, 9. ,, ,, adult male; nat. size.
,, 10. ,, ,, adult male, middle of under surface of body; *a*, mesosternum; *b*, *c*, metasternum; *d*, 2nd abdominal sternite of Brunner.
,, 11. Acanthodyta spiniventris, female; nat. size.
,, 12. Cacomorpha aberrans, female; nat. size.
,, 13. Phyllium brachysoma, female; nat. size.
,, 14. Chitoniscus feejeeanus, left tegmen; nat. size.
,, 15. Phyllium sp. young; nat. size.

PLATE IX.

Fig. 16. Anchiale stolli; extremity of body of female, with egg; *a*, superior (of 9th segment), *b*, median (of 9th segment), *c*, inferior (of 8th segment), processes; *d*, egg; *e*, cercus. $\times \frac{5}{3}$.
,, 17. Anchiale confusa; extremity of body of female. $\times \frac{5}{3}$.
,, 18. Anchiale confusa; dorsal view of terminal segment of male; magnified.
,, 19. ,, stolli; ,, ,, ,, ,, ,, ,,
,, 20. Acanthodyta spiniventris; extremity of body of male. × 2.
,, 21. Graeffea lifuensis; extremity of body of female. × 2.
,, 22. Gigantophasma pallipes, ♂ hind leg; nat. size.
,, 23. Cacomorpha aberrans; female; side view of middle of body; *a*, pseudo-tracheal gill of metathorax; *b*, base of hind femur. × 4.
,, 24. Phyllium brachysoma, front leg, magnified.

FIG. 25. Anchiale stolli; female nymph, undersurface of extremity of body, to show the partially developed genital processes; 25*a*, the parts in their natural position; *a*, genital operculum formed by 8th segment; *b*, inferior processes (of 8th segment); *c*, superior processes (of 9th segment). 25*b*, the same with the operculum turned forwards; 25*c*, the same with the operculum and inferior processes turned forwards; *d*, median processes (of 9th segment).

„ 26. Myronides sp.? female nymph, to show the partially developed genital processes; 26*a*, the parts in their natural position; 26*b*, with the operculum turned forwards; *a*, operculum; *b*, inferior processes; *c*, superior processes; *d*, median processes.

„ 27. Egg of Anchiale stolli; 27*a*, inferior pole of same, showing hilar scar, *a*. × 8.

„ 28. Hilar area as seen on inner face of endochorion of Anchiale stolli. × 10.

„ 29. Egg of Anchiale confusa; 29*a*, inferior pole of the egg. × 8.

„ 30. Egg-tube of Anchiale confusa with partially formed egg; *a*, the egg proper; *b*, operculum; *c*, capitulum. × 8.

„ 31. Section of operculum and capitulum of egg of Anchiale stolli; *a*, process of the operculum bearing the capitulum *b*. × 8.

„ 32. Egg of Brachyrtacus celatus. × 8.

„ 33. Egg of Myronides bituber; 33*a*, operculum with capitulum, × 8; 33*b*, hilar scar and extremity of hilar area, more magnified.

„ 34. Egg of Myronides sordidus, × 8; 34*a*, operculum and capitulum.

„ 35. Egg of Gigantophasma bicolor. × 8.

„ 36. Egg of Hermarchus pythonius, × 8; 36*a*, operculum.

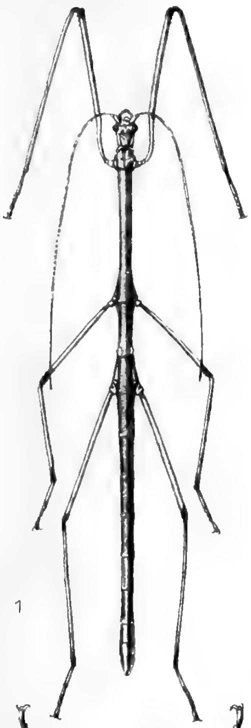
„ 37. Egg-tube of Hermarchus pythonius with young egg; *a*, egg proper; *b*, operculum; *c*, adjacent nutrient chamber. × 8.

„ 38. Part of a young egg of Hermarchus pythonius taken from the egg-tube, showing nutrient matter in the operculum; more magnified.

„ 39. Egg of Cyphocrania hanitschi, × 6; 39*a*, the hilar scar with the true micropylar orifice.

„ 40. Egg of Acanthodyta spiniventris (operculum lost). × 8.

„ 41. Egg of Eurycantha horrida, × 6; 41*a*, operculum detached; 41*b*, central area of operculum.



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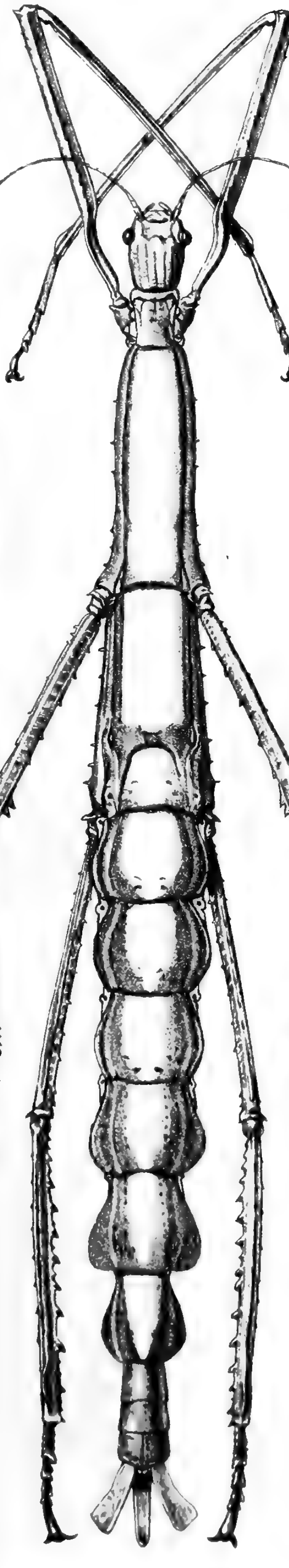

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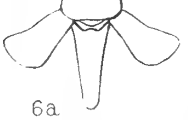

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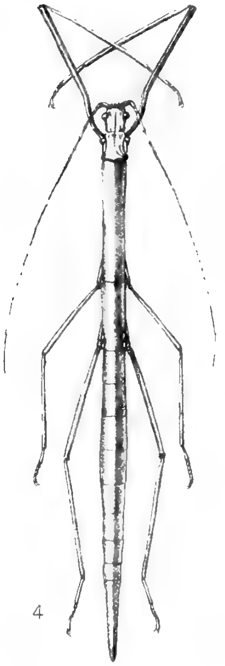

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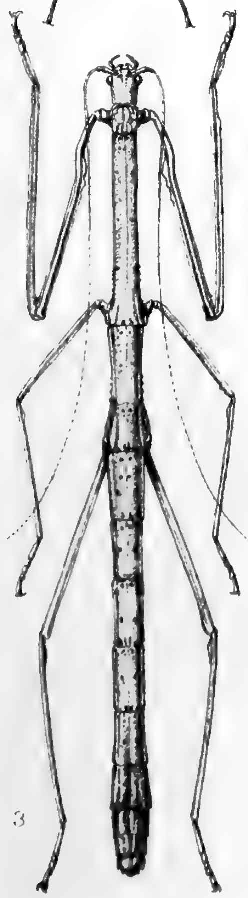

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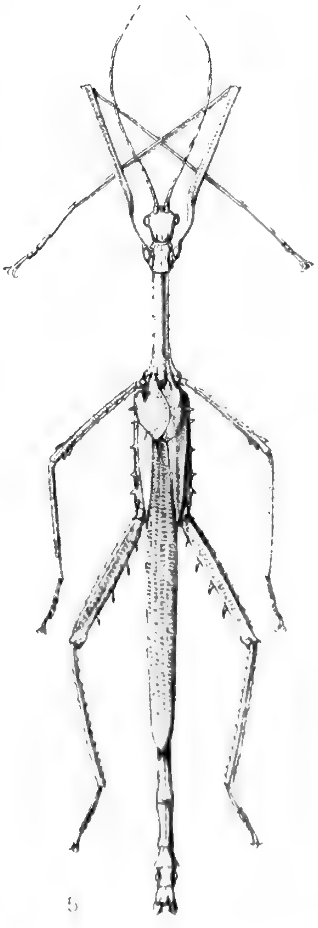

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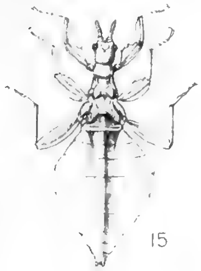
SHARP. PHASMIDAE.

Edwin Wilson, Cambridge.



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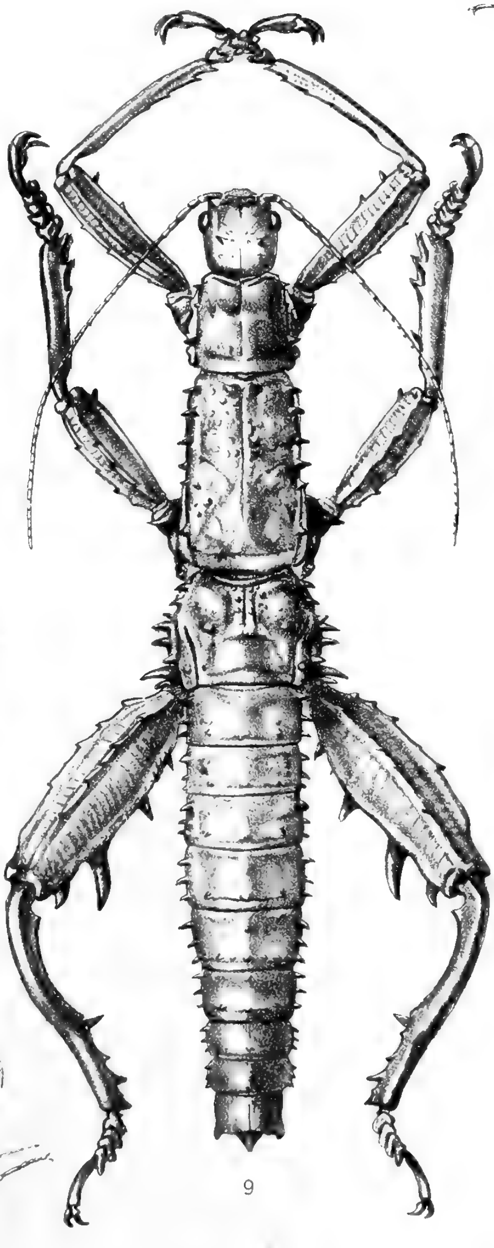

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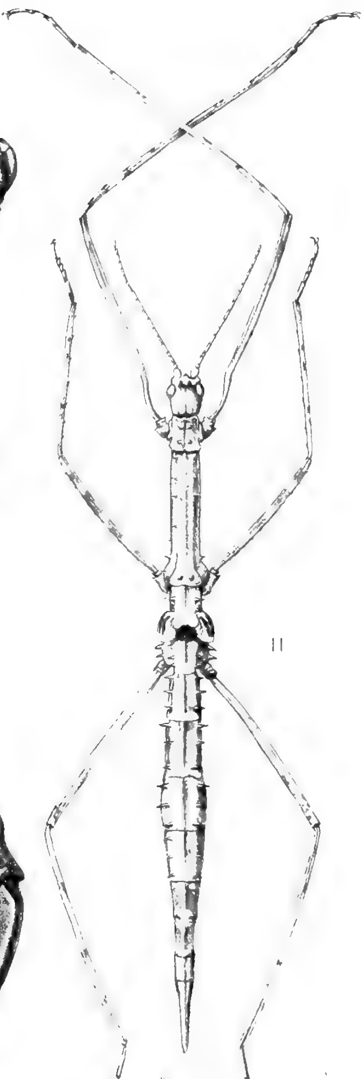

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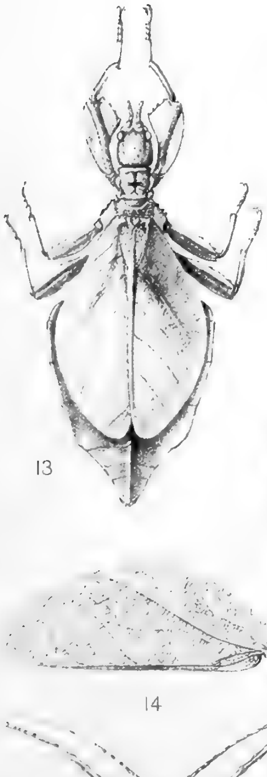

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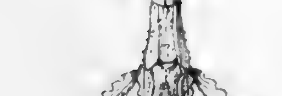

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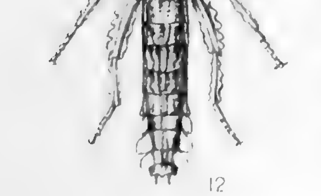

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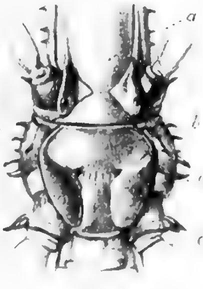

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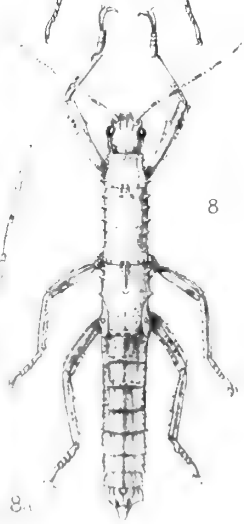

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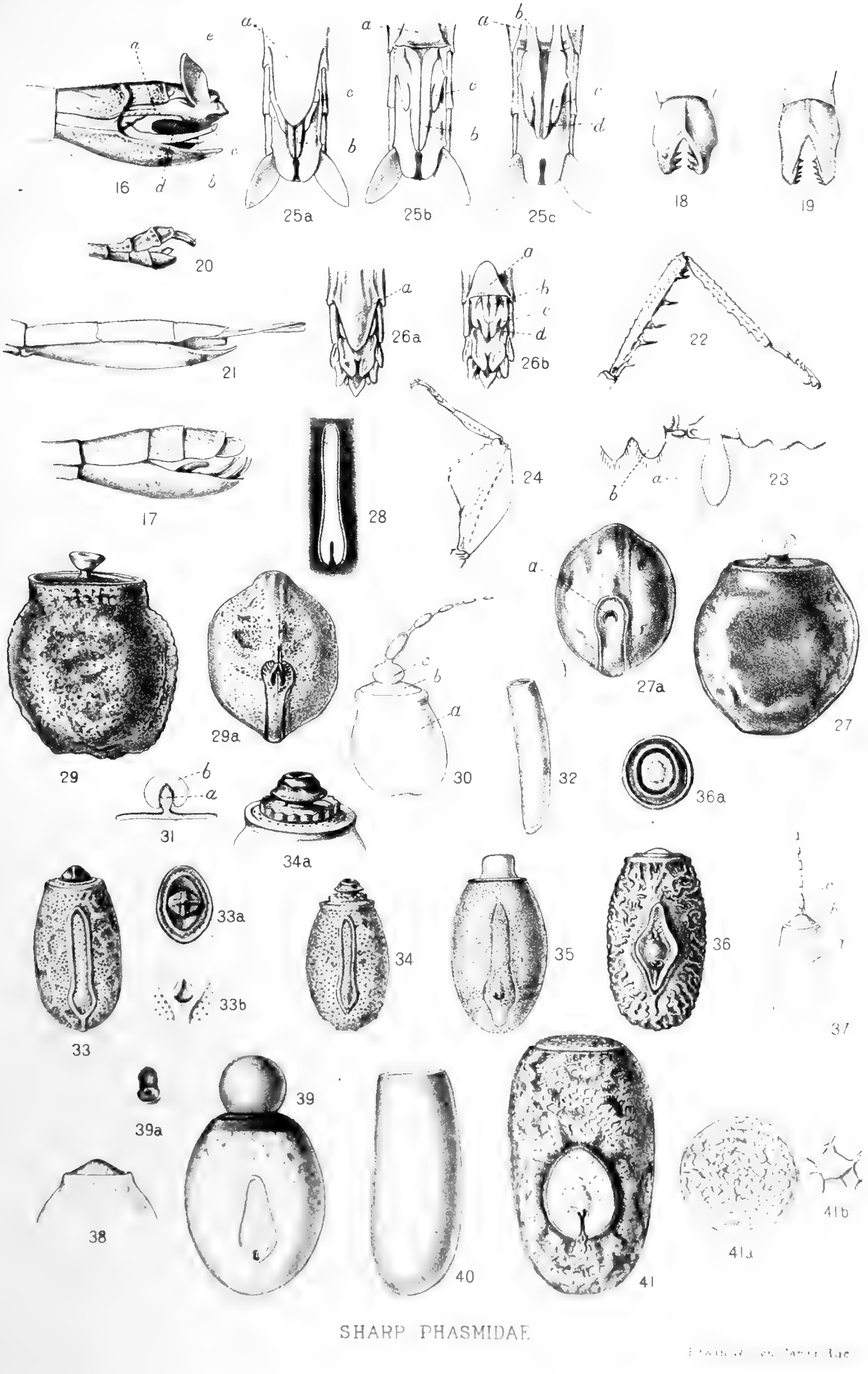
SHARP PHASMIDAE

[illegible] Wilson Cambridge



SHARP PHASMIDAE

Edwin Wilson, Cambridge

SCORPIONS, PEDIPALPI AND SPIDERS COLLECTED BY DR WILLEY IN NEW BRITAIN, THE SOLOMON ISLANDS, LOYALTY ISLANDS, ETC.

BY R. I. POCOCK,
OF THE BRITISH MUSEUM OF NATURAL HISTORY.

With Plates X. and XI.

THE Arachnida forming the subject matter of the following pages are referable to 49 species. Of these a large majority (namely thirty-six) was collected in New Britain, six only being obtained in the Solomon Islands and nine in the Loyalty Archipelago and on the Isle of Pines. All the species met with in the last-mentioned localities prove referable to previously described forms; but of the six brought from the Solomon Islands two appear to be new, and of the 36 from New Britain no fewer than 14 are undescribed, so that the total number of *species novae* collected amounts to 16, that is to say, nearly 35 per cent. of the whole collection.

Dr Willey's researches in the Solomon Islands add three species to the list recently published by me[1], namely, one Scorpion (*Archisometrus perfidus*), one Pedipalp (*Thelyphonus leucurus*) and one Spider (*Linus alticeps*).

From the Archipelago of New Britain, including New Ireland, Duke of York Island and New Hanover, the following species had been recorded in 1881 (see Thorell, Ann. Mus. Genova, XVII., pp. 684—711):—*Gasteracantha panisicca*, Butl.; *G. pentagona*, Walck.; *G. studeri*, Karsch; *Argiope brownii*, Cambr.; *Argiope picta*, L. Koch; *Argiope pentagona*, L. Koch; *Epeira trigona*, L. Koch; *E. gazellae*, Karsch; *Nephila maculata*, Fab.; *Heteropoda vulpina*, Cambr.; *Heteropoda peroniana*, Walck.; *Palystes ignicomus*, L. Koch; *P. pinnotherus*, Walck. Of these 13 species, *Gasteracantha panisicca*, recorded by Mr O. P. Cambridge, is probably identical with the species Thorell subsequently described as *G. karschii*, and *Heteropoda vulpina* described by Mr O. P. Cambridge is, in my opinion, identical without doubt with *Palystes ignicomus* of L. Koch. It is further possible that the specimens referred to *Argiope pentagona* by Karsch are identical with those that Mr Cambridge described as *A. brownii*, the two species being closely related.

Keyserling subsequently recorded the following species from New Ireland:—*Gasteracantha violenta*, L. Koch; *G. mollusca*, L. Koch; *Cyclosa insulana*, Costa, and *Argyroepeira grata*, Guérin; and since the majority of those contained in Thorell's list also came from New Ireland or New Hanover, and the Duke of York Island, the exact locality of the specimens collected by Mr Brown being apparently doubtful, it is clear that the material brought by Dr Willey from New Britain is of considerable value from a faunistic point of view seeing that practically nothing was previously known of the Arachnid fauna of that island.

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[1] *Ann. Mag. Nat. Hist.* (7), I. pp. 457—475, 1898.

Of the 36 species obtained in the island, 14 have been described as new. With the exception of the one Attoid spider, *Tarodes lineatus*, which is the representative of a new genus, all the new forms belong to genera which have a wide range in the Indo and Austro-Malayan area, the only exception to the statement being furnished by the Pedipalp *Abalius willeyi*, from New Britain, which belongs to a genus hitherto only met with in New Guinea and Samoa. The rest of the species, too, are for the most part either widely distributed themselves over the same area or belong to widely ranging genera. In fact this collection supplies one more link in the chain of evidence which proves that so far as the Arachnida, with the exception of some of the Scorpions, are concerned there is no geographical barrier between the Oriental and Australian regions of Sclater and Wallace.

A few points of interest connected with the bionomics of some of the species remain to be mentioned. Of these perhaps the most important are Dr Willey's discovery of the cocooning habits of *Fecenia*, and of the nesting habits of *Conothele*. Attention may also be drawn to the cocoons of *Ordgarius* which, I believe, have never been hitherto described.

Lastly, there is the remarkable stridulating organ found in *Plexippus stridulator*. Stridulating organs of various structures have been found in genera of many families of Spiders, but none up to the present time in any member of the family Attidae. Moreover the organ, consisting of a series of strong ridges on the lower side of the mandible and of the serrula or finely-denticulated ridge which runs along the fore edge of the maxilla, occupies a position which is unique in the order Araneae.

List of the species obtained in New Britain:—

SCORPIONES.

Hormurus australasiae.

PEDIPALPI.

Abalius willeyi, sp. n.
Sarax sarawakensis.

ARANEAE.

Encyocrypta pictipes, sp. n.
Conothele arboricola, sp. n.
Nephila maculata.
Argiope magnifica.
„ *picta.*
Araneus caput-lupi.
Cyclosa insulana.
Argyroepeira grata.
„ *granulata.*
Tetragnatha rubriventris.
Cyrtarachne tricolor.
Ordgarius bicolor, sp. n.
Gasteracantha brevispina.
Gasteracantha taeniata karschii.
Actinacantha aciculata, sp. n.
Lathrodectus hasseltii.
Psechrus argentatus.
Fecenia angustata.
Oxyopes macilentus.
„ *papuanus.*
Lycosa willeyi, sp. n.
Ctenus rufisternus, sp. n.
Heteropoda venatoria.
Pandercetes plumosus, sp. n.
Sparassus actaeon, sp. n.
Palystes ignicomus.
Thelcticopis ochracea, sp. n.
Thomisus pustulosus.
Diolenius lugubris.
Tarodes lineatus, gen. et sp. n.
Zenodorus variatus, sp. n.
Bathippus proboscideus, sp. n.
Plexippus stridulator, sp. n.

List of the species obtained in the Solomon Islands:—

SCORPIONES.

Hormurus australasiae.
„ *karschii.*
Archisometrus perfidus.

PEDIPALPI.

Thelyphonus leucurus, sp. n.

ARANEAE.

Gasteracantha signifer.
Linus alticeps, sp. n.

List of the species obtained in the Loyalty Islands and the Isle of Pines:—

SCORPIONES.

Hormurus australasiae.

ARANEAE.

Nephila venosa.
„ *insularis.*
Argiope aetherea.
„ *protensa.*
Cyrtophora cylindroides.
„ *moluccensis.*
Gasteracantha westringii.
Lathrodectus hasseltii.

ORDER. SCORPIONES.

FAMILY. SCORPIONIDAE.

GENUS. *Hormurus*, Thor.

Hormurus australasiae (Fabr.).

Syst. Ent., p. 399, 1775.

LOC. New Britain; Rubiana, New Georgia in the Solomon Islands, and Maré, Lifu and Uvea in the Loyalty Islands.

Ranges from the Polynesian Islands westwards as far as Burma.

Hormurus karschii, Keyserling.

Die Arachniden Australiens 1885, p. 31, Pl. III, Fig. 3.

LOC. Rubiana, New Georgia (Solomon Islands).

Recorded from New Guinea where the species appears to be not uncommon.

FAMILY. BUTHIDAE.

GENUS. *Archisometrus*, Kraep.

Archisometrus perfidus (Keyserling).

Isometrus perfidus, Keyserling, Die Arachn. Australiens 1885, p. 15, Pl. II, Fig. 2.

LOC. Rubiana, New Georgia (Solomon Islands). Hitherto known only from the Fiji Islands.

ORDER. PEDIPALPI.

FAMILY. THELYPHONIDAE.

GENUS. *Abalius*, Kraepelin.

Abalius willeyi, sp. n.

Pl. X. Fig. 2.

Colour: a uniform deep brown above, paler below and on the extremities of the legs.

Carapace rugose throughout, also granular laterally on the thoracic portion. *Tergites* closely granular; *sternites* rugose and finely granular laterally, smooth and punctured in the middle; genital operculum punctured in the middle, granular at the sides, with a longish broad impression in the middle of its posterior half and lightly impressed on each side of the median prolongation.

Coxae of *chelae* smooth and punctured below, the process directed forwards, externally convex, internally normally shouldered: trochanters smooth below and armed with two spines, rugose and punctured above and armed with five spines, the angular the longest and the anterior longer than either of the interior spines; femur coarsely punctured below and externally, smoother above, armed with two spines, the upper very small; tibia and hand sparsely punctured, tibial process with two spinules near the apex on its posterior aspect.

Legs: tibial spur and protarsal spur on 2nd, 3rd and 4th legs; tarsus of 1st with 7th, 8th and 9th segments modified as represented in Figure 2, Pl. X.; 2nd segment not twice as long as broad, longer than 3rd, 3rd to 6th progressively decreasing in length.

Total length of carapace and abdomen not including caudal feeler 22 mm., of carapace 7·5.

LOC. New Britain.

Only two species of the genus *Abalius* have been hitherto described, namely, *A. rohdei*, Kraepelin, from Papua, and *A. samoanus*, Kraepelin, from Upolu. This new species is nearly allied to the latter, but certainly differs in the form of the tarsal segments of the legs of the 1st pair. In *A. samoanus* the 8th segment is much shorter than the 7th and much wider than long, whereas in *A. willeyi* the 8th is longer than the 7th and longer than its basal width, the 7th and 8th being together much longer than the 5th and 6th, and the 2nd segment only about one-third longer than the 3rd. In *A. samoanus* the 2nd segment is twice as long as the 3rd, and the 5th and 6th are as long as the 7th and 8th.

Keyserling's species *Thelyphonus insulanus* (Die Arachniden Austral. 1885, p. 42, Pl. IV, Fig. 2) from the Fiji Islands and New Hebrides, whence the British Museum has examples, does not belong to the genus *Abalius* as Kraepelin supposed would be likely, but to *Thelyphonus* in the strict sense of the word.

GENUS. *Thelyphonus*, Latr.

Thelyphonus leucurus, sp. n.

Pl. X. Fig. 1—1 *a*.

♀. Trunk, legs and chelae a nearly uniform dark brown, with the posterior border of the tergites redder; lower side of trunk and of coxae of legs paler; tail whitish-yellow.

Carapace granular behind, roughened with wrinkles in front; the interocular area marked with four low longitudinal crests, a pair on each side of the middle line and one on each side above the ocular ridge. Upper side of *abdomen* granular, coarsely coriaceous between the granules, the median stria on the tergites traceable to the 8th; ventral surface coriaceous; genital plate punctured, setose, with shallow median groove and a pair of impressions.

Lower surface of coxae of *chelae* punctured and setose, transversely wrinkled in front towards the middle line; apex of coxal process directed forwards, the inner surface with normal and rounded shoulder; trochanter with two lower spines and six upper spines, three on the inner edge and two on the anterior edge external to the long angular spine; femur with one inferior spine and a small superior spine; upper side of trochanter and of femur coarsely punctured, wrinkled and subgranular towards the inner edge; tibia and hand smooth, coarsely but sparsely punctured; three spines on the outer edge of the tibial process, the series continued by about three more spines, inner edge of manus and of immovable digit with about nine spines.

Tarsus of 1st leg, with its 2nd segment about twice as long as wide, as long as the two succeeding segments, which like the 5th and 6th are wider than long; 8th segment enlarged, wider than long, with a longish internal distal process, 9th segment more than one-third the length of the entire tarsus, quite five times as long as wide, its basal half on the inner side widely excavated, black, the extremities of the excavation marked by a low tuberculiform elevation.

Legs externally granular; tibial and protarsal spur on the 2nd, 3rd and 4th legs.

Ommatoids, small space between them equal to about four times their diameter.

Tail thick.

♂. Differing from ♀ in normal sexual characters; but in addition the legs are redder on their distal half, there is one moderately large bifid spine on the anterior edge of the upper surface of the trochanter, the sixth spine present in the ♀ being absent on one side and represented on the other by a high tubercle; tibia and hand more closely punctured; chelae otherwise as in the ♀; 9th tarsal segment of 1st leg scarcely as long as the sum of the 6th, 7th and 8th, the 2nd not so long as the 3rd and 4th.

Total length 27 mm., of carapace 9 mm.

LOC. Solomon Islands: Narowal (♀) and Rubiana, New Georgia (♂),

The genus *Thelyphonus* ranges from India and Ceylon to the Fiji Islands. This species is most nearly allied to *T. asperatus* Thorell (Ann. Mus. Genova (2), VI., p. 382, 1888) from Java and Amboina but may be at once recognised by the difference in the structure of the tarsal segments of the legs of the 1st pair in the ♀, the process on the 8th segment being considerably shorter and the basal emargination of the 9th segment much longer and defined posteriorly by a distinct tuberculiform eminence (see Kraepelin, Abh. Nat. Ver. Hamburg, XV., p. 31, fig. 32 *b*, 1897).

FAMILY. TARANTULIDAE.

GENUS. *Sarax*, Sim.

Sarax sarawakensis (Thorell).

Charon sarawakensis, Thorell Ann. Mus. Genova (2), VI., p. 354, 1888.

Sarax sarawakensis, Kraepelin, Abh. Nat. Ver. Hamburg XIII., p. 45, 1895.

LOC. New Britain.

The specimens procured by Mr Willey have been compared with examples of *S. brachydactylus* from Luzon, kindly presented to the British Museum by Mons. Simon and with examples of the same genus collected by Mr Oates beneath stones at low water in the Andaman Islands. The specimens appear to me to be co-specific. Hence I am of opinion, with Prof. Kraepelin, that up to the present time only one species of this genus is known, namely that to which Thorell gave the name *sarawakensis.* This species has been hitherto recorded from the Philippine Islands, Borneo and New Guinea.

ORDER. ARANEAE.

SUBORDER. MYGALOMORPHAE.

FAMILY. BARYCHELIDAE.

GENUS. *Encyocrypta*, Simon.

Simon, Ann. Soc. Ent. France 1888, p. 247.

Pocock, Ann. Mag. Nat. Hist. (6) XVI., p. 225, 1898.

Encyocrypta pictipes, sp. n.

Pl. XI. Fig. 17.

Colour of carapace chocolate brown, sparsely covered with yellowish hairs; legs ochre brown, ringed with black, one black ring on the distal end of the femur, one on the patella, two on tibia and protarsus, one on tarsus; abdomen a dull muddy brown, indistinctly variegated with black.

Carapace about as long as patella and tibia of 4th leg and as patella, tibia and tarsus of palp; its width about as long as patella and tibia of 2nd leg, shorter than those of 1st.

Mandibles with rake consisting of shorter and longer, curved, pointed, slender spiniform teeth intermixed with the bristles; armed below on the inner side with about 12 larger and smaller teeth.

Labium without cusps, bristly; *maxillae* with nine or ten cusps or the anterior angle of the proximal extremity.

Sternum with marginal sigilla.

Palpi with about seven setiform spines on the inner and under side of the tibia at its distal end.

Legs: 1st and 2nd pairs without spines, with at most thickened bristles on the lower side of the distal end of the tibia; 3rd leg with one or two spines on anterior side of patella, one on anterior side of tibia and two setiform spines on lower side of tibia at its distal end; protarsus with three strong anterior spines and about three pairs of spines below, those situated along the posterior side of the lower surface setiform; 4th leg with its tibia armed below with a few setiform spines; protarsus with three strong spines in front and three below, two at the apex, as well as some spiniform setae; *scopulae* on palpus and on legs of 1st and 2nd pairs undivided and extending to the base of the segments; protarsus of 3rd with a few apical scopular hairs, scopula of 3rd tarsus divided; scopular hairs on 4th protarsus scarcely traceable, scopula on 4th tarsus divided by a wide band of setae; *claws* armed with two teeth near the middle of their length, the second posterior tooth small on the posterior legs.

Measurements in millimetres. Total length 12, length of carapace 5·5, width 4·5; length of palp 8·5, of 1st leg 12, 2nd leg 11·5, 3rd leg 11, 4th leg 15 (all measured from base of femur).

Loc. New Britain.

Judging by the colour of the legs this species most resembles *Idiommata annulipes*, Thorell (Ann. Mus. Genova XVII., p. 248, 1881), from Yule Island, New Guinea, but differs from it at least in the absence of spines from the tibia of the anterior legs.

FAMILY. CTENIZIDAE.

GENUS. *Conothele*, Thorell.

Ann. Mus. Genova XIII., p. 304, 1878.

Conothele arboricola, sp. n.

Pl. X. Fig. 3—3 *a*.

Colour of upper side a nearly uniform blackish brown; abdomen tinted with purple; lower surface paler brown.

Carapace smooth, slightly hairy laterally; with a pair of long setae on the summit, a few shorter ones between this and the ocular tubercle, two in front of the tubercle; tubercle transversely oblong; carapace about as long as wide, its length about equal to that of patella, tibia and protarsus of 1st leg, and as long as patella, tibia and half the protarsus of the 4th leg and about equal to the three distal segments of the palpus.

Mandibles with rake consisting of a single row of teeth above the socket of the fang and three or four additional teeth above the inner end of the series; armed below with ten teeth, six along the outer row, four along the inner.

Labium armed with an anterior line of six strong cusps and a pair of cusps on one side behind: maxillae armed below and on the distal angle with 35 to 40 cusps.

Palp: patella armed with two spines below, one outside, one inside: tibia and tarsus covered laterally with bands of short close-set spines.

Legs: tibiae, protarsi and tarsi of 1st and 2nd spined like the palpi, except that the apex of the tibiae on the outer side has a thick subdorsal cluster of spines continuous with those along the posterior margin; patella of 1st with two inferior external spines; patella of 3rd leg armed with 6—8 anterior spines, tibia with an anterior distal cluster of about four, and a posterior distal cluster of about the same number; protarsus with 2—2 distal spines above; and a few setiform spines below; tarsus with about five anterior distal spines and one posterior; 4th leg with a few spiniform setae on the lower side of tibia; about two slender spines on the protarsus and one or two on the distal end of the tarsus; *claws* of palpus with one strong basal tooth; of 1st and 2nd leg with one tooth, that on the anterior claw the larger; of 3rd with one tooth each; the anterior claw of 4th unarmed, the posterior armed with one large tooth.

Abdomen granular; from each granule arises a bristle.

Measurement in millimetres. Total length 13, length of carapace 5, of palp 9, of 1st leg 10, of 2nd leg 9, of 3rd leg 9, of 4th leg 10·8 (measured from base of femur).

LOC. New Britain.

Evidently nearly related to *C. doleschallii,* Thorell (Ann. Mus. Genova XVII., p. 237, 1881), from the Fly River, New Guinea, but differing apparently at least in the spine armature of the patellae of the 1st and 2nd legs, these segments in *C. doleschallii* being described as spined both externally and internally (*in utroque margine*). With *C. malayana,* Dol., from Amboina I am unable to compare it, except in so far as the little that Thorell has said concerning the latter seems to apply to this specimen from New Britain. Unfortunately neither in his description of *C. doleschallii,* nor elsewhere, so far as I can learn, does Thorell mention any characters for distinguishing that species from the previously described *C. malayana,* although a specimen of the latter was contained in his collection in 1878.

The two remaining species, namely *C. birmanica,* Thorell (Ann. Mus. Genova XXV., p. 19, 1887), from Burma, and *C. cambridgei,* Thorell (Ann. Mus. Genova XXVIII., p. 402), from Sumatra, differ from the three already discussed in having the eyes of the posterior line straight and not procurved.

A portion of the trap-door nest sent with the Spider proves that the genus *Conothele,* like *Moggridgea, Pseudidiops* and *Sason,* constructs its domicile upon the trunks of trees. It is a singular fact that in the Trap-door Spiders which have adopted this habit, the mandibles have quite independently acquired a subvertical position; but although this character was known to be present in *Conothele,* there was no direct evidence to show that it was correlated with the habit above described. Happily Mr Willey has satisfactorily settled the point. The remaining genera which constitute Simon's section Pachylomereae, namely, *Pachylomerus, Cyclocosmia* and *Chorizops* retain, so far as is known, the normal habit of digging their burrows in the ground.

SUBORDER. ARACHNOMORPHAE.

FAMILY. ARGIOPIDAE.

(= Epeiridae of recent authors.)

GENUS. *Nephila*, Leach.

Aranea maculata Fabr., Ent. Syst. II., p. 425 (1793).

LOC. New Britain.

Widely distributed throughout tropical Asia.

Mr Willey also obtained in the same island two examples of a variety of this species somewhat resembling that known as *walckenaerii*, and differing from the typical form in the absence of spots on the abdomen, the lower surface of which has a broad undivided yellow band extending from the vulva to the spinners and a corresponding band on the dorsal side, which, however, is divided longitudinally by darker median stripes.

Nephila venosa, L. Koch.

Verh. k.-k. zool.-bot. Ges. Wien XVII., p. 183, 1867; Die Arachn. Austral., p. 148, Pl. XII, Fig. 1 (1872).

LOC. Isle of Pines.

Previously known from Queensland, Papua, Fiji, Samoa, etc.

Nephila insularis, Keyserling.

Die Arachniden Austral. 1887, p. 215, Pl. XIX, Fig. 5.

LOC. Lifu, Loyalty Islands.

Recorded from the Loyalty Islands by Keyserling.

GENUS. *Argiope*, Sav. in Aud.

Argiope aetherea (Walck.).

Ins. Apt. II., p. 112, 1841.

LOC. Lifu, Loyalty Islands.

Originally recorded from New Guinea, subsequently obtained in Cape York, etc.

Argiope magnifica, L. Koch.

Die Arachniden Austral. 1871, p. 27, Pl. II, Fig. 6.

LOC. New Britain.

Dr Thorell (Ann. Mus. Genova XVII., p. 63, 1881) cites the name *magnifica* amongst the synonyms of *A. aemula*, Walck.; but examples of *magnifica* in the British Museum from Rockhampton and New Guinea may be recognised from examples labelled *aemula* by Thorell from Burma in that the yellow bands on the lower side of the abdomen meet behind and above the mamillae in a broad semicircular yellow band.

Argiope picta, L. Koch.

Die Arachniden Austral. 1871, p. 33, Pl. III, Fig. 3.

LOC. New Britain.

Recorded from Queensland, New Guinea, Aru, etc.

Argiope protensa, L. Koch.

Die Arachniden Australiens I., p. 211, Pl. XVIII, Fig. 8.

Loc. Uvea, Loyalty Islands.

Recorded by Koch from Bowen (Port Denison) in Australia.

Genus. *Araneus*, Linn.

(= Epeira of recent authors.)

Araneus caput-lupi (Dol.).

Acta Soc. Sci. Indo-Neerland 1859, p. 35, Pl. VIII, Fig. 6.

Loc. New Britain.

Previously recorded from Amboina, the Moluccas, Aru, Yule Island, etc.

Genus. *Cyclosa*, Menge.

Cyclosa insulana (Costa).

Cenni Zool., etc., p. 65, 1834; and of recent authors. (For synonyms, see Thorell, Ann. Mag. Nat. Hist. (6), IX., p. 232, 1892.)

Loc. New Britain.

Widely distributed in Malaysia and in the Mediterranean area of the Palæarctic Region.

Genus. *Cyrtophora*, Simon.

Cyrtophora cylindroides (Walck.).

Epeira cylindroides, Walck. Ins. Apt. II., p. 136, 1837 (= *viridipes*, Dol., Thor. etc., *nephilina*, L. Koch).

Loc. Isle of Pines.

Recorded by Walckenaer from Cochin China; by Doleschall from Amboina: also known from Papua, Solomon Islands, etc.

Cyrtophora moluccensis (Dol.).

Epeira moluccensis, Doleschall, Nat. Tijdschr. Nederland-Indië XIII., p. 418, 1857; id. Acta Soc. Sci. Indo-Neerland. V., 1859, Pl. IX, Fig. 3.

Loc. Lifu, Loyalty Islands.

Ranging from India and Ceylon over the whole of Indo- and Austro-Malaysia.

Genus. *Argyroepeira*, Emerton.

Argyroepeira grata (Guérin).

Epeira grata, Guérin, Voyage de la Coquille, Zool. II., 2, p. 51 (= *coccinea* Doleschall).

Loc. New Britain.

Previously known from Halmahera, Amboina, Ceram, Aru and New Guinea.

Argyroepeira granulata (Walck.).

Tetragnatha granulata, Walck. Ins. Apt. II., p. 222, 1841 (= *Epeira orichalcea*, Dol.).
Loc. N. Britain.
Occurring in Celebes, Amboina, Papua, etc.

Genus. *Tetragnatha*, Latr.

Tetragnatha rubriventris, Doleschall.

Tijdschr. Nederland-Indië XIII., p. 410, 1857 (see Thorell, Ann. Mus. Genova, XVII., p. 131).

Loc. New Guinea. A single specimen taken on bank of river at Igebai, Milne Bay. The species has been previously recorded from Halmahera, Amboina, Aru, Salawatty, New Guinea and Cape York.

Genus. *Cyrtarachne*, Keys.

Cyrtarachne tricolor, (Dol.).

Plectana tricolor, Doleschall, Acta Soc. Sci. Indo-Neerland, p. 44, Pl. VIII, Fig. 3 (1859).

Cyrtarachne tricolor, Thorell, Ann. Mus. Genova XVII., p. 57, 1881.

Loc. New Britain. This species has been previously recorded from Celebes, Amboina, Cape York and New Guinea.

Genus. *Ordgarius*, Keyserling.

Ordgarius bicolor, sp. n.

Pl. X. Figs. 4—4 *a*.

Colour; carapace blackish brown; abdomen deep blackish chocolate brown below, behind, at the sides, and above on the prominence, but between the prominences ornamented with a broad yellowish-brown band which behind the prominences expands to the right and left and extends over the whole of the area of upper side of the abdomen upon which there are no tubercles; legs pale yellow, annulate, there being three deep black bands on the femora and fainter ones upon the patellae, tibiae and protarsi; coxae, sternum, maxillae and labium a uniform deep blackish brown.

Carapace without spines, but strongly tuberculated, eight tubercles on the cephalic area, a pair behind, two in a line in front of the pair, the foremost on the summit of the head, and two smaller ones on each side of this lying towards the lateral ocular tubercle.

Abdomen heart-shaped, about one-third wider than long, with a pair of high, broad, rounded prominences; the prominences, the sides of the abdomen, and posterior portion of upper surface studded with rounded tubercles.

Legs unspined.

Measurements in millimetres. Total length 13, width of abdomen 12·5, length of abdomen 9·5.

New Britain.

Allied to the Ceylonese species *O. hobsoni*, O. P. Cambridge (Proc. Zool. Soc. 1877, p. 562, Pl. LVI. Fig. 3), of which the British Museum has received specimens from Pundel Oya in Ceylon (*E. E. Green*) but differing in the smaller size and greater number of the tubercles of the abdomen, the smaller size of the median tubercle on the cephalic area of the carapace and the absence of a tubercle from the middle of the area on the upper side of the abdomen circumscribed by the four sigilla.

From the remaining three species of the genus, namely, *O. sexspinosus*, Thor. (Bihang Svenska Vet. Akad. Handl. XX., Pl. IV, no. 4, p. 48, 1894), from Burma, *O. clypeatus*, Simon (Ann. Soc. Ent. France, 1896, p. 473), from Amboina and *O. monstrosus*, Keyserling (Arachniden Australiens, Pt. XXXIII., p. 114, Pl. IX, Fig. 2, 1886), from Peak Downs, Queensland, *O. bicolor* differs in having the prominences of the carapace low and tuberculiform, not spiniform.

The cocoon of *O. bicolor* which Mr Willey brought back, consists of a spherical case of pale yellow silk suspended at the upper end by a slender stalk of the same material and marked with irregularly arranged rows of excrescences, often of a dark brown colour, which run from the direction of the stem towards the opposite pole. Several cocoons are placed together and made to adhere one to another by threads of fine silk. Pl. X. Fig. 4 *a*.

GENUS. *Gasteracantha*, Sund.

Gasteracantha brevispina, Dol.

Tijdsche Nederland-Indië XIII., p. 423, 1857.
LOC. New Britain.
Ranging from Burma to the Fiji Islands.

Gasteracantha taeniata karschii, Thorell.

Ann. Mus. Genova (2), V. p. 230, 1887.
LOC. New Britain.

Dr Thorell based his species *G. karschii* upon a single example from New Britain and pointed out that it differs from the typical *G. taeniata* in having a single large yellow spot on each side of the ventral cone. The British Museum has an example from Mioko, off New Britain, presenting this feature; but the series of specimens obtained by Dr Willey shows that the character is inconstant. In most of the specimens, in fact there are two spots on each side of the cone as is usual in *G. taeniata* and its allies; but in two examples the spots are united, whereas in another they are united on one side of the cone and separated on the other. But although the character most relied upon by the describer of the species thus falls to the ground, *G. karschii* may, I think, be recognised as a subspecies of the Papuan *taeniata* by its shorter, thicker and at the same time more clavate median spines and by the anterior spines being smaller, closer to the medians and directed more forwards.

In one of the specimens the anterior black transverse band is mesially interrupted, involving only the external two sigilla, its median portion being represented by a large black spot which involves the anterior pair of median sigilla and extends forwards to the two median sigilla of the anterior line.

Gasteracantha signifer, Pocock.

Ann. Mag. Nat. Hist. (7), I., p. 465, June, 1898.

Loc. Narowal, Solomon Islands.

Also obtained in the Solomon Archipelago by Mr C. M. Woodford and by the officers of H.M.S. *Penguin.*

Gasteracantha westringii, Keyserl.

Keyserling, Sitzb. Isis Dresden, 1863, p. 66. L. Koch, Die Arachniden Austral. I., p. 3, Pl. I, fig. 2, 1871.

Loc. Lifu, Loyalty Islands.

The type of this species, a dried specimen without locality, is now preserved in the British Museum. Its length as compared with its transverse width is rather less than in the examples collected by Mr Willey and the posterior spines are longer in proportion. Probably these differences are due to mode of preservation and not to natural variation.

Keyserling's collection also contained specimens of the same species, resembling those from the Loyalty Islands, from Brisbane. Curiously enough, the author did not recognise them as specifically identical with the type of his *G. westringii*, but identified them as *G. mollusca* of L. Koch. The British Museum also has dried examples labelled, though erroneously, 'Georgia.' This is perhaps a mistake for New Georgia, the name applied to one of the islands of the Solomon Archipelago, where the species very likely occurs.

GENUS. *Actinacantha*, Simon.

Actinacantha aciculata, sp. n.

Pl. X. Fig. 5.

Colour: carapace, mandibles, labium and maxillae black, polished, legs yellow or reddish, with brown coxae and the distal end of protarsus and tarsus black; sternum yellow with a narrow black margin; upper side of abdomen pale yellow with black sigilla, the black on the sigilla of the anterior row sometimes fused and forming a black stripe on each side, the two not uniting in the middle line, the prominences which support the spines red, spines black; the yellow of the upper surface encroaching on the lower; the lower side spotted yellow, a pair of large spots at the sides of the area between the vulva and the spinning eminence.

Abdomen pentagonal in form; the anterior spine short, directed obliquely forwards and outwards and upwards, barely half the length of the median spine, from the base of which it is separated by a space about equalling its own length; median spine longish and slender, its length about equal to the width of the head, very slender arising abruptly from the prominence that supports it and not gradually; posterior spine resembling the median but about three-fourths its length, space between the prominences of the posterior spines about equal to the length of the median spine and rather less than the space separating the bases of the median and posterior spine on each side. Lower side of *abdomen* and the prominences that bear the spines granular.

Measurements in millimetres. Total length 9, width of head 3, width of abdomen, including median spines 15, width at posterior base of anterior spines 8·5, length along the middle line of abdomen 6, length including posterior spine 8·4.

Loc. New Britain.

This species is closely allied to *A. pentagona* Walck. (Ins. Apt. II., p. 168; see also L. Koch, Die Arachniden p. 10, Pl. I, fig. 6) from New Ireland but has the spines considerably longer, the medians in *A. pentagona*, according to C. Koch's figure, being much shorter than the width of the head. The spines are also much broader at the base than in *A. aciculata.*

Actinacantha studeri Karsch (Zeitschr. gesammt. Naturwiss. LI., p. 799, 1878), from New Hanover is also related both to *A. pentagona* and *A. aciculata.* With *A. pentagona* I am unable to compare it, being acquainted with *A. studeri* merely from its description. It appears, however, to differ from *A. aciculata* in having the sternum black with a median yellow band, and the legs and palpi black with only the femora, patellae and part of the tibiae of the palpus and first two pairs of legs red.

FAMILY. THERIDIIDAE.

GENUS. *Lathrodectus*, Walck.

Lathrodectus hasseltii, Thorell.

Öfv. Vet. Ahad. Forhandl. XXVII., p. 369 (1870) (= *scelio*, Thor.).

Loc. New Britain and the Isle of Pines.

Abundant in Australia from Cape York, southwards; also recorded from New Zealand.

FAMILY. PSECHRIDAE.

GENUS. *Psechrus*, Thor.

Ann. Mus. Genova XIII., p. 170, 1878.

Psechrus argentatus (Doleschall).

Tegenaria argentata, Doleschall, Nat. Tijdschr. Nederl. Indië, XIII., p. 407, 1857.

Psechrus argentatus, Thorell, Ann. Mus. Genova XIII., p. 171 (1878).

Loc. New Britain.

This species has previously been recorded from Amboina, Ceram, and New Guinea (Island of Faor and the Fly River).

Allied species have been recorded from Ceylon (*P. torvus*, Cambr.) and Singapore (*P. singaporensis*, Thor.).

GENUS. *Fecenia*, Simon.

Bull. Soc. Ent. France, 1887, p. CXCIV. (for *Mezentia*, Thor. preoccupied).

Fecenia angustata (Thorell).

Pl. X. Fig. 6.

Mezentia angustata, Thorell, Ann. Mus. Genova XVII., p. 204, 1881.

LOC. New Britain.

A mutilated specimen agreeing with *angustata* from Ternate in colour and not disagreeing with the description of it in any reliable structural features, was obtained.

Mr Willey fortunately secured this specimen when guarding its newly hatched young. The nest consists of an irregular shaped silken sac adhering tightly to the surface of a rolled leaf with one or two arched apertures (for the ingress and egress of the mother) round the margin. The edges of the leaf are held together with silk and thus form a tubular chamber for the support and protection of the nest.

This cocoon-nest is very different from the nest of *F. cylindrata* discovered by Mr Oates in Burma (see Thorell, Spiders of Burma, pp. 64—66, 1895). This nest, which according to Mr Oates is placed horizontally in the centre of the web, consists of a straight tube of silk interwoven with twigs, seeds, etc., open at its broad end but closed at the narrow opposite extremity. Since the spider found in this tube is an immature female, it is possible that the cylindrical nest is constructed for protection during the process of moulting.

Mr Willey's discovery of the cocooning habits of *Fecenia* are of great interest, since they fill up an important gap in our knowledge and show how the genus differs in this respect from its near ally *Psechrus*, which according to Mons. Simon carries the cocoon in its jaws. This difference of habit between the two is exactly paralleled by the two Heteropodine genera *Sparassus* and *Heteropoda*, the latter carrying the cocoon, the former enclosing it in a rolled leaf.

FAMILY. OXYOPIDAE.

GENUS. *Oxyopes*, Latr.

Oxyopes macilentus, L. Koch.

L. Koch, Die Arachniden Austral. II., p. 1000, Pl. LXXXVII, Figs. 4—5.

Thorell, Ann. Mus. Genova XVII., pp. 393—395, 1881.

LOC. New Britain.

This species has been recorded by Koch from Cape York, Gayndah, Bowen, Port Mackay and Rockhampton in Australia and by Thorell from Arfak and Ramoi in New Guinea.

The specimens (♂, ♀) collected by Mr Willey have been compared with authentically-named examples from Rockhampton contained in the Keyserling collection. They appear to me to be specifically identical, and since the occurrence of this species in New Britain is thus substantiated, there can be no reason for doubting the accuracy of Thorell's determination of the Papuan form as *macilentus*.

Oxyopes papuanus, Thorell.

Pl. X. Fig. 7.

Ann. Mus. Genova, XVII., pp. 395—399, 1881.

Loc. New Britain.

A single female example referred to *O. papuanus* agrees with the description of the latter sufficiently closely to make the identification probably correct. Thorell has recorded *papuanus* from Andai, Ramoi, and Dorei Hum in Papua, from Wokan in the Aru Islands and from Cape York in Australia.

The cocoon of this species consists of a subspherical silken sac attached to the tip of the folded termination of a branch of the inflorescence of a mallow-like plant probably referable to *Triumfetta.*

FAMILY. LYCOSIDAE.

GENUS. *Lycosa,* Latr.

Lycosa willeyi, sp. n.

Pl. X. Fig. 8.

Colour: carapace piceous or deep castaneous with a pale median dorsal band and a lateral band of about the same width, the dark intervening area crossed by narrow radiating flavous stripes; maxillae, labium and mandibles black, the latter clothed with flavous hairs; sternum and coxae ochraceous; legs and palpi ochraceous, covered with flavous hairs; the scopulae fuscous and the spines black; abdomen uniformly dirty yellow below; a deeper ochre yellow finely speckled with black above, with indistinct traces of a short anterior median darker stripe.

Carapace a little longer than patella and tibia of 4th leg, slightly excelling tibia and protarsus of 1st leg, and a little less than protarsus and half the tarsus of the 4th leg; *eyes* of anterior line a little narrower than those of the median, a little procurved, the medians larger than the laterals and separated from the edge of the clypeus by a space which slightly exceeds their diameter, the distance between the medians less than their diameter; distance between eyes of 2nd line a little less than their diameter.

Palpi: femur with 1, 1, 4 spines above; patella with 1 internal setiform spine; tibia with 3 and tarsus with 4 setiform spines.

Legs: 1, 2, 3, 4 in length, 2nd and 3rd nearly equal; femur of 1st armed above with 7 spines, 2 of them being internal and apical; patella unarmed; tibia with 2, 2, 2 weak spines below, protarsus armed below with 2, 2, 1 spines amongst the scopular hairs and 1, 1 at the apex above the scopula; 2nd leg armed like the 1st except that the 2 spines on the anterior side of the upper surface of the femur are separated, not close together; 3rd and 4th legs with patella armed with 1, 1 spine, tibia armed with 2, 2, 2 spines below, 2 in front, 2 above, and 2 behind, the protarsi armed with about 12 spines arranged in 4 rows of 3 each, those on the lower side of the 4th protarsus not so noticeably arranged in series.

Vulva (as in figure).

Measurements in millimetres. Total length 19, length of carapace 10, of 1st leg 22, 2nd leg 21, 3rd leg 28, 4th leg 28.

Loc. New Britain.

With the eyes of the anterior row a little narrower than those of the median, the abdomen uniformly yellow below, two spines on the upper side of the tibia of the 3rd and 4th legs, the patellae of the 1st and 2nd pairs without spines, the anterior median eyes larger than the anterior lateral, the protarsus of the 4th leg shorter than the patella and tibia of this limb and the carapace ornamented with median and lateral bands, *Lycosa willeyi* falls alongside of *L. pulvere-sparsa* of L. Koch (Die Arachniden Austral. II., pp. 895 and 941, Pl. LXXXI., Fig. 6, 1877 and 1878) from Rockhampton, but certainly differs from it, at least in the form of the vulva, the excavation of the epigynal plate being much broader, the cross-bar of the median piece much longer, etc.

FAMILY. CTENIDAE.

GENUS. *Ctenus*, Walck.

Ctenus rufisternus, sp. n.

Pl. X. Fig. 9—9 *a*.

Colour: (dry) carapace clothed laterally with dark yellowish hairs, naked above but showing traces here and there and just behind the eyes of having been covered with silvery white hairs; mandibles, palpi and limbs clothed with dirty yellowish hairs, those on the tibia of the 1st and 2nd legs silver white, and those on the tibiae and protarsi of 3rd and 4th yellowish white; hairs of abdomen greyish black, with a broad pale band in the dorsal middle line and spots of silvery hairs below; integument of cephalothorax and legs (in alcohol) blackish, with a broad reddish line in the dorsal middle line; sternum and coxae bright yellowish red.

Carapace higher behind than in front, a nearly even slope from the posterior to the anterior edge of the upper surface; a little shorter than patella and tibia of 1st leg and a little longer than those of 2nd, a little longer than 4th protarsus. *Eyes:* ocular quadrangle wider than long, narrower in front than behind; anterior median eyes smaller than posterior median and closer together, space between them about equal to their radius; eyes of second row a little procurved, the lower edge of the laterals slightly below the level of the lower margin of the medians; the anterior laterals oval, separated from posterior medians by a space about equalling their long diameter; clypeus short, less than radius of anterior centrals.

Legs: femur of 1st armed with 11 spines, arranged in rows approximately 4, 3, 4; patella, spines 1, 1; tibia armed with 5 pairs below, 2 in front, 3 above, and 2 behind; protarsus armed with 12 spines 3, 3, 3, 3; with or without an additional median spine above; 2nd leg armed apparently as the 1st; 3rd leg, femur with about 11 spines; tibia with 3 pairs below, 2 spines in front, 3 above, and 2 behind; protarsus with 3 pairs below, 3 spines in front, 3 behind, with 1 extra above and 1 at the apex; 4th leg armed like the 3rd, with about 15 spines more irregularly arranged than on the other legs.

Palp with tibia about as long as patella and armed externally with a quadrate process, the upper edge of which is convex, the lower straight; a spiniform process on its distal margin; palpal organ as in figure.

Measurements in millimetres. Total length 12, length of carapace 7·2, width 5, length of 1st leg 18, of 2nd 15, of 3rd 13·5, of 4th 19·2.

Loc. New Britain.

Easily distinguishable from *C. agalenoides*, L. Koch, from Gayndah, and *C. agræcoides*, Thorell, from Cape York, by its red coxae and sternum, absence of distinct rings on the legs, and also from the former in the form of the palpal organ, etc.

Family. Heteropodidae.

Genus. *Heteropoda*, Latr.

Heteropoda venatoria (Linn.).

A single specimen of this, the common large house-spider of the tropics, was collected in New Britain.

Genus. *Pandercetes*, L. Koch.

Pandercetes plumosus, sp. n.

Pl. X. Fig. 10.

Colour: (dry) carapace and abdomen covered above with whitish hairs intermixed with yellow, the hairs around the eyes tinted with brown and those on the carapace behind the head with pale green; hairs on upper side of abdomen rubbed away; hairs on legs yellowish white, developed into long fringes, especially on the femora, as in *P. plumipes*; (in alcohol), the carapace, legs and abdomen are testaceous, mottled with black, the legs being very noticeably spotted with blackish grey, the blackish spines showing up strongly; labium and maxillae and tip of mandibles ferruginous; sternum coxae and under side of legs entirely testaceous yellow; 3rd leg with an elongate black spot at base of femur and a long black line traversing the whole of the lower side of the tibia and protarsus.

Carapace about as wide as long, about as long as protarsus of 3rd leg.

Palpi: femur armed with 4 spines; patella with 1, 1; tibia with 3 inner, 1 upper, 2 outer; tarsus with 3 inner and 3 outer. *Legs:* femur of 1st leg with 3, 3, 3 spines, patella with 1 posterior spine; tibia with 4 pairs of long spines beneath; protarsus with 3 pairs of spines, one pair being situated above close to base; 2nd leg armed like 1st; 3rd leg femur with 3, 3, 2 spines, tibia with 2, 2 spines beneath and 1 anterior and 1 or 2 posterior spines, protarsus with 2, 2 inferior spines and 1 anterior basal spine; 4th leg spined much as the 2nd but less regularly, femur with only 1 posterior spine; tibia and protarsus with 5 spines.

Vulva consisting of a sub-oblong plate, hairy at the sides and marked mesially with a longitudinal groove which anteriorly expands into a longitudinally oval depression.

Measurements in millimetres. Total length 14, length of carapace 6, of 1st leg 29, of 2nd 29, of 3rd 22, of 4th 26; length of femur of 2nd 8·6.

LOC. New Britain.

This species certainly differs from *Pandercetes plumipes* of Doleschall from Amboina (Acta Soc. Sci. Indo. Neerland, 1859, p. 53, pl. III., fig. 9), which it resembles in plumosity, at least in having much shorter legs; for example, judging by Doleschall's figure, the femur of the 2nd leg in *plumipes* is about twice as long as the carapace (7 : 14), whereas in *P. plumosus* the femur is only once and a half times the length (6 : 8·6). From *P. isopus*, Thorell, from Fly River, New Guinea (Ann. Mus. Genova. XVII., pp. 308, etc.), it differs in having the legs much longer as compared to the carapace, the proportion between the 1st leg and the carapace being 29 : 6, whereas in *isopus* the proportion is $24\frac{3}{4}$: 6. Moreover the leg measurements given by Thorell probably include the trochanter and part of the coxae, so that the difference is no doubt even greater than appears at first sight.

GENUS. *Sparassus*, Latr.

Sparassus actaeon, sp. n.

Pl. X. Fig. 12.

♀ *Colour:* hairy clothing of limbs and carapace a rich ochre or golden yellow; upper side of head and anterior surface of mandibles rubbed smooth; sternum very scantily clothed, upper side of abdomen much the same colour but rather darker; lower side darkish brown with four faint pale stripes passing from the epigastric fold to the spinners: integument of carapace and limbs a deep chestnut brown, mandibles, maxillae, labium and sternum black.

Carapace longer than broad, moderately high, its length equal to that of tibia of the 1st leg and a little less than its protarsus; less than tibia of 2nd, less than patella and tibia of 3rd, about equal to tarsus and protarsus of 3rd; its width just equal to protarsus of 4th. *Eyes* of posterior line straight, the medians smaller than the laterals and a little nearer to each other than either is to the corresponding lateral; ocular quadrangle a little wider behind than in front; anterior median eyes separated by a space, which is less than their diameter and nearer to each other than either is to the lateral; clypeus a little less than the diameter of anterior median eye.

Mandibles moderately strongly geniculate at the base.

Legs: long; 2, 1, 4, 3; the 2nd from the base of the femur more than four times as long as the carapace; 2nd exceeding the 1st by the length of the tarsus and the 3rd by the length of the tarsus and $\frac{4}{5}$ of the protarsus: 1st leg, femur with 9 or 10 spines above, patella with spines 1, 1, tibia with 2, 2, 2 below, 2 in front and 2 behind; protarsus with 2, 2 below, 2 in front, and 2 behind; 2nd leg spined like the 1st, the femur irregularly; 3rd leg like the 2nd, 4th leg with only an anterior patellar spine.

Vulva consisting of a chitinous plate marked with two arched grooves running longitudinally, approaching each other but not meeting in the middle line in front and circumscribing a heart-shaped area which shows a median depression.

Measurements in millimetres. Total length 34, length of carapace 17, width 15, length of 1st leg 67, of 2nd 72, of 3rd 51, of 4th 55.

LOC. New Britain.

According to L. Koch's tables of Australian species of *Sparassus* this new form falls under the heading and alongside of *S. nitelinus* from Peak Downs, a species which it also somewhat resembles in the form of the vulva. *S. actaeon* certainly differs, however, in being much larger, differently coloured and in possessing much longer legs.

GENUS. *Palystes*, L. Koch.

Palystes ignicomus, L. Koch.

Palystes ignicomus, L. Koch, Die Arachniden II., p. 701, pl. LX., figs. 2—20, 1875.
Sarotes vulpinus, O. P. Cambridge, Proc. Zool. Soc. 1877, p. 286.

LOC. New Britain.

The specimen of the species described by Dr Koch was collected in New Ireland. The type of *vulpinus*, which Mr Cambridge has kindly sent to me for examination, was obtained by the Rev. George Brown either in the Duke of York Island or on the adjacent coasts of New Ireland or New Britain. Although this specimen is a not quite adult female, I have no hesitation in regarding it as specifically identical with *P. ignicomus*, of which Mr Willey obtained some beautifully coloured examples (♂, ♀).

GENUS. *Thelcticopis*, Karsch.

Thelcticopis ochracea, sp. n.

Pl. X. Fig. 11.

Colour: carapace, sternum, and legs a nearly uniform pale castaneous tint, legs paler than carapace, both scantily clothed with greyish white hairs; abdomen a pale mouse grey with a series of indistinct median spots above and short oblique stripes of the same tint on each side; mandibles deep brown.

Carapace about as long as patella and tibia of 4th leg, a little shorter than those of 2nd leg. *Mandibles* moderately strongly geniculate. *Palpi* with tarsus apically scopulate, its femur armed apically with 5 spines, patella with 1 anterior and 1 posterior spine, tibia with 3 anterior, 1 superior and 2 posterior spines, tarsus with 3 anterior (inner) and 3 posterior (outer).

Legs: 1st, 2nd and 4th nearly equal; femur of 1st armed with 1 or 2 anterior, 1 superior and 3 posterior spines, patella unarmed, tibia with 6 pairs of inferior spines, protarsus with 1 pair of inferior spines; 2nd leg, femur with 3, 2, 3 spines, tibia with 5 pairs of inferior spines; 3rd leg, femur with 3, 2, 1 superior spines; tibia, 3 pairs of inferior spines, and 1 anterior spine; 4th leg as in 3rd, but the tibia armed in addition with 2 interior and 2 posterior spines, and the protarsus with 2 pairs of inferior spines, 3 anterior and 3 posterior; tibiae of 1st and 2nd leg very slightly scopulate anteriorly.

Vulva consisting of a large plate deeply hollowed out, the margin of the excavation semicircularly concave in front, produced posteriorly and laterally into a rounded prominence on each side, and ending behind in a pair of narrowed apically rounded processes projecting beyond the hinder border of the median sclerite, which consists of a pair of smooth shining bosses united posteriorly and ending in a small subquadrate prominence.

Measurements in millimetres. Total length 15·5, carapace 6·8, length of 1st leg 20, of 2nd 19·5, of 3rd 15·5, of 4th 19·5.

LOC. New Britain. A single ♀ example was obtained.

In its small size this species approaches *T. birmanica*, Thorell, from Burma, and *T. flavipes*, Pocock, from Batjan, but certainly differs from both in the form of the vulva. In *T. birmanica* the lateral portions of this organ end posteriorly in a pair of relatively widely rounded skeletal pieces and are not narrowed and produced as in the other two. Again in *T. flavipes* the median sclerite consists of two elongate ridges, ending behind in a narrow process which projects beyond the apices of the lateral pieces.

FAMILY. THOMISIDAE.

GENUS. *Thomisus.*

Thomisus pustulosus (L. Koch).

Xysticus (Musumena) pustulosus, L. Koch, Verh. zool.-bot. Ges. Wien, XVII., p. 220, 1867; *id.* Die Arachniden Austral. I., p. 531, pl. 40, fig. 6, 1874.

Pistius pustulosus, Thorell, Ann. Mus. Genova, XVII., p. 331, 1881.

LOC. New Britain.

This flower-frequenting species is evidently not uncommon in parts of Queensland, the British Museum possessing specimens from Rockhampton, Herbert River, etc. L. Koch has recorded it from Cape York, Bowen, Brisbane, etc., and Thorell from the Kei and Aru Islands and from Papua.

FAMILY. ATTIDAE.

GENUS. *Diolenius*, Thor.

Diolenius lugubris, Thorell.

Ann. Mus. Genova, XVII., p. 414, 1881.

A single female of this or of a closely allied species was collected. The type of *D. lugubris*, a male, was obtained at Ramoi, in New Guinea.

Tarodes, gen. nov.

Carapace low, longer than wide, flat above, the cephalic region not or scarcely higher than the thoracic, the posterior fifth abruptly sloped downwards close up to the fore-part of the abdomen which is in contact with it or abuts against it; cephalic portion a little shorter than thoracic. Ocular area perhaps a little wider than long, parallel sided, eyes of the 2nd row equidistant from those of the 3rd and 1st, and in the same line with them; clypeus linear; the anterior eyes nearly in contact, the upper edge of the laterals on a level with the upper edge of the medians.

Mandibles small and vertical; labium much longer than wide; maxillae of medium length, distally expanded.

Sternum convex, oval but narrowed behind, with its margin strongly excavated, ending posteriorly in a blunt extremity, and not passing between the 4th coxae.

Legs: 1st pair large, with coxae and trochanter long, the coxae much longer and stouter than those of the rest of the legs; trochanter slender, cylindrical, but distinctly though not much longer than the coxae; femora much longer than trochanter, thick and curved; patellae shorter than femora and about half the length of the tibiae, which are much thickened and hairy and spiny below; protarsus slender, not half as long as the tibia and spiny below. The remaining legs short, the 4th longer than the 3rd, and the 3rd than the 2nd.

Abdomen narrow and elongate.

This genus seems to stand near *Tara*[1] of Peckham (= *Atrytone*, Keyserling[2]); but is certainly different in having the tibia of the 1st leg inflated.

Tarodes lineatus, sp. n.

Pl. XI. Fig. 13.

Colour: carapace mahogany brown with black pigment around the eyes; scantily clothed above with yellowish white hairs which form a thicker whitish stripe in the middle line, a broad yellowish white band passing along the side below the eyes and a white marginal band; hair in neighbourhood of eyes with a distinct reddish tinge; abdomen covered above with yellowish white hairs; its integument yellow with four longitudinal black bands running from the fore-part past the middle, and posteriorly breaking up into or giving place to short obliquely transverse black stripes. The two black bands on each side united in front and closer together than are the two admedian bands; between the posterior extremities of the latter there is a median black stripe; lower side of abdomen not clothed with white hairs, blackish; 2nd, 3rd and 4th legs yellow, the 3rd and 4th distally faintly banded with black; sternum, labium, mandibles, maxillae, palpi and greater part of 1st legs piceous or mahogany; the protarsi and tarsi of 1st legs flavous; the upper side of the femora and patellae paler than the inner and lower, and clothed with yellow hairs.

Carapace longer than patella and tibia of 4th, shorter than those of 1st.

Mandibles short, a little longer than the front of the carapace, geniculate at the base, flat in front and rugose; fang groove armed with 2 + 2 teeth, fang short. *Palpi* shorter than carapace; the femur armed with 1 upper apical spine; patella a little longer than tibia; tibia not twice as long as broad, armed externally with a broad bifid spur; tarsus nearly as long as patella and tibia, piriform, apex truncate but thickly hairy; palpal organ consisting of a somewhat oval horny coriaceous disk ending distally in a small hooked process lying transversely, the apex of the hook directed internally.

Legs of 1st pair rugose, coxae about twice as long as broad; trochanter four or perhaps five times as long as broad; femur with upper edge strongly convex; tibia armed below with 7 internal and 5 or 6 external spines, all strong and of medium length; protarsus armed with 2 internal and 3 external spines. *Femora* of legs 2–4 armed apically with about three spines, femur of 2nd thickened, tibia of 2nd with 3 inferior spines, its protarsus with 2 apical and 1 further behind; tibia of 3rd with 1 apical, of 4th with 2 apical; protarsus of 4th with an apical cluster of spinuliform setae.

Abdomen more than twice as long as broad, with a thickish tuft of upright hairs on its anterior extremity.

Measurements in millimetres. Total length 5·8; length of carapace 2·5, width 1·8; patella and tibia of 1st leg 3, of 4th 1·5.

Loc. New Britain. A single male example.

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[1] Tr. Wisconsin Acad. Sci. VI. (1886), p. 272.

[2] Keyserling, in L. Koch's *Die Arachniden Australien*, II. p. 1378, pl. CXVI. p. 6.

GENUS. *Linus*, Peckham.

Sinis, Thorell, Ann. Mus. Genova, XIII. p. 269, 1878 (preoccupied).
Linus, Peckham, Trans. Wisconsin Acad. 1885, p. 264.

Linus alticeps, sp. n.

Pl. XI. Fig. 14.

A detailed description of the new species is unnecessary since the differences that obtain between it and *L. fimbriatus* (Dol.) may be briefly expressed in tabular form as follows.

a. Carapace with the posterior cephalic angle widely rounded and strongly obtuse, the upper surface of the cephalic portion much less strongly elevated posteriorly, the whole carapace being longer as compared with its height; the height from posterior eye to a point between the coxae of 2nd and 3rd legs about equal to the length of the tibia of the 1st leg and less than length of tibia of 4th............*fimbriatus* (Dol.).

b. Carapace with posterior cephalic angle nearly square, only a little obtuse, the upper surface of the cephalic portion being much more strongly raised behind; the whole carapace shorter as compared with its height; the height along a line taken through posterior eye to a point between the 2nd and 3rd coxae exceeding the length of the tibia of 1st leg and about equal to that of tibia of 4th leg. ....*alticeps*, sp. n.

Measurements in millimetres of *L. alticeps.* Total length 7·5; length of carapace from posterior border to anterior eye 3·8; height from posterior border to summit of head 3·3; vertical height from posterior eye 2·8; length of legs (from base of femur), 1st 11, 2nd 10, 3rd 9, 4th 13·5 (patella and tibia of 4th 4·5; tarsus and protarsus 5·5; patella and tibia of 1st 4).

LOC. Rubiana, New Georgia (Solomon Islands).

For comparison with the single adult female of *L. alticeps* obtained by Mr Willey, I have in my hands a single adult female identified by Dr Thorell as *L. fimbriatus*, Dol., which was collected by Sig. Beccari in Sumatra. According to Thorell *L. fimbriatus* ranges from Sumatra through Amboina and Papua to Cape York. For descriptions of the species reference may be made to: Doleschall, Nat. Soc. Sci. Indo-Neerland, 1859, p. 22, pl. V. fig. 8; Thorell, Ann. Mus. Genova, XIII. p. 269, etc., 1878, and *id. op. cit.* XXXI. p. 352, 1892.

L. labiatus, Thorell, from Burma and Java, has apparently the same form of carapace in the female as *L. fimbriatus*.

GENUS. *Zenodorus*, Peckham.

Ephippus, Thorell, Ann. Mus. Genova, XVII. p. 643, 1881 (preoccupied).
Zenodorus, Peckham, Tr. Wisconsin Acad. VI. p. 297, 1885.

Zenodorus variatus, sp. n.

Carapace black, with a paler transversely arched area behind the posterior eyes; a patch of golden metallic hairs behind these eyes and more of the same colour on the areas between the eyes; a conspicuous marginal band of white hairs on the posterior half of the sides of the carapace; mandibles, maxillae and labium black, palpi yellow with tarsus blackish; legs of 1st and 2nd pairs reddish brown, with tarsus and basal half of patella clear yellow and distal two-thirds of protarsus black; 3rd leg with coxa and trochanter yellow, femur reddish brown, paler distally, the rest of the segments yellowish with darker apices; 4th leg coloured like the 3rd but with basal half of femur and patella paler, protarsus annulate; abdomen blackish, with a pair of large spots formed of metallic golden scales on the fore part and two narrower transverse bands of the same tint behind, one in the middle the other at the posterior end.

In its structural characters this species stands near *Z. juliae*, Thorell; but differs in having the clypeus, that is to say, the area between the anterior eyes and the thickened marginal rim, less than half the diameter of the median eyes, only 3 long spines, instead of 6 shorter ones, upon the distal inferior apex of the tibia of the 1st leg, and no spines on the patellae of the 1st and 2nd.

Measurements in millimetres. Total length 7·5; length of carapace 4, width 3·2; length of 1st leg 9, of 2nd 7, of 3rd 11, of 4th 8, patella and tibia of 3rd 3·6, of 1st 4.

Loc. New Britain. A single adult male.

Differs from both *Z. juliae* and *Z. d'urvillei* in having the legs much more distinctly variegated, the clypeus lower and the presence of only 3 spines on the lower side of the distal end of the 1st tibia.

GENUS. *Bathippus*, Thor.

Bathippus proboscideus, sp. n.

Pl. XI. Fig. 15.

Colour: carapace pale castaneous, black close to eyes, with white hairs and a few red ones below the eyes and on each side of the anterior eyes, the rest naked; mandibles yellowish brown with steel blue polish internally; palpi uniformly yellow; legs yellowish, femora brown, with metallic polish outside and inside; coxae of 1st and 2nd black in front; tibia and protarsus of 1st also sometimes blackish; maxillae and labium blackish, sternum pale; abdomen pale at the sides, with a broad black band above and below.

Carapace about as long as tibia of 1st leg, scarcely two-thirds the length of the basal segment of the mandible. Basal segment of *mandible* about five times as long as thick, armed with two spiniform teeth near the base and four teeth nearer the extremity, two of these are quite at the end, one on each side of the base of the fang, the inner one smaller and tubercular, the outer one much larger and bearing an external nodule; of the remaining teeth one, the external, is of moderate size and spiniform and stands about one-third of the distance from the end, while the other, farther forwards and on the inner side, is long, strong and slightly arched; the *fang*, which extends back as far as the spiniform teeth of the basal segment, is bent at an acute angle close to its base and armed internally on the distal side of the angle with a longish spiniform tooth. Distal external angle of *maxillae* rounded.

Palpi long and slender, the tibia at least one-third longer than either tarsus or patella.

Legs armed with long spines; patellae with an anterior and a posterior spine.

Measurements in millimetres. Total length of body 10·5; length of carapace (not including eyes) 4, width 3·3; length of basal segment of mandible 7·2, of fang from its basal angle 7·8, of palp 5·8, of 1st leg 16·5, of 2nd 12·8, of 3rd 14·8, of 4th 13·8.

LOC. New Britain. Several male examples.

In the shape and great length of its mandibles, of which the basal segment is considerably longer than the carapace, this species resembles *B. montrouzieri*, Lucas from New Caledonia (Rev. Mag. Zool., 1869, p. 208, pl. II. figs. 8—12) and *B. montrouzieri papuanus*, Thorell (Ann. Mus. Genova, XVII. p. 526), of which the British Museum possesses specimens from Aru Island and the Fly River, Papua. *B. proboscideus*, however, may be at once recognised by the presence of a longish tooth at the base of the fang, which is strongly angled; by the small size of the apical tooth on the inner side of the basal segment, and by the concavity of the upper and convexity of the lower side of the segment.

GENUS. *Plexippus* (C. Koch), Thorell.

Plexippus stridulator, sp. n.

Pl. XI. Figs. 16—16*c*.

♂. *Colour:* carapace yellowish brown, the head region darker, redder, sometimes a paler median band on the thoracic portion; the region of the eyes clothed with hairs of a rusty red, traces of hairs of the same colour visible here and there on the thoracic portion, which like the area below the eyes is clothed with white hairs; mandibles dark, metallic, with a clothing of long white hairs; palpi and legs reddish brown, the anterior two pairs with bluish metallic lustre, tarsus and distal half of protarsus pale yellow; maxillae and labium deep brown, sternum and coxae flavous; abdomen with a pale median dorsal band with border sinuous and set off with black spots; sides of abdomen fuscous above, pale below, with a dark median ventral stripe; sides of abdomen clothed with snow-white hairs, intermixed with those of a bronzy hue above.

Carapace equal to length of patella and tibia of 2nd leg. *Mandibles* vertical, shorter than carapace, diverging from the base, the inner distal angle at the base of the fang produced into an elongate conical tooth; the fang-groove armed in front near the base with two spiniform teeth and behind with one long sharp spike and, at the base of the fang, a small conical tooth; on the posterior surface of the mandible there is a submedian vertical series of about 12 short strong ridges; fang moderately long, sinuous. *Maxillae* about twice as long as the labium, their distal portion produced externally into a strong acute angle of about 70 degrees, the margin between the angle and the scopulate oral margin straight; on the upper surface of the maxillae the *serrula* extends along the border to the external angle; patella and tarsus of palp subequal in length, tibia longer than either and armed externally and distally with a long straight spine.

Legs: tibia of 1st thickly hairy below and armed with 2, 2, 2 long spines and 1 anterior distal spine; protarsus of 1st and 2nd with 2, 2 spines; tibia of 2nd with 1 (posterior), 2, 2 spines below and 3 spines in front: patella of 1st without spines, of 2nd with 1 anterior spine, of 3rd and 4th with 1, 1 spines; femora with 5—7 spines above; tibia and protarsus of 3rd and 4th with many spines.

Measurements in millimetres. Total length 11·5; length of carapace 5, width 4; length of basal segment of mandible 2, of palp 5, of 1st leg 14, 2nd leg 11, 3rd leg 12, 4th leg 11·5.

LOC. New Britain.

This interesting new species of which unfortunately the male only is known is sufficiently characterised by the possession of the stridulating organ, consisting of a series of ridges on the lower side of the mandible which are scraped against the 'serrula' on the edge of the maxilla.

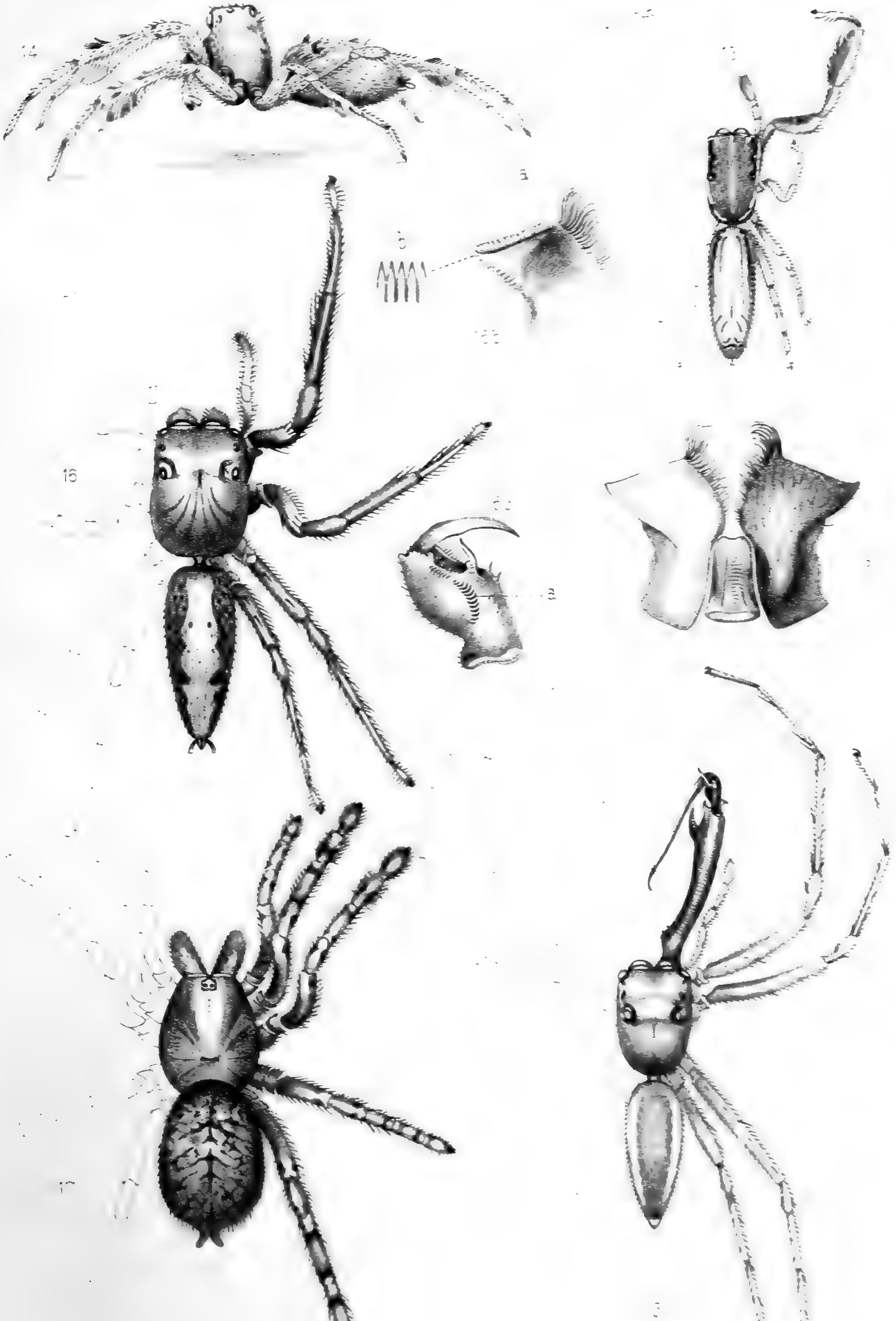
EXPLANATION OF PLATES X. AND XI.

FIG. 1. *Thelyphonus leucurus*, sp. n. ♀. Dorsal view.
1 *a*. " " " Under side of distal segments of tarsus of 1st leg of the right side.
2. *Abalius willeyi*, sp. n. Dorsal view of distal segments of tarsus of 1st leg of the right side.
3. *Conothele arboricola*, sp. n. ♀. Nat. size.
3 *a*. " " " Trap-door nest on bark of tree. Nat. size.

(The specimen from which the figure is drawn has no lid covering the aperture of the nest. On the assumption, however, that the lid was accidentally broken away or that the nest was incomplete at the time of discovery, I have ventured to have the structure represented as in fig. 3 *a*. Nevertheless the possibility that *Conothele* habitually leaves the orifice of her nest exposed must be borne in mind. R. I. P.).

4. *Ordgarius bicolor*, sp. n. ♀. × almost 4 times.
4 *a*. " " " Cluster of cocoons.
5. *Actinacantha aciculata*, sp. n. ♀. × 2.
6. *Fecenia angustata*, Thor. Spider on lower side of rolled leaf cut away to show the enclosed cocoon: natural size.
7. *Oxyopes papuanus*, with its cocoon in the bent stem of a mallow-like plant (? *Triumfetta*).
8. *Lycosa willeyi*, sp. n. Vulva.
9. *Ctenus rufisternus*, sp. n. Palpus of ♂ from below.
9 *a*. " " " Tibia and base of tarsus of palp to show tibial spur.
10. *Pandercetes plumosus*, sp. n. Vulva.
11. *Thelcticopis ochracea*, sp. n. Vulva.
12. *Sparassus actaeon*, sp. n. Vulva.
13. *Tarodes lineatus*, gen. et sp. n. ♀.
14. *Linus alticeps*, sp. n. ♀. Lateral view.
15. *Bathippus proboscideus*, sp. n. ♂. Dorsal view.
16. *Plexippus stridulator*, sp. n. ♂. Dorsal view.
16 *a*. " " " Maxillae and labium from below.
16 *b*. " " " Inner surface of left maxilla showing the *serrula* (*a*) extending along its distal margin and an enlargement of the teeth of the *serrula* (*b*).
16 *c*. " " " Lower side of right mandible showing the series of stridulatory ridges (*a*).
17. *Encyocrypta pictipes*, sp. n. ♀. × 3.

F. O. Pickard Cambridge del.



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POCOCK. ARACHNIDA

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