A note on Fregata

By ALEXANDER WETMORE

PLATE I

[*In a previous number of this publication* (*Bull. Raffles Mus., 8, 1933, p. 72*) *I made the following statement when writing about the Christmas Island Frigate-bird.—*

"*Gular pouch.*—I cannot fully understand Andrews' remark, "about the beginning of January the adult males begin to acquire the remarkable pouch of scarlet skin beneath the throat". Other authors have made similar remarks in relation to *Fregata*. It seems to me that the *adult male* of *F. andrewsi* always has a bright red gular pouch and no doubt this is only inflated in "display", but it has, I think, yet to be demonstrated that there is any seasonal variation in form".

I then had some correspondence with Dr. A. Wetmore of the Smithsonian Institution on the subject and the following are excerpts from his letters. F. N. CHASEN.]

While I am not familiar with this species I do know quite well the males of *F. magnificens* and *F. m. strumosa*. In these the gular pouch is large and brilliant red in colour, during the nesting season when it is displayed prominently. Males are attentive to the nest and undertake much of the work of incubation when the egg has been laid. As soon as this stage in the breeding is reached there is no longer display of the gular pouch which immediately begins to shrink in size and to change to a dull orange in colour. In a short time it can no longer be inflated to prominent size as I have demonstrated with a blow pipe on freshly killed individuals.

The sac, therefore, is purely a character of the breeding period and becomes atrophied later. In view of the close relationship among the frigate birds I would assume that *andrewsi* would have the same history though this is purely supposition on my part.

The photograph which is enclosed herewith is one that I made on Laysan Island in the Hawaiian Bird Reservation on May 2, 1923. The birds are *Fregata minor strumosa*, assuming that this race is valid. On the right is shown a bird with full development of the gular sac with this appendage fully inflated; at the left is another male that is past the display stage and in which the sac has begun to shrink. Both specimens I inflated carefully to the full capacity of the gular sac. This picture illustrates my point fully.

Ueber einige Xanthidae (Crustacea Dekapoda) von Singapore und Umgebung

Von HEINRICH BALSS, *München.*

TAFEL II, III

Der Direktor des Raffles Museum, Singapore, übersandte mir zur Bestimmung eine grössere Sammlung von Xanthiden. Der grösste Teil hiervon ist von dem Herrn Curator M. W. F. Tweedie gesammelt worden.

Neben vielen bekannten litoralen Formen des Indo-pacific, deren Aufzählung sich nicht lohnen würde, enthielt sie auch einige seltenere Arten, über die nachstehend einige Bemerkungen veröffentlicht werden sollen.

Überraschend war der Fund einer neuen Art, die ich vorläufig zur Gattung *Zalasius* Rathbun (besser bekannt unter dem præoccupierten Namen *Trichia* de Haan) stelle, obwohl vielleicht später, wenn noch verwandte Arten gefunden werden sollten, für sie ein besonderes Genus errichtet werden muss. Leider hat sie mir die nähere Verwandtschaft der Gattung, deren Stellung im System noch unsicher ist, nicht geklärt.

Auch von der nicht häufigen Gattung *Atergatopsis* A. Milne Edwards konnte eine neue Art beschrieben werden, die ich Herrn Tweedie zu Ehren benannt habe.

Zur Revision hatte ich auch einige der von Herrn Melbourne Ward beschriebenen Xanthiden von der Christmas Insel vor mir, deren Bestimmung meiner Ansicht nach öfters geändert werden mus.

Mit Vergleichsmaterial haben mich Herr Prof. Benick (Lübeck), Herr Prof. Dr. Boschma (Leyden) und Miss Dr. I. Gordon (London) unterstützt, denen ich meinen herzlichsten Dank sage.

FAMILIE PARTHENOPIDÆ(?).

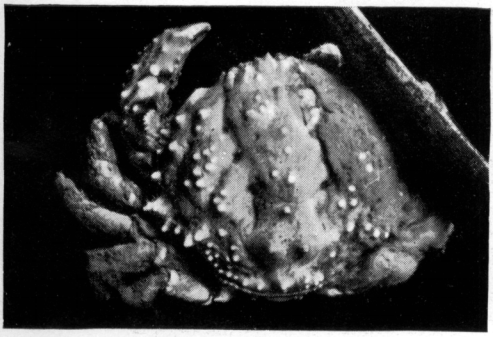
Gattung **Zalasius** Rathbun

Trichia de Haan, Balss 1922 pg. 100.
Zalasius McNeill und Ward 1930 pg. 374 (Lit.).

Zalasius sakai[1] n.sp. Taf. II, Fig. 1, 2.

Fundangabe:—I ♀ ohne Eier, Cl 28·5 mm., Cb 30 mm.: Ohne genaueren Fundort.

1. Benannt zu Ehren von Herrn Dr. T. Sakai (Simoda, Japan), dem Verfasser schöner Arbeiten über die Dekapoden Japans.



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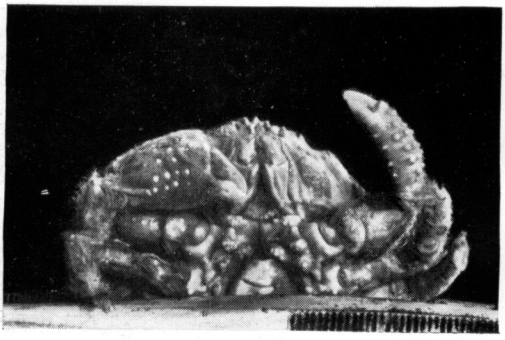

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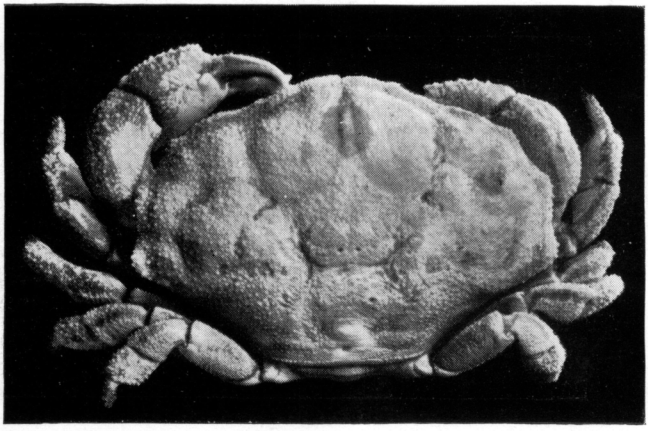

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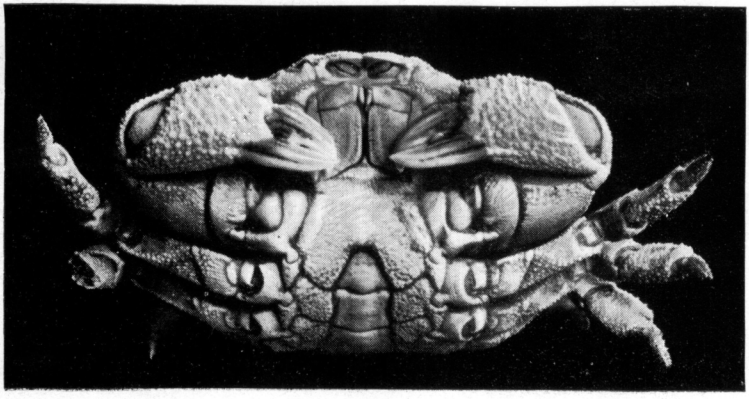

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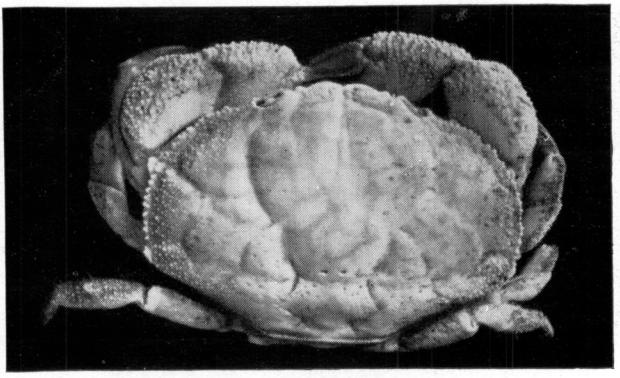
Malayan Xanthidae.



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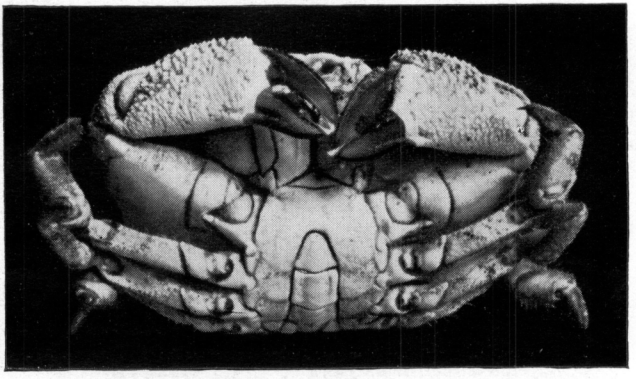

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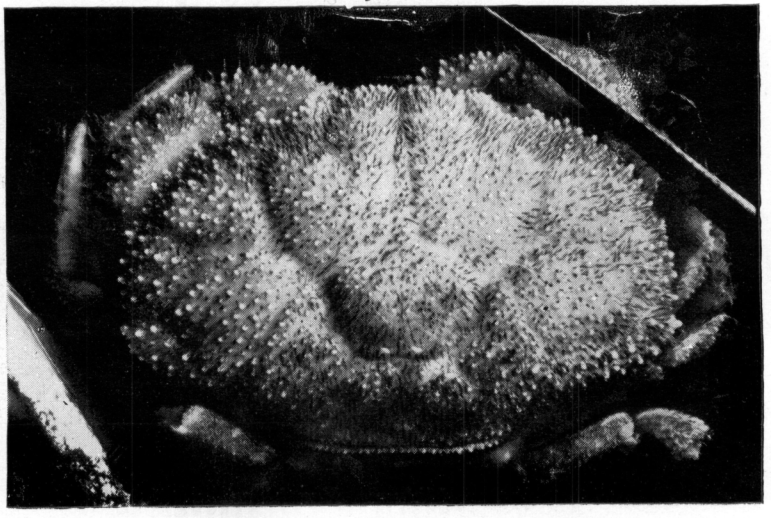
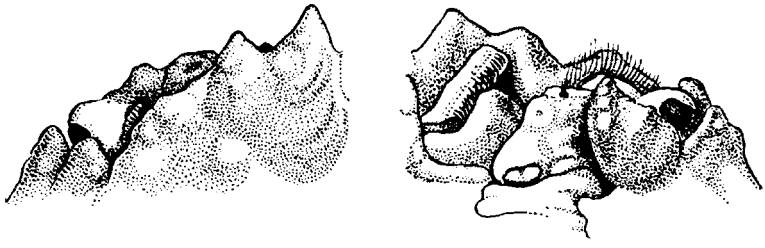


3

Malayan Xanthidae.



a. b.

Fig. 1. *Zalasius sakai* sp.n.

Beschreibung:—Der Carapax ist von ziemlich gerundeter Form und stark gewölbt, sowohl in der Richtung von vorne nach hinten, wie nach den beiden Seiten hin. Er sowohl wie die Scherenfüsse, Sternum und Abdomen sind mit einem dichten Haarfilz bedeckt, welcher die Oberflächenskulptur vollkommen verbirgt (auf dem abgebildeten Exemplare ist er auf der einen Seite entfernt worden). Nach seiner Wegnahme sieht man die Furchen auf der Oberfläche deutlich; es werden von ihnen folgende Felder begrenzt (Bezeichnungen nach der Abbildung 1 in Rathbun 1925 pg. 2): Das Meso + Metagastricalfeld, das Protogastricalfeld, das Urogastrikal– + Cardiacal– + Intestinalfeld, das Hepatikalfeld, das Epi– und das Mesobranchialfeld, welch letzteres von dem Metabranchialfelde nicht abgesetzt ist. Sämtliche Felder sind mit kleinen Tuberkeln bewehrt, und zwar tragen das Mesogastrikalfeld deren 3 hintereinander in der Mediane, das Protogastricalfeld 3, in einem Dreieck stehende; auf der Hepatikalregion stehen 4 (in 2 Reihen hintereinander aufgereiht), auf der Epibranchialregion ca. 8, und auf der Mesobranchialregion 3 Tuberkel.

Am Carapaxseitenrand ist an der Hepatikalregion ein stumpfer Vorsprung zu bemerken; auf diesen folgen zuerst 5 kleinere Tuberkel, hierauf ein grösserer, dem wieder 4 kleinere sich anreihen, welche sich auf die Oberfläche des Carapax hin fortsetzen. Die Metabranchialfläche ist dann wieder mit einem Haufen von kleineren Tuberkeln besetzt, die oberhalb des Hinterrandes eine Reihe bilden.

Die Stirn (Fig. 1) besteht aus vier Zähnchen; die beiden mittleren springen stärker vor und verbinden sich nach unten mit dem Interorbitalseptum; die beiden äusseren entsenden nach unten einen Fortsatz, gegen welchen sich das basale (= zweite) Glied der Antennenstiele mit seinem Innenrande breit anlegt. In die zwei Lücken zwischen den inneren und äusseren Stirnzähnen legen sich die Antennulæ ein.

Die Augenhöhlen sind vollständig geschlossen; sie werden gebildet von dem Lobus superciliaris (= Augendach der Oxyrhyncha), dem Lobus accessorius, dem Lobus externus und dem Lobus internus, sowie dem basalen Gliede des Antennenstieles. (Bezeichnungen nach Ortmann in Bronn 1902 pg. 839). Tiefe Furchen trennen die einzelnen Loben voneinander.

Die Antennulæ liegen längsgestreckt, die Antennengeisseln sind nur kurz.

Die dritten Maxillarfüsse haben ganz die Form derer von *Zalasius dromiaeformis* (de Haan) (vergl. de Haans' Abbildung Tafel H).

Die Pterygostomialregion ist durch eine vordere Querfurche in ein kleineres vorderes und ein grösseres hinteres Stück zweigeteilt; das kleinere Stück und die vordere Hälfte des hinteren Stückes sind mit kleinen Tuberken besetzt, wie sie sich auch auf dem Exopodit des Mxp. 3 finden.

Das Sternum ist durch die in Häufchen stehenden Tuberkeln charakterisiert, welche den Coxen der Pereiopoden gegenüberstehen. Das vorderste Glied (zwischen den Mxp. 3) ist durch eine quere Tuberkelreihe von dem übrigen Teile abgesetzt. Die Episterna sind (wie bei *Z. dromiaeformis*) deutlich.

Die Scherenfüsse entsprechen in ihrer Form denen von *Z. dromiaeformis;* die Carpi tragen etwa sieben Tuberkel, die Palma hat auf der unteren Hälfte der äusseren Fläche etwa siebzehn Tuberkel, die zwar nicht genau, aber doch annähernd in drei oder vier Längsreihen stehen. Die obere Hälfte hat etwa vier grössere Tuberkel und auch die (sonst glatte) Innenfläche trägt neben der Carpusartikulation etwa acht kleinere Tuberkel. Die Finger sind stumpf und glatt; der bewegliche hat am Innenrande zwei Tuberkelchen.

Die Schreitfüsse entsprechen in ihrer Form denen von *Z. dromiaeformis,* d.h. die Meri, Carpi und Propodi sind breit, während die Dactyli sehr lang und schmal und etwas nach vorne gebogen sind.

Verwandschaft:—Durch die Form der Stirn, der Maxillarfüsse, des Sternums u.s.w. erweist sich die neue Art als unzweifelhaft in die Verwandschaft von *Zalasius* gehörig; man könnte für sie, wegen der aberranten Gestalt des Carapax, eine neue Gattung begründen; doch tue ich dies vorläufig noch nicht, um nicht die Gattungsnamen unnötig zu vermehren.

Die Stellung von *Zalasius* im Systeme wird leider durch die neue Art nicht klarer. Die geschlossenen Augenhöhlen weisen ja auf eine höhere Stellung unter den Krabben hin, aber die Form der Stirn und der Mxp. 3 ist eine von allen anderen

Gruppen abweichende. Von McNeil und Ward wurde sie in die Nähe der Parthenopidæ gestellt, von denen sie allerdings durch die vierzähnige Stirn stark abweicht. Immerhin vermute ich, wegen des Übergreifens der Seitenzähne des Carapax auf dessen obere Fläche, ebenfalls eine Verwandschaft mit den Oxyrhynchen.

Jedenfalls ist die Gattung sehr aberrant. Leider ist es mir auch durch Studien an Abbildungen *fossiler* Formen nicht gelungen, ihre Stellung näher zu fixieren.

FAMILIE XANTHIDÆ.

Section HYPEROLISSA Alcock.

Xantho reynaudii H. Milne Edwards var. **cultripes** Alcock.

Xantho scaberrimus var. *cultripes* Alcock 1898 pg. 117.
Demania splendida Laurie 1906 pg. 397 Taf. II Fig. 1.
Xantho reynaudi Odhner 1925 pg. 81.

Fundangaben:—1 ♂ (Cl 60 mm., Cb 80 mm.) Singapore, Fischmarkt. 1 ♂ (Cl 46 mm., Cb 59 mm.) Philippinen, Mus. München.

Bemerkungen:—Alcock hat diese Form als Varietät von *X. scaberrimus* Walker (= *X. reynaudi* H.M.E.) aufgefasst. Ihre Unterschiede von der Forma typica sind allerdings, besonders in der Bewehrung der Pereiopoden, so bedeutend, dass man sie auch als gute Art betrachten könnte. Immerhin ist es auffallend, dass bisher nur wenige und nur sehr grosse Exemplare gefunden worden sind. Falls junge Tiere sich durch dieselben Merkamle unterscheiden sollten, so müsste die Form als besondere Art angesehen werden.

Laurie's *Demania splendida* ist zweifellos identisch mit dieser Form.

(Exemplare der forma typica liegen mir von Siam und Hongkong vor, Mus. München).

Geographische Verbreitung:—Alcock's Exemplar stammte ebenfalls von Singapore; das Laurie's von Ceylon, Trinkomalee.

Xantho reynaudii H.M.E. var. **baccalipes** Alcock.

Xantho scaberrimus var. *baccalipes* Alcock 1898 pg. 117.

Fundangabe:—1 ♂ (Cl 48 mm., Cb 63 mm.), Pulau Angsa, Malaccastrasse.

Geographische Verbreitung:—Diese var. ist bisher nur von Ceylon bekannt.

Xantho (Leptodius) gracilis (Dana).

Leptodius gracilis de Man 1888 pg. 287 Taf. XI Fig. 2.
„ „ Rathbun 1906 pg. 848 Taf. IX Fig. 2.
„ „ Bouvier 1915 pg. 106 Text-fig. 32.
Leptodius planus Ward 1934 pg. 24 Taf. III Fig. 6.

Fundangabe:—1 ♂ 1 ♀ Christmas Island (Paratypen von Ward's Art, die zeigen, dass es sich um diese altbekannte, allerdings seltenere Art des Indopacific handelt).

Geographische Verbreitung:—Von der Ostküste Africas bis Hawai und Polynesien.

Lachnopodus subacutus (Stimpson).

Lachnopodus subacutus (Stimpson) in: Balss 1934 pg. 509 (das. Synonymie).

Lioxantho laevidorsalis und *L. subacutus* Ward 1934 pg. 12, 13, Taf. II, Fig. 1, 2.

Fundangaben:—1 ♂ (Cb 15 mm.) und 1 ♀ (Cb 12 mm.) (Paratypen der beiden von Ward bestimmten Exemplare).

Bemerkungen:—Zum Vergleich lag mir ein von Odhner bestimmtes Exemplar von Ralum, Neu Pommern, vor. Die von Ward als Artunterschiede aufgefassten Merkmale sind meines Erachtens solche der Grösse; es handelt sich nur um eine einzige, stark variabele Art. Schon Odhner hat ja festgestellt, dass *Xantho bidentatus* A.M.E. (= *X. laevidorsalis* Miers) mit der Stimpson' schen Art identisch ist.

Xantho demani Odhner ist eine andere Art, die mir von Flores vorliegt.

Die Gattung *Lioxantho* Alcock ist von Odhner (1925 pg. 84) überhaupt aufgelöst worden; er hat ihre Arten zu *Xanthias* gestellt. *L. tumidus* Alcock, welche Form Ward als Typus der Gattung designieren wollte, ist aber identisch mit unserer Art.

Geographische Verbreitung.—Vom Roten Meer und Madagaskar bis Hawai und Tahiti. Von der Christmas Insel schon durch Calman (1909) gemeldet.

Gattung **Parapanope** de Man

Balss 1935 pg. (Lit.).

Die Gattung gehört in die Nähe von *Cycloxanthops,* wie Alcock (sub *Hoploxanthus*) richtig sah.

Parapanope euagora de Man.

Balss 1935 pg. 134.

Fundangabe:—1 ♀ mit Eiern (Cl 10·6 mm., Cb 16·0 mm.) "7 miles west of Sultan Shoal, near Singapore," 30–40 m. Tiefe.

Geographische Verbreitung:—Ostküste Vorderindiens, Nicobaren, Malacca, Java See, China.

Parapanope cultripes (Alcock).

Hoploxanthus cultripes Alcock 1898 pg. 126.

Fundangabe:—3 ♂ 3 ♀ mit Eiern, Penangstrasse, 4–8 m. Tiefe.

Bemerkungen:—Diese Art ist seit ihrer Erstbeschreibung nicht mehr angefunden worden. Sie unterscheidet sich von *P. euagora* durch die geringere Granulierung des Carapax und die glatteren Scheren. Bei dem grössten ♂ (Cl 11·5 mm., Cb 17 mm.) hat die eine (allein erhaltene) Schere eine Crista am Oberrande mit 3 stumpfen Zähnen, während die anderen Cristen des Aussenrandes nur als stumpfe Leisten hervortreten. Die Form des Carapax ist bei beiden Arten dieselbe, aber bei unserer Art fehlen die starken Granulationen von *euagora*, sodass sie viel glatter erscheint; auch fehlen z·B. die Granulationen oberhalb des Posterolateralrandes.

Die ♂ und ♀ unterscheiden sich (wie bei *euagora*) dadurch, dass der letzte Epibranchialzahn beim ♀ stark seitlich verlängert ist, beim ♂ nicht.

Bemerkenswert ist die frühe Geschlechtsreife der ♀ ; solche mit Eiern am Abdomen liegen bereits mit Cl 6 mm., 9·8 mm. vor.

Geographische Verbreitung:—War bisher nur von Karachi bekannt.

Platypodia cristata (A.M.E.).

Lophactaea cristata Alcock 1898 pg. 100 (ältere Lit.).
Platypodia cristata Balss 1924 pg. 6 (neuere Lit.).

Fundangabe:—1 ♀ ohne Eier, Cl 15·5 mm., Cb 23 mm., Sultan Shoal, near Singapore.

Bemerkungen:—Die Granulationen des Carapax sind bei unserem Exemplare feiner, als bei solchen von Madagaskar, Tamatave, (Mus. München).

Geographische Verbreitung:—Ostküste Afrikas und Rotes Meer bis Java und Cochin China.

Actæa subglobosa Stimpson.

Odhner 1925 pg. 75 Taf. IV Fig. 19.
Sakai 1935 pg. 161, Text-fig. 78, Taf. 48 Fig. 3 (Lit.).

Fundangabe:—1 ♀ (Cl 20 mm·, Cb 26 mm.) bei Singapore Island. (Verglichen mit Exemplaren des Münchener Museums).

Geographische Verbreitung:—Die Form war bisher nur von Japan (Nagasaki und Kataura, Provinz Satsuma) und Hongkong bekannt.

Actæa depressa White.

Actaea depressa und *A. scabra* Odhner 1925 pg. 38, 39 Taf. 11 Fig. 18, 19.

Balss 1935 pg. 136.

Fundangabe:—1 ♂ (Cl 21 mm., Cb 30·5 mm.), 1 ♂ (Cl 30 mm., Cb 44 m.), Horsburgh Lighthouse, South China Sea.

Bemerkungen:—Die von mir (l.c.) ausgesprochene Vermutung, dass die Odhner' sche *A. scabra* nur die adulte Form von *depressa* darstellt, wird mir durch diese beiden grossen männlichen Exemplare zur Gewissheit; denn dass die Granula in der Jugend spitz, im Alter gerundeter sind und dass die hinteren Seitenränder in der Jugend steiler aufsteigen als im Alter, sind durch das Wachstum leicht erklärbare Unterschiede.

Geographische Verbreitung:—Von Natal bis zu den Bonin Inseln und Queensland.

Actæa amoyensis (de Man).

Odhner 1925 pg. 42 Taf. 111 Fig 3.

Fundangabe:—1 ♂ (Cl 20·5 mm., Cb 29·5 mm.) 4° 0′ N.B., 99° 52′ O.L., 80 m. Tiefe, von Kabel. 1 ♀ ohne Eier (Cl 20 mm., Cb 28·3 mm.), 1° 25′ 3″ N.B., 102° 58′ O.L. von Kabel.

Geographische Verbreitung:—Bombay, Malaccastrasse, Singapore, Amoy, Formosastrasse (51 m. Tiefe).

Actæa alcocki Laurie Taf. II Fig. 3, 4.

Laurie 1906 pg. 403, Text-fig. 5.

Odhner 1925 pg. 43, Taf. 3 Fig. 4.

Fundangaben:—1 ♂ (Cl 38 mm., Cb 55 mm.), 1 ♀ mit Eiern (Cl 41 mm. Cb 57 mm.), 4° 0′ N.B., 99° 52′ O.L., 80 m. Tiefe, von Kabel. 1 ♀ ohne Eier (Cl 24 mm., Cb 35·5 mm.), 3° 48′ 10″ N.B., 100° 14′ 50″ O.L., 86 m. Tiefe, von Kabel.

Bemerkungen:—Unsere Tiere, die bedeutend grösser als der Typus (Cl 16·5 mm., Cb 25 mm.) sind, haben einen von Haaren völlig freien Carapax. Der rote Fleck auf der Gastrikalregion ist bei einigen Exemplaren erhalten. Sehr charakteristisch sind die Scheren (vergl. Abbildung). Die Oberränder der Schreitfüsse sind mit kleinen Dornen versehen.

Verwandtschaft:—Die Art bildet einen Übergang von *Actea* zu *Atergatopsis*. Nach dem Schlüssel von A. Milne Edwards (1865 pg. 212) müsste man sie zu *Atergatopsis* stellen, da die Furchen der Carapaxoberfläche wenig ausgeprägt sind. Die Scherenfinger mit dem starken Mittelzahne und der starken äusseren Riefung erinnern an die von *Atergatopsis granulatus*. Andererseits ist aber die längliche Form des Carapax mehr für die *Actaea*-arten (wie *A. amoyensis* und *A. obesa*) charakteristisch, neben die Odhner unsere Art gestellt hat.

Geographische Verbreitung:—Zum ersten Male wiedergefunden. Der Typus stammte von Ceylon, Golf von Manaar. Die Form scheint das Sublitoral zu bevorzugen.

Atergatopsis tweediei n.sp. Taf. III, Fig. 1, 2.

Atergatopsis granulatus Miers 1884 pg. 529 (partim).

Fundangaben:—1 ♂ (Cl 35 mm., Cb 49 mm.), 1 ♂ (Cl 30 mm., Cb 42 mm.) und 1 ♂ juv. 4° 26′ 42″ N.B., 112° 16′ 55″ O.L., 90 m. Tiefe, von Kabel. 1 ♀ ohne Eier (Cl 40 mm., Cb 57 mm.) 5° 36′ 40″ S.B., 112° 05′ 30″ O.L., 70–80 m. Tiefe, von Kabel, 22.1.1933.

Beschreibung:—Diese Art, welche schon Miers (l.c. Exemplare des "Samarang") vorgelegen hat, muss ich nach einem Vergleich mit dem von mir (1935 pg. 137) als *granulatus* A.M.E. bestimmten Exemplare des British Museum von der Macclesfieldbank, das mir wieder vorliegt (Taf. III Fig. 3), als neu bezeichnen.

Wie schon Miers bemerkt, ist die Carapaxoberfläche nur an den Randflächen granuliert, sonst aber vollkommen glatt, sodass die Felderung sehr deutlich ist. So ist 3 M gut abgegrenzt, 1 M aber mit 2 M verschmolzen und dieses nicht in der Mitte zweigeteilt. 1 L, 2 L und 3 L sind wieder verschmolzen, 4 L, 5 L, 6 L und 1 R sind deutlich, wenn auch die hinteren Begrenzungen von 5 L und 6 L sowie von 1 R fehlen. Die Granula auf den Seitenrändern sind klein; auch fehlt dem Carapax jede Behaarung (die bei *A. granulatus* sehr ausgesprochen ist).

Die Stirn springt in der Mitte amorbogenförmig vor, an den Seiten befindet sich eine stumpfe Ecke und eine Kerbe, die sie vom Supraorbitalrande abgrenzt. An diesem, der ebenfalls granuliert ist, sind zwei Furchen deutlich; hinter dem (kaum vorspringenden) Exorbitalzahne folgt wieder eine Furche und der Infraorbitalzahn ist gerundet.

An dem scharfen Seitenrande ist nur der Posterolateralzahn ausgeprägt.

Auch die untere Fläche des Carapax, die Mxp. 3 und das Sternum sind fein granuliert.

Die Scherenfüsse entsprechen denen von *A. granulatus* insofern, als der starke, reisszahnähnliche Zahn auf dem Index vorhanden ist. Während aber bei *A. granulatus* die Finger hell sind, sind sie bei *A. tweediei* sehr dunkel, fast schwarz und entsprechen so mehr denen von *A. lucasi.* Carpus und Palma tragen sehr starke Granula, sind aber unbehaart (Unterschied von *granulatus*). An der Palma ist nahe dem gerundeten Oberrande eine nicht sehr deutlich ausgesprochene Längsfurche

vorhanden; der Pollex ist aussen gerieft und trägt am scharfen Oberrande proximal einige kleine Granula; auch der Index ist gerieft.

Die Schreitfüsse sind granuliert und ganz wenig behaart, ähneln aber im übrigen denen von *A. granulatus*.

Verwandschaft:—Wegen des starken Reisszahnes ist die Form dem *A. granulatus* am nächsten verwandt, unterscheidet sich aber von diesem durch die glatte, unbehaarte Carapaxoberfläche.

Bemerkt sei, dass *Actaea inskipiensis* Rathbun (1923, "Endeavour") vielleicht ein juv. von *Atergatopsis granulatus* darstellt.

Chlorodopsis pilumnoides White.

Chlorodopsis pilumnoides Alcock 1898 pg. 167 (Altere Lit.).
Chlorodopsis palaoensis Sakai 1936 pg. 167, Taf. 13 Fig. 2, Taf. 14 Fig. 1.

Fundangabe:—1 ♂ (Cl 40, Cb 60 mm.) Sultan Shoal, near Singapore, XII 1933.

Bemerkungen:—Dieses Exemplar ist das grösste bisher bekannte der Art. Zum Unterschiede von jüngeren Tieren ist die untere Hälfte der Aussenfläche der Palma ziemlich glatt (statt fein granuliert zu sein).

Sakai's Art ist unzweifelhaft mit dieser Form identisch.

Geographische Verbreitung:—Von Ceylon über den Malayischen Archipel bis zu den Riu Kiu Inseln und Samoa.

Pilodius harmsi Balss.

Mit dieser von mir (Zoolog. Anzeiger Bd. 106 pg. 228, 1934/5) beschriebenen Art ist *Chlorodopsis natalensis* Ward (1934/12) identisch; mein Name hat die Priorität.

Section HYPEROMERISTA Alcock.

Pilumnus scabriusculus Adams und White.

BALSS 1933 pg. 24 (Lit.).

Fundangabe:—1 ♂, Sultan Shoal, near Singapore (Cl 35 mm., Cb 45 mm.).

Geographische Verbreitung:—Von der Ostküste Afrikas bis Samoa.

Pilumnus sinensis Gordon.

BALSS 1933 pg. 22 Taf IV Fig. 20, 21.

Fundangabe:—1 ♂, 1 ♀, 4° 40′ N.B., 104° 16′ O.L., Dredge 60–70 m.

Geographische Verbreitung:—Bisher bekannt von den Lakkadiven, Andamanen, Golf von Siam and Hongkong.

Pilumnus barbatus A. Milne Edwards.

Pilumnus barbatus A. Milne Edwards 1873 pg. 243, Taf. IX, Fig. 7.
Pilumnus heterodon Sakai 1934 pg. 307, Fig. 19.
„ „ „ 1935 pg. 117, Fig. 88.

Fundangabe:—1 ♀ juv. (Cl 4·5 mm., Cb 6·1 mm.); 1 ♂ (Cl 6 mm., Cb 9 mm.), 1 ♀ (Cl 6·5 mm., Cb 9·3 mm.), 1 ♀ mit Eiern (Cl 7 mm., Cb 11 mm.), Sultan Shoal, near Singapore.

Bemerkungen:—Diese charakteristische kleine Art scheint sehr selten zu sein.

Bei unseren Tieren hat das juv. genau die Gestalt, wie sie die Abbildungen von A. Milne Edwards und Sakai wiedergeben; dagegen ist bei den älteren Tieren auch der dritte Seitenrandstachel nicht spitz, sondern stumpf und von derselben Form, wie der zweite (hepatikale). Der letzte Seitenrandstachel aber ist auch bei diesen klein und spitz.

Die Spitzen sämtlicher Stacheln auf den Scherenfüssen, sowie auch auf den Carpi der Schreitfüsse sind dunkelbräunlich; auf den Schreitfüssen sind diese Stachelchen sehr klein und zwischen den Haaren versteckt, sodass sie den bisherigen Beschreibern entgangen sind.

Die beiden Stirnlappen springen bei den grösseren Tieren sehr stark nach vorne vor und sind "amorbogenartig" geschweift.

Von den beiden Scherenfüssen trägt der grössere die Stacheln (in Reihen angeordnet) nur auf den oberen zwei Dritteln seiner Aussenfläche, während bei dem kleineren Fusse auch das untere Drittel mit ihnen bewehrt ist. Die Finger sind relativ kurz und schliessen fest; sie tragen auf den Schneiden ca. fünf scharfe Zähnchen, zwischen denen Rillen entspringen, die sich auf die Aussenfläche fortsetzen.

Synonymie:—Sakai's *P. heterodon* ist zweifelsohne mit der Milne Edwards' schen Art identisch, wie aus den Abbildungen hervorgeht.

Verwandtschaft:—Die Form ist durch die stumpfen Seitenrandstacheln sehr aberrant in der Gattung; doch mag sie vorläufig weiter bei *Pilumnus* aufgeführt werden.

Geographische Verbreitung:—Bisher nur bekannt von Neu Caledonien und Nagasaki.

Heteropanope glabra Stimpson.

Balss 1933 pg. 32 (Lit. und Synonymie).
Yokoya 1933 pg. 184.

Fundangaben:—Viele Exemplare von Kuantan, Pahang (Grösstes Exemplar: Cl 11 mm., Cb 15 mm.); Port Swettenham, Selangor; Johore Straits, Singapore.

Fig. 2. *Heteropanope glabra* Stimpson.

Bemerkungen:—Ich gebe zum besseren Erkennen der Art ein Bild der Seitenrandzähne (Fig. 2).

Geographische Verbreitung:—Von der Ostküste Afrikas an östlich über den Mergui Archipel, Singapore, Hongkong bis Japan (126 m. Tiefe, Koti), Malayischer Archipel, Queensland, Merauke.

Eurycarcinus integrifrons de Man.

DE MAN, 1879 pg. 55.
NOBILI 1906 pg. 290, Taf. XI Fig. 2 (Synonymie).

Fundangaben:—Port Swettenham, Selangor (in demselben Glase wie *Heteropanope glabra*).

Bemerkungen:—Ich hatte zum Vergleich zwei Cotypen vor mir, für deren Zusendung ich Herrn Prof. Dr. Boschma, Leyden, danke. Unsere Exemplare sind kleiner (Cl ca 10·2 mm., Cb 12·7 mm.) als diese Cotypen und unterscheiden sich von ihnen durch folgende Merkmale:—

1. Die beiden letzten "Zähne" des Vorderseitenrandes sind nicht dornförmig, sondern einfache Einkerbungen in den Seitenrand, sodass sie den "Zähnen" 1 und 2 ähneln. Es ist dies ein Jugendmerkmal, da auch bei dem kleineren Cotyp (Cl 14 mm., Cb 19 mm.) diese Zähne noch nicht so stark hervortreten, und erst bei dem erwachsenen Tiere 7 Cl 17 mm., Cb 22 mm.) deutlich sind.

2. Die Finger der Scherenfüsse, die bei den Cotypen hell sind, sind bei unseren Exemplaren von brauner Färbung; auch sind sie im Verhältnis kürzer als bei den Cotypen.

Verwandtschaft:—Die Form steht der *Heteropanope glabra* äusserst nahe und unterscheidet sich von ihr durch folgende Eigentümlichkeiten:—

1. Der Körper ist (in Alkohol) einfarbig hellgelb und ermangelt der für *glabra* so charakteristischen Flecken (*"Eurycarcinus maculatus"* A.M. Edw.).

2. Bei der grossen Schere ist der starke Zahn an der Basis des festen Fingers, der für *H. glabra* so bezeichnend ist, zwar ebenfalls angedeutet, aber bei weitem nicht so stark entwickelt.

3. Die Zähnelung des Carapaxseitenrandes ist nicht so stark durchgeführt. Man kann eigentlich nur von Einkerbungen in den Seitenrand sprechen.

Geographische Verbreitung:—Rotes Meer, Aden (Nobili); Bombay; Karachi; Andamanen.

Pilumnopeus eucratoides (Stimpson).

Heteropanope eucratoides Stimpson (1858) 1907 pg. 64, Taf. VIII Fig. 2, 2*a*.
Heteropanope eucratoides de Man 1888 pg. 56, Taf. III, Fig. 3, 4.
Pilumnopeus eucratoides Balss 1933 pg. 33 (nur Name).

Fundangaben:—3 ♂ (grösstes Cl 8·5 mm., Cb 11 mm., gemessen an den Anterolateralstacheln); 1 ♀ mit Eiern (Cl 6·5 mm., Cb 8·4 mm.) Singapore Island; 1 ♂ (Cl 10·5 mm., Cb 13·6 mm.), 2 ♀ ohne Eier Serangoon, Singapore; 7 ♂, 1 ♀ mit Eiern (Cl 5·8 mm.) Siglap, Singapore.

Bemerkungen:—Mit den Beschreibungen gut übereinstimmend. Die Scherenfinger sind stärker nach abwärts gebogen, als in Stimpson's Abbildung (l.c.; auf der Tafel ist die Figur fälschlich mit 1a bezeichnet, während die Erklärung pg. 237 richtig 2a angibt).

Geographische Verbreitung:—Bisher nur Hongkong und dem Mergui Archipel angegeben.

Gattung **Planopilumnus** Balss

Planopilumnus Balss 1933 (VI) pg. 39.
Rathbunaria Ward 1933 (VIII) pg. 386.

Planopilumnus spongiosus orientalis Balss.

P. s. orientalis Balss 1933 (VI) pg. 40, Taf. V Fig 26, Taf. VI Fig. 27, 28.
Rathbunaria sculptissima Ward 1933 (VIII) pg. 387, Taf. 23, Fig. 5, 6.

Fundangabe:—1 ♀, Pulau Ubin, bei Singapore.

Bemerkungen:—Ward's Genus und Species fällt in die Synonymie dieser von mir zwei Monate vor Ward's Publikation aufgestellten Art.

Geographische Verbreitung:—Bisher bekannt von Thursday Island (Torresstrasse), Collingrove (Ostaustralien), Cap York und Palau.

Planopilumnus penicillatus (Gordon).

Pilumnus penicillatus Gordon (1930) 1931 pg. 542, Fig. 18.

Fundangabe:—1 ♂ (Cl 5 mm, Cb 6·7 mm.) bei Pulau Pawai, near Singapore, dredged 20–30 m.

Bemerkungen:—Diese, an ihrer charakteristischen Behaarung leicht kenntliche Art steht wohl dem *Planopilumnus labyrinthicus* (Miers) am nächsten, weshalb ich sie zu meiner Gattung *Planopilumnus* stelle.

Geographische Verbreitung:—Bisher nur von Hongkong bekannt.

Gattung **Parapilumnus** Kossmann (Balss emend.)

Parapilumnus Kossmann 1877 pg. 38.

Parapilumnus Balss 1933 pg. 38.

Ich habe l.c. übersehen, dass die Gattung, resp. Untergattung nicht von de Man, sondern bereits von Kossmann aufgestellt worden ist, der sie allerdings auf ein meiner Ansicht nach unzureichendes Merkmal (den Mangel von Furchen an den Augenhöhlen) gründet und so zur Zusammenfassung von nicht miteinander verwandten Arten gelangt. Ich möchte sie daher in der von mir l.c. aufgestellten Form aufrecht erhalten.

Parapilumnus quadridentatus de Man.

Parapilumnus quadridentatus de Man 1895 pg. 537, (1897 Taf. 13 Fig. 6.
„ „ Nobili 1906 pg. 278.
„ „ Kemp 1918 pg. 249, Fig. 6.

Fundangabe:—7 ♂, 5 ♀ (davon zwei kleine mit Eiern), Seletar, bei Singapore, III. 1933.

Bemerkungen:—Ich habe mit Cotypen des Museums Lübeck verglichen.

Die Form steht unzweifelhaft der *Heteropanope indica* de Man (1887 pg. 53, Tafel 3 Fig. 1, 2), die ich allerdings noch nicht gesehen habe, nahe. Sie unterscheidet sich von ihr durch den ungefurchten Augenhöhlenrand, den Mangel an deutlichen Querfurchen auf dem Carapax, sowie eine anders gebaute Stirn.

Geographische Verbreitung:—Pontianak, Borneo (de Man); Tale Sap (Ostküste Siams, Kemp); Rotes Meer (Nobili).

Glabropilumnus lævimanus (Dana).

Pilumnus laevimanus Balss 1933 pg. 31 (Lit.).

Fundangaben:—Viele Exemplare von Sultan Shoal, Pulau Senang, Pulau Pawai, Inseln bei Singapore; Pulau Pisang, Malaccastrasses; Horsburgh Lighthouse, South China Sea.

Bemerkungen:—Ich stelle diese Form (die ich l.c. bei den aberranten Arten von *Pilumnus* aufzählte) jetzt zu der von mir aufgestellten Gattung *Glabropilumnus* (1933 pg. 39) wegen der Bildung ihrer Stirn.

Die kleine Art ist sehr variabel; bei den Exemplaren von Sultan Shoal z.B. ist der Carapax glatt, weisslich, wähend er bei denen von Horsburgh Lighthouse stark behaart ist; ebensolche Unterschiede betreffen auch die Behaarung der beiden Scheren; immerhin ist bei der grösseren Schere immer ein Teil glatt und unbehaart.

Geographische Verbreitung:—Von der Ostküste Afrikas bis China und Japan sowie Malayischer Archipel.

ANMERKUNG: Inzwischen erhielt ich durch die Freundlichkeit von Miss Dr. Gordon, London, die Typen einiger weiterer Formen zugesandt, die Ward 1934 von der Christmas Insel beschrieben hat. Es zeigte sich, dass *Paraxanthias haematostictus* Ward (pg. 20) identisch ist mit der von mir mit ? zu *P. ponapensis* Rathbun gestellten Form (Balss 1935 pg. 135). *Medaeus noelensis* Ward (pg. 17) ist ein typischer *M. granulosus* Haswell. *Tweedieia noelensis* Ward (pg. 22) erwies sich als gleich mit *Phymodius odhneri* Gordon 1934. *Pseudoliomera natalensis* Ward (pg. 11) ist als gute Art aufrecht zu erhalten; ich verglich sie mit *Ps. granosimana* aus dem Roten Meere.

München, Dezember 1937.

ERKLARUNG DER TAFEL II.

Abb. 1, 2. *Zalasius sakai* sp.n.
Abb. 3, 4. *Actaea alcocki* Laurie.

ERKLARUNG DER TAFEL III.

Abb. 1, 2. *Atergatopsis tweediei* sp.n.
Abb. 3. *Atergatopsis granulatus* A.M.-E.

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Leeches (Hirudinea) principally from the Malay Peninsula, with descriptions of new species

By J. PERCY MOORE

PLATES IV, V.

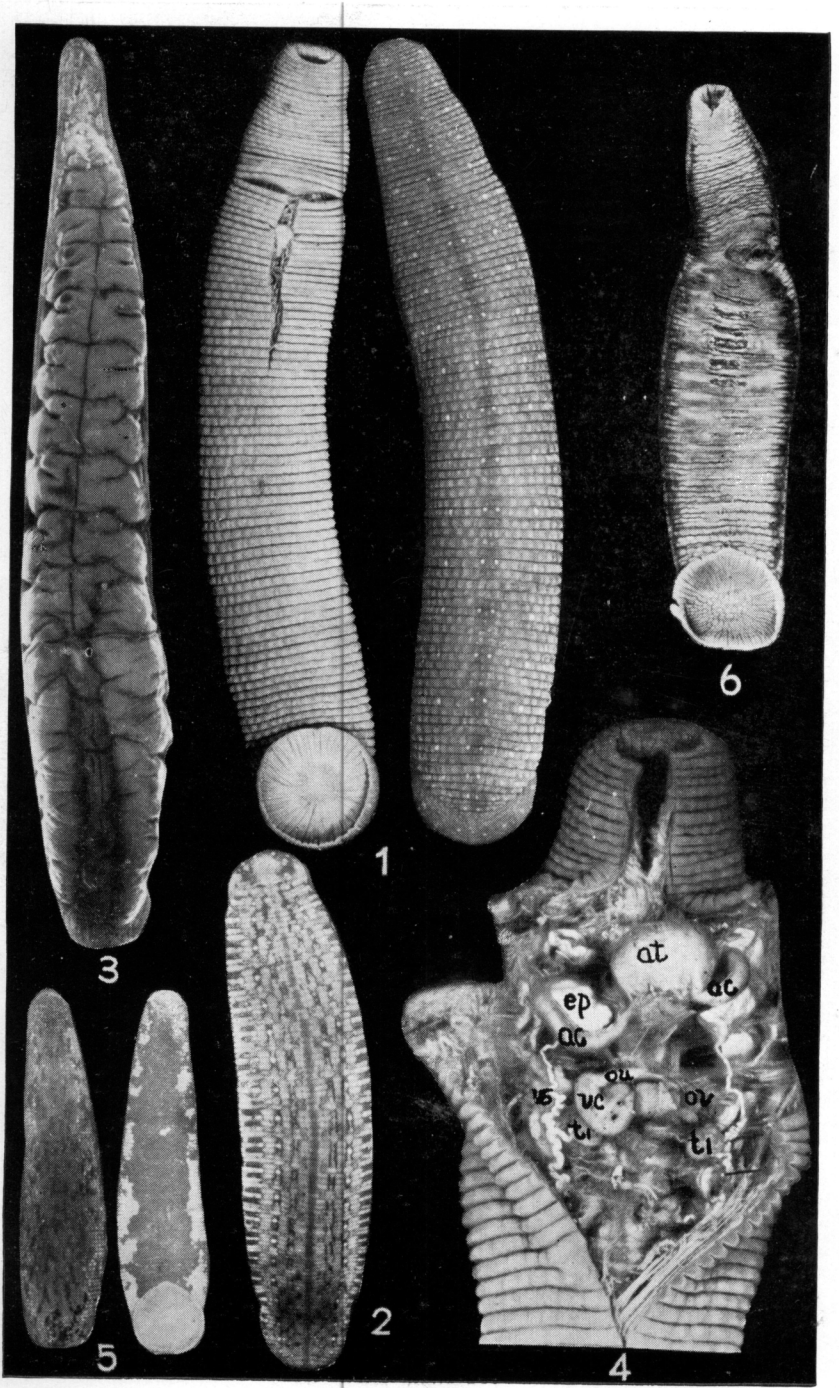
The present paper is a report on a small but interesting collection of leeches, mostly from Pahang, Johore, and Malacca, belonging to the Raffles Museum. Most of them were collected by the Curator, Mr. M. W. F. Tweedie, and I am indebted to the Director for the privilege of studying the collection. Under each lot the label is quoted in full, and, unless stated otherwise, Mr. Tweedie is to be understood as the collector. Mr. Tweedie also has kindly checked the spelling of the geographical names. I am further indebted to the Raffles Museum authorities for their generosity in permitting me to retain the types. The use of a technician in the preparation of sections I owe to a grant from the Special Research Fund of the University of Pennsylvania.

GLOSSIPHONIDÆ.

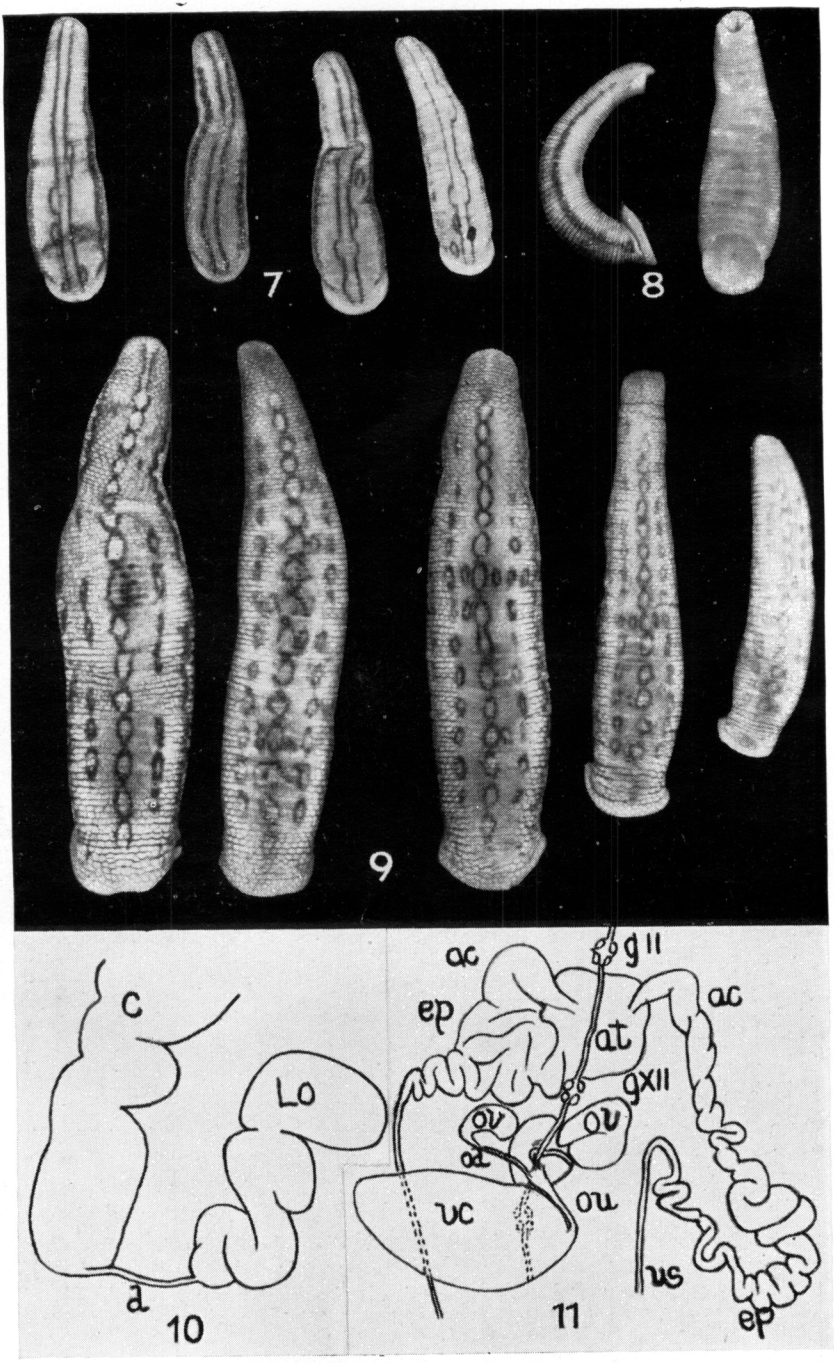
Batrachobdella reticulata (Kaburaki, 1921).

This species was described originally from a single specimen and since has been unreported. The seven examples in the present collection measure from 2·5 × ·9 to 4· × 2·1 mm. and are all contracted, broad, flat and thin. They differ, therefore, in both size and shape from the extended type specimen, which measured 11· × 2· mm. In general external appearance they resemble closely *G. fusca* Castle, especially in the large eyes and caudal sucker, but, as will appear below, differ greatly in internal anatomy. Superficially the eyes appear as a single pair, large, very black, and widely separated. This is due in part to the contraction and telescoping of the head segments, for on carefully cleared and mounted specimens, and especially in sections, the two pairs of eyes on somites III and IV[1] are easily distinguished, as described by Kaburaki. These are both directed cephalo-laterad and those of the first pair are about one-half the diameter of the second and closer together. The mouth is situated near the center of the cephalic sucker on somite III. The gonopores are separated by two annuli and situated, the ♂ at XI/XII, the ♀ at XII *a2/a3*, not at XI *a2/a3* and XII *a1/a2* as figured by Kaburaki but as correctly stated in his original text. Sensillæ

1. The cephalic annulation cannot be determined definitely and it may be that the eyes really belong to somites II and III.



Malayan Hirudinea.



Malayan Hirudinea.

and papillæ are as described by Kaburaki. The color has faded to a nearly uniform grayish brown, with little trace of pattern except the nearly universal deep longitudinal striation resulting from the deposition of pigment between the muscle bundles.

A few facts concerning the internal anatomy derived from a study of a single series of sections may be added. The gastric cæca are seven pairs as figured by Kaburaki. The atrium is large and the ejaculatory bulbs of its cornua massive for a leech so small, and the epididymis a small compact knot of the sperm duct with no prolonged postatrial loop. Only five pairs of testes, situated at XIII/XIV to XVII/XVIII, were found but other specimens might have the more usual sixth pair. The ovisacs have the customary form and extend from the gonopores to somite XVI. It will be seen, therefore, that this species departs in several respects from *Glossiphonia* and still farther from *Helobdella* and approaches *Placobdella* and *Batrachobdella,* to the latter of which, following Autrum, I have referred it provisionally.

The single lot of seven specimens was taken from "buffalo leeches" *(Hirudinaria manillensis)* collected at Gadek near Malacca, in December, 1934. An attached memorandum reads: "Found on the buffalo leeches after the latter had been kept in captivity for several months". Kaburaki's specimen was found within the mantle cavity of an *Anodonta* at Jullundur, Punjab.

Hirudinaria manillensis (Lesson, 1842).

There are two tubes of typical examples of this common buffalo leech, all of medium size. The female genitalia of several were dissected and all found to have the typical form as figured in the Fauna of British India Hirudinea volume (p. 223), that is, the cæcate vagina is divided into a sac and a short duct which opens into the female genital bursa separately from the common oviduct. The color pattern and other features also are typical, the former being complete and sharply defined on the smaller specimens, but, as usual, more broken and obscure on the larger ones. On all the median dorsal dark brown or black stripe is strongly developed.

"Gadek, near Malacca, December, 1934, Buffalo leeches", six specimens. These are the bearers of the *B. reticulata;* Sumatra (no specific locality), purchased alive, 6/34", one specimen measuring 52· × 16· × 8· mm., the largest in the collection.

Limnatis dissimulata sp. nov. (Plate IV, figs. 1–4).

Diagnosis:—External morphology (form, size, color, annulation, etc.) similar to *Hirudinaria manillensis;* color pattern more delicate and submarginal black stripes totally absent or

represented by a few spots only. Teeth about 120; gastric cæca simply lobed. No vaginal cæcum but common oviduct opening into summit of vaginal sac as in *L. nilotica* and *Hirudo.*

Description:—Type (Gunong Pulai, Johore, No. 1) measures in mm. length 86·, end of lip to ♂ pore 15·; widths, buccal ring 6·5, ♂ pore 11·3, maximum (XX) 13·, anus 4·; depths at same points 4·5, 6·5, 6·, and 3·2; caudal sucker 13·5. This is the largest specimen, most of the others being about 60· × 11· × 5·5 mm. and the smallest 24·5 × 5·8 × 2·, sucker 3·3 mm. These equal the size of ordinary *H. manillensis* but are inferior to the largest examples of that species.

Form of preserved specimens (fig. 1, 2) robust and moderately flattened, with greatest width at about XX and the head broadly rounded with large mouth; lip with ventral median fissure; caudal sucker equal to maximum body width with radiating ridges numbering 24 to 30 centrally and dividing once or twice into 56 to 77 at the margins. Gonopores as usual in the furrows XI *b5/b6* and XII *b5/b6*, both rather large pores and of approximately equal size. One example has a portion of the atrial lining everted from the ♂ pore as a soft cylindrical papilla about 1·5 mm. long and 1 mm. diameter. Nephropores are mostly minute but quite obvious pores on the caudal margins of *b2* in the ventral intermediate line from VIII to XXIV inclusive. On one specimen the last was not found.

Constitution of the somites as in *H. manillensis*, differing only slightly in proportions of annuli which are probably inconstant. Somites I, II and III uniannulate and incompletely separated, a median area between the eyes of the first and second pairs extending over all three and the areas laterad of the eyes irregular and overlapping. IV 2–annulate, *a3* clearly defined for entire width of head, and *a1* and *a2* united medially but usually separated laterad of the third pair of eyes by a shallow furrow. V 2–annulate, similar to IV except that it extends onto the venter where the two annuli unite to form the buccal ring. Dorsally the larger anterior annulus *(a1 a2)* bears two rows of sensory papillæ, the fourth pair of eyes being in line with the second row (*a2*) and several of its tessellæ laterad of the eyes united with those of the preceding annulus IV *a3*. VI 3–annulate, *a1* slightly $< a2$ slightly $< a3$ dorsally, *a1* and *a2* united ventrally as post-buccal ring. VII 3–annulate, $a1 < a2 < a3$ or $a1 = a2 < a3$. VIII 4–annulate $a1 > a2 = b5 = b6$, first nephropore on *a1*. IX–XXIII 5–annulate, all annuli approximately equal or *a2* slightly smaller than the others. XXIV 4–annulate, $a2 <$ or $= b1 = b2 < a3$, 17th nephropore on *b2*. XXV 3–annulate $a2 < a3 < a1$. XXVI 2-annulate $(a1\ a2) > a3$, sensillæ on *a2*. XXVII 1–annulate, followed by the anus

and an indistinct post-anal annulus. Irregularities, such as partial unions of contiguous annuli, split and spiral annuli occur on a few somites of two specimens.

On the dorsum each annulus of the complete somites of the middle region is divided into 15–17 irregularly quadrate areas, usually one median between the paramedian sensillæ, two between the latter and the intermediate sensillæ and three or four on each side between the latter and the margins, which with the four bearing the paramedian and intermediate sensillæ makes the total as stated. Some of the larger areas show incipient division and the sensillæ may be borne on separate tessellæ or on one end of a larger one. Each of these areas or tessellæ bears numerous sharp, conical sensory papillæ, usually in clusters consisting of a larger central one surrounded by a number of small ones. On areas undergoing incipient division there are usually two such groups. Small papillæ also are scattered between the clusters. Farther forward in the preclitellar region the short furrows gradually disappear and the areas are represented by thickenings or swellings of the annuli bearing groups of sensory papillæ arranged, not in clusters, but in short transverse rows of 3 or 4 or sometimes more. On the venter the areas are usually ill-defined but each annulus has a corresponding number (15–17) of mammilliform swellings each bearing a larger teat-like papilla and several scattered small papillæ. Sensillæ are arranged exactly as in typical *Hirudinaria*. Each consists of a translucent, colorless, low, elliptical dome with a raised axial, white, sensory line inclined to the median axis of the leech at an angle of 25°–30°, in the case of the dorsal paramedians, about 45° for the intermediates and at nearly 90° for the supra-marginals and marginals. The first two pairs are conspicuous but, apparently due to the preservative, the marginal, supramarginal and ventral sensillæ are very difficult to detect.

Color pattern best preserved on the small 24 mm. example (fig. 2), on which it is almost exactly like the hirudinarian pattern but more delicate in its tracery. Dorsal ground color clear dusky chrome yellow to clay color marked by a narrow, dull brown, black-flecked, median stripe, which is faintly beaded, tending to become paler and narrower intersegmentally on *b6* and *b1* and anteriorly sometimes actually interrupted, while the expanded wider parts on *b2*, *a2* and *b5* occupy the entire median field between the paramedian sensillæ. Supra-marginals are a series of dense black, quadrangular spots on *b2* and *b5*, united at their medial ends by a thin, black, arched line across *a2*. Paramedian-intermediate fields occupied by a delicate reticulum of black or dusky lines united by deeper black spots at certain

nodal points. This consists essentially, as in *Hirudinaria,* of paired outer paramedian and intermediate chain stripes, the links of which expand intersegmentally on *b6* and *b1* and contract segmentally on *a2*. By means of three series of small black spots on *b6* and *b1* the two series of links are united with each other, the intermediate come into contact with the supramarginal spots and the outer paramedians extend into the median field. The exact size and configuration of the links varies but the contracted lines between them extend over *a2* and more or less of the contiguous annuli *b2* and *b5*. In some cases the narrow black lines forming the two sides of a link remain separated in these connectives but usually they are united by black spots on *b2* and *b5* or on either of these or on *a2*. The reticulum becomes heavier and blacker caudally and its components are distributed homologously on the incomplete somites both anteriorly and posteriorly. Exposed part of caudal sucker with a median and a pair of smaller lateral yellow fields separated by a pair of large irregular black spots; the covered part yellow with a few small black spots. Venter nearly uniform pale ashy yellow, immaculate except for a few very small submarginal black spots. Marginal stripes clear saffron yellow.

On larger examples the pattern is largely reduced and broken, the reticular or conjoined chain pattern becomes scattered irregular spots, the median stripe obscure and broken but the supramarginal spots remain dense and sharply defined. The venter may have a greenish tinge, the marginal stripes orange or clear yellow and the submarginal stripe is entirely absent on all of the specimens available. On the type and largest specimen even the median stripe is obsolete and only the supramarginals remain.

Jaws, as typical of the *Limnatis-Hirudinaria* group, large (long and low), and bearing about 120 teeth measuring ·038 × ·007 mm. in the middle of the series of the type. Salivary papillæ of two sizes, many small ones about ·035 mm. diameter on each side of dentinal ridge and larger ones (·06 mm. diam.) in two lines of 4–6 farther down on sides of jaw. Gastric cæca of one dissected (fig. 3) were moderately filled with blood.

Male reproductive organs of two dissected, the nerve cord in one passing to the left side of atrium and vagina and in the other to the right of the atrium and left of the vagina. Atrium (fig. 4) very broadly pyriform, the penis sac subcylindrical, somewhat flattened, and pressed nearly horizontally beneath the nerve cord by the massive spheroidal prostate which is of about equal length, strongly muscular with the prostate end enveloped in a thick, continuous, smooth layer of white glands. Atrial cornua or ejaculatory ducts open into each side

of the prostate end and issuing from the glandular covering widely separated, drop nearly vertically to the body floor either the left or the right one passing beneath the nerve cord. No definite ejaculatory bulb, but the muscular duct, which is about three times the length and at its widest part about 1/5 the diameter of the atrium, gradually increases from the narrow terminal portion to a diameter about 3 times as great in its middle portion and then again tapers to the epididymis. On each side the ductus forms an S-shaped curve by the side of the atrium and almost completely encircles the epididymis, except for a portion of its antero-ventral face, its ental end bending sharply ventrad to join the caudal or ectal end of the dorsal limb of the epididymis. Epididymis unusually small, of the usual U-shape but widely open caudo-ventrad, the ectal or dorsal limb much wider than the ventral and formed of a closely folded soft-walled tube of greater diameter than the ventral limb into which it tapers; the ventral limb continues caudad as a similarly folded tube that tapers into the vas deferens which has the usual appearance and follows the usual tortuous course along the body floor laterad of the testes. First pair of testes at XIII/XIV, others not dissected.

Ovisacs soft, white, pyriform bodies about 2·5 × 1·5 mm. lying on the body floor at XI/XII in line with the testes. Each gives rise to a short oviduct about its own length but the left slightly longer and passing beneath the nerve cord in both examples dissected. They join at an ovate albumen gland somewhat larger than an ovisac and tapered to the common oviduct which is about as long as, but somewhat wider than a paired oviduct, and which opens into the very tip of the tapered and hooked inner end of the vagina, with which it forms a continuous tube. Vagina divided into a thinner walled, widened ental bulb and a muscular duct or stalk of about twice its length and one-half its diameter which is folded against the concave face of the curved bulb, and which becomes somewhat widened to form a genital bursa at the ♀ pore. There is no vaginal cæcum as in *Hirudinaria* and the entire organ is like that of typical *Limnatis*.

The collection includes eight specimens of this species, as follows: "Gunong Pulai, Johore 4/33. Coll. M. W. F. T., in streams". Type and three others; "Bukit Sagu, near Sungai Lembing, Pahang, September 1935. Coll. M. W. F. T.", two; "Bentong, Pahang. 7/35" one with *Haemadipsa picta;* "Bukit Chintamani, near Bentong, Pahang, August 7, 1935", one with *Haemadipsa sylvestris interrupta.* The last two are small specimens with well preserved color pattern.

When the above described leeches were first examined they were thought to be *Hirudinaria manillensis*, of which several veritable examples occur in the collection. It was noted that minor differences in the color pattern existed, especially the greater delicacy of the dorsal markings, the less extention laterally of the supramarginal spots and total absence of the submarginal stripes. But such variations commonly occur within the limits of a species. The entire external morphology indicated this species. But dissection showed notable differences in both the digestive and reproductive systems. In the former the gastric cæca are less divided and the principal ones less prolonged than in *Hirudinaria* and in the latter the vagina lacks a cæcum and is simply fusiform as in typical *Limnatis*. The species, therefore, is referred to that genus, although externally it is nearly or quite indistinguishable from the common local species of *Hirudinaria*. It is another example of the parallelism in superficial characters so frequent in the fauna of the Indo-Malayan region. Not only in color pattern but also in the form and posture of the sensillæ does this species depart from conditions in typical *Limnatis*. In this respect it resembles a species from West Africa which I have identified provisionally as *L. africana* Blanchard in which the reproductive organs are similar. It is possible that examples of this species may have been included in the material on which some of the many species of Oriental leeches placed in the synonymy of *Hirudinaria manillensis* and *H. granulosa* were based, but it is impossible from the brief description of color to determine this.

Hæmadipsa zeylanica subagilis Moore (1929).

A single specimen conforming in every respect to the characteristics of this subspecies. It has well-marked median head areolæ, and a nearly complete row of irregular areolæ between the third and fourth pairs of eyes, a complete narrow but strong median black line and some dusky mottling on both dorsum and venter.

"Gunong Pulai, Johore, April 1934, M. W. F. T. Coll." one specimen with *H. picta* and *Phytobdella catenifera*.

Hæmadipsa zeylanica (Moquin-Tandon, 1826) var. (Plate IV, fig. 5).

Also represented by a solitary sample in this collection is a distinctive color variant which seems to lack the attributes of a subspecies or geographical race. It occurs sporadically (as material in the writer's collection establishes) in localities very widely separated geographically. For this reason and in the absence of intergrades it may be regarded provisionally as possibly a Mendelian segregate.

The two specimens measure respectively 19·5 × 4·2 ×1·6, with the caudal sucker 4· × 4·2, and 12· × 2· × 1·2 and 2· × 2·1 mm. There are no median areolæ on the head and none between eyes 3 and 4. There are 71 sucker rays and the prehensile papilla is little developed. Sensillæ are prominently elevated and nephropores conspicuous; but furrow pits, as usual in this species, are obscure. The ground color in the preserved specimens, which differ little from living ones taken at Mungpoo, Darjeeling District, India, is brownish yellow with suffused brown more evident on the head and the median dorsal field of the body; the dorsum blotched all over with elongated, more or less connate, irregular, black spots, and with no distinct median stripe; the venter almost solid black with irregular lateral margins. The sensillæ and many of the papillæ are white or pale yellow. Blanchard's (1917) fig. 3 and 4, Pl. VIII resembles this variety.

"Gunong Brinchang, Pahang, 4,500–5,500 feet, March, 1935", two specimens.

Hæmadipsa sylvestris interrupta Moore (1935).

Typical examples of this subspecies occur in four lots. All have the furrow pits deep and well defined on IX and X and evident but less developed on VIII and XI but with conspicuous white spots indicating their position on all four somites.

"Temerloh; Pahang, June 15, 1935", seven specimens; same "July 6, 1935", five specimens; "Bukit Chintamani, near Bentong, Pahang, August 7, 1935", ten specimens with one *Limnatis dissimulata;* "Jungle near Sungai Lembing, Pahang, September 1935" eighteen specimens, all small.

Hæmadipsa picta Moore (1929).

Typical examples of this ornate species occur in two lots.

"Gunong Pulai, Johore, April 1934", three specimens with *H. z. subagilis* and *Phytobdella catenifera;* "Bentong, Pahang, July, 1935", one with *Limnatis dissimulata.*

Tritetrabdella gen. n.

Resembling *Philaemon* Blanchard externally in having the complete somites quadrannulate *(a1, a2, b5, b6)* but differing in the possession of 3 instead of only two jaws and consequently, if Harding's subfamilies be recognized, belonging to the Trignathoferae whereas *Philaemon* belongs to the Duognathoferæ in which the median dorsal jaw is absent. Type species *T. scandens.*

Tritetrabdella scandens sp. n. (Plate V, figs. 7, 8).

Diagnosis:—A land leech having the general aspect of a medium size *Haemadipsa* but distinguished by the quadrannulate somites and the gonopores separated by 3 to 3 1/2 annuli (♂ XI *a2/b5*, ♀ XII *a2/b5* to XII 1/2 *a2*). Auricles 3–lobed but small. Color as preserved pale yellow with two pairs (paramedian and supra-marginal) of longitudinal black stripes.

Material:—The type and three paratypes from Penang Hill, Coll. M. W. F. T., April, 1935.

Description:—Type measures in mm.: length 15·6, to ♂ pore 3·6; widths, buccal 2·, ♂ pore 2·6, maximum (XX, XXI) 4·, anus 2·4; depths at same points about 1·, 1·3, 2·5 and 1· mm.; caudal sucker 3·5 × 4·. Shape as usual in preserved specimens of land leeches, rather stout and moderately depressed with greatest width far back and both ends broadly rounded. Upper lip strongly areolated, the areas forming the margin of the lip minute and granule-like, the others much larger, of a diameter 3 to 4 times as great; on the four specimens at hand no median areas and none separating those bearing the 4th and 5th eyes. Ventral face of lip soft and finely granular, apparently with no permanent furrows anteriorly but a median fissure posteriorly continuing forward the median velar sinus. On the sides and floor of the buccal chamber are four pairs of folds or lobes which reach to the membranous velum, through the triangular opening of which the three jaws are visible. Eyes as usual, five pairs on annuli 2, 3, 4, 5 and 8, all large and conspicuous, the 2nd and 3rd pairs especially so, with deep black pigment cups. Furrow pits slightly developed and obscure, partly due to the uniformly colored, nearly unpigmented condition of the region in which they lie, the best developed pair at IX *a1/a2*. Gonopores at XI *a2/b5* and XII *a2/b5* or the latter more or less within *a2*, that is separated by from 3½ to 4 annuli; on the type *b5* and *b6* are coalesced behind the ♂ pore so that at first sight the gonopores appear to be separated by less than three annuli.

Each annulus of complete somites is divided on the dorsum into about 14–16 areoli bearing sensory papillæ and separated into paired groups by a deeper median furrow which is nearly continuous for the entire length. Venter nearly smooth, without definite areas. Sensillæ inconspicuous, low, whitish, arranged as usual in *Haemadipsa*. Nephropores seen on only a few somites on the caudal border of *a1* in the marginal line; the first pair carried forward from VIII to the margins of the mouth on somite V in line with the 4th pair of eyes; the last (17th) pair, as usual displaced from XXIV caudad to the ventral face of the auricles, found only in sections. Auricles relatively smaller than in *Haemadipsa*, as usual trilobate, the lobes rounded,

without angulation or production of the corners and the median lobe only about 1/3 as broad as the others. Caudal sucker large, broadly ovate, with a definite anterior median prominence but no sharply hooked papilla as in many species; radiating ribs 56 to 59, extending farther into the center than in many species, leaving only a small depressed, faintly tessellated circular area (fig. 8).

Color as preserved pale yellow or clay-color dorsally with two pairs (paramedian and supra-marginal) of sharply-defined, longitudinal black stripes, the latter broader and simple, the former with a few, asymmetrical, elongated black rings or loops which frequently occur in connection with breaks in the stripes. These differ in exact form and position on each specimen but occur on the lateral sides only of the stripes (fig. 7).[1]

Annulation:—Preocular somite (I) of two rows of areolæ, the posterior of normal size like the rest of the dorsum, the anterior much smaller, almost granular, like those of the ventral face of the lip. II uniannulate, formed of 2 large paramedian ocular plates bearing the first pair of eyes, together with marginals. III uniannulate, with a pair of paramedian interoculars, a pair of intermediate oculars and marginals, IV also uniannulate, bearing the 3rd pair of eyes, similar to III but with two pairs of interoculars. V biannulate, *(a1 a2)* slightly $> a3$, the first with 6 interoculars, large oculars bearing the 4th pair of eyes, and marginals; ventrally uniannulate and forming the buccal ring. On none of the four specimens is there any median area and none between the eyes of the 3rd and 4th pairs. VI 3–annulate above, $a1=a2=a3$, the 5th pair of eyes on *a2;* biannulate below, $(a1+a2)> a3$, the first forming the post-buccal ring. VII 4–annulate, $a1 = a2 > b5 = b6$. VIII–XXII 4–annulate, $a1 = a2 = b5 = b6$, or on some somites of the middle region $a1 > a2 > b5 = b6$ with the furrow $a2/b5$ deepest. XXIII 3–annulate, with *a1* and *a2* partly united ventrally. XXIV biannulate *(a1 a2)* slighty $> a3$. XXV, XXVI and XXVII each uniannulate, their lateral flanges forming the three lobes of the auricles.

Anatomy:—Jaws three, having the arrangement and form characteristic of *Haemadipsa,* that is, relatively small but high and prominent, with about 45 teeth of the usual form, and no salivary papillæ. The dorsal median jaw recess is prolonged forward for a short distance as a narrow tube. There is no similar diverticulum from the recesses of the paired jaws, but ventral to them and reaching to somite VI is a more extensive cæcal diverticulum from the buccal cavity. Pharynx very short

1. Compare Blanchard 1917, fig. 7, which represents this pattern attributed to *H. zeylanica.*

and narrow, with three muscular ridges continuous with the three jaws. Oesophagus also with the same three folds, and in addition three others alternating with them, the six disposed as median dorsal, median ventral and two lateral pairs. Gastric cæca as in *Haemadipsa,* the last pair with no Lambert's organ and the rectum without a cæcum.

Reproductive organs studied on sections only. They appear to be essentially as figured for *H. sylvestris* in Fauna India, Hirudinea p. 281, except that the atrium is relatively larger and rises well above the level of the nerve cord with a very thick glandular layer covering the prostate and the ectal ends of the ejaculatory bulbs, which also are large and broadly ellipsoidal. The female organs have the vaginal duct longer and the vaginal sac folded.

Phytobdella catenifera sp. nov. (Plates IV, V, figs. 6, 9, 10, 11.).

Diagnosis:—Size large for a land leech, up to 50 mm. in length. Color yellowish with chain stripe pattern in black. Somites IX–XXIII 6–annulate, VI, VII and VIII 5–annulate, V 3–annulate, XXIV 2–annulate and I–IV, XXV–XXVII uniannulate, with variations. Fourth and 5th eyes separated by 3 annuli. Gonopores separated by 6–7 annuli, the ♂ usually at XI *b5/b6,* the ♀ at XII/XIII, but both varying.

Description:—A large and stout species. The type measures in mm.: length 44·, to ♂ pore 8·5; widths, at buccal ring 2·8, at ♂ pore 4·, maximum (XX) 7·, anus 6·; depths at same points 2·, 3·, 4·2, 4·; sucker 6·5 × 7·. Other specimens are similarly proportioned and have maximum lengths, widths, and depths of 19· × 3·5 × 2· to 53· × 9· × 5· with suckers of 3·2 to 8· mm., most of the 24 specimens being around 35–40 mm. long. Form in the moderately extended state half-round posteriorly with the dorsum arched and the venter flat, subterete anteriorly; greatest width near caudal end (XX) tapering regularly and gently to the broadly rounded head. All appear to be more or less filled with blood. A few more extended individuals with empty cæca are less widened and more rounded throughout. Lip broadly rounded, the venter with a median fissure not reaching anterior border, and 2 or 3 pairs of lateral furrows separating marginal lobes and ventral ridges; below and on margin above finely granular, remainder of dorsum coarsely granular or pebbled, the areolæ being elevated and rounded. Buccal ring or caudal margin of the cephalic sucker crenulate, with numerous shallow furrows; lateral buccal lobes low and inconspicuous, either little developed or strongly contracted on these specimens. Eyes five pairs, all conspicuous, and directed as usual in the Hæmadipsinæ, on annulæ 2, 3, 4, 5 and 9, the 4th and 5th pairs separated by three annuli instead of two as usual in land leeches. Furrow

pits wanting or slightly developed on X and XI. Clitellum weakly developed, distinguished chiefly by its grayish color, extending over 18 annuli, from X *b6*, to XIII *b5* inclusive. Gonopores variable in position, separated by 6, 6 1/2, or 7 annuli; the ♂ most frequently in the furrow XI *b5/b6*, but in one case each at XI *b4/b5*, on *b5* and on *b6*; ♀ generally in the furrow XII/XIII but quite frequently in XII *b5/b6* or rarely within *b6*. Male gonopore a large orifice, sometimes with the partly everted bursa protruding as a conical papilla, in others with the tip of the penis projecting. Female gonopore usually much smaller than the male but in some cases of large size due to the relaxation of the sphincter muscles. Nephropores seen only with great difficulty as small pores on the lateral margins of the caudal border of *b2*, on some specimens indicated by a minute dot of dark pigment; first and last pairs not detected in surface views. Auricles vestigial, represented by small, somewhat tumid and overlapping, but separated lappets on the margins of XXV, XXVI and XXVII. Anus as usual. Caudal sucker broadly ovate with the anterior papilla little prominent and not hooked on any of these specimens; central areolated area slightly elevated and surrounded by about 45 rays, some of which bifurcate to form about 63–65 (59–72) marginal rays and lobes. Sensillæ and papillæ have been smoothed out and decolored so completely that they are indiscernible in surface views.

Annulation:—There is considerable variation in the annulation of anterior somites but of ten examples studied in detail seven agree with the type, which is described. I preocular, composed of two rows of granules or minute areolæ bearing labial sense organs. II uniannulate, consisting of a pair of large paramedian oculars bearing the first pair of eyes, a small median and one pair of marginal areolæ. III uniannulate, large intermediate oculars, 3 interoculars (1 median and a pair of paramedians) and irregular marginals. IV typically uniannulate, consisting of the 3rd pair of larger oculars (intermediates) usually 5 interoculars and several marginals. On all of these somites the median area is usually somewhat anterior to the paired ones of the same row. Three specimens have IV biannulate, two with two complete rows and one with one complete and one incomplete row of areolæ between the oculars. V most often 3–annulate, in which case *a1* and *a2* are each represented by 2 complete rows of 9–11 areolæ, which extend across the dorsum between the oculars, and an irregular group of areolæ laterad of the oculars and which extend along the caudal border of the sucker to form part of the buccal ring. *a3* is the first complete annulus and continues on to the venter where it forms most of the buccal ring. In one case it is partially

subdivided dorsally into two rows of areolæ (*b5* and *b6*). In cases where IV is biannulate V also is biannulate, one row of areolæ apparently being shifted between these two somites, attaching in some cases to the oculars of one, in others to those of the others. One specimen has it running obliquely from the left ocular of IV to the right ocular of V. VI typically 5–annulate, on the dorsum ($b1 = b2 < a2 = b5 = b6$) the 5th pair of eyes on *a2*, ventrad *b1*, *b2* and *a2* unite to form the postbuccal ring and *b5* and *b6* unite to form *a3;* rarely *b1* and *b2* are undifferentiated, making the somite 4–annulate, or *b5* and *b6* in addition remain undivided, making it 3–annulate. VII 5–annulate, $b1 = b2 = b5 = b6$ slightly $< a2$, the furrow *a2/b5* deeper than the others and the annuli grouped 3–2. VIII exactly like VII. On the largest specimen VII is normal on the left side but on the right *a2* is divided into *b3* and *b4* making 6 annuli. IX–XXIII 6–annulate, all secondary annuli (*b1–b6*) developed and approximately equal in size. On most specimens, especially at and near the margins, the secondary annuli are grouped 2 by 2 to indicate the primary annuli and on the venter of many a 4–2 arrangement persists. XXIII 5–annulate on venter from the reduction and fusion of *b5* and *b6*. XXIV normally biannulate, ($a1 + a2 > a3$), but on the largest specimen triannulate dorsally and biannulate ventrally, where *a1* and *a2* are united on the left, *a2* and *a3* on the right side. XXV, XXVI and XXVII each uniannulate, the last two united at the lateral margins. Besides the variations described minor ones occur, especially in the exact arrangement of the areolæ at the anterior end. The largest example, in which certain somites are more elaborated than is typical, also has several spiral and split annuli which makes exact delimitation of annuli and somites uncertain.

Color faded but the pattern well preserved. Colors probably least altered in the smallest examples in which the ground is generally orange yellow on the dorsum, paler and duller at both ends and on the venter, grayish on the clitellum; dorsal markings black or blackish and marginal stripes clear yellowish buff. Other specimens have the general ground color above hair brown or drab, becoming dusky on the head and caudal sucker and more yellow in the centers of the black rings. Markings are three or five black, dorsal, chain stripes and black edging, both above and below, to the yellow marginal stripes. When best developed the chain stripes extend for practically the entire length of the body but tend to be broken caudad and to lose the chain character cephalad. The rings or links are elliptical with the widest part intersegmental at *b6/b1* and the constrictions (or breaks) small dense black spots on *b3* and *b4*. While all agree in the general pattern no two specimens are exactly alike

in the details. On the type, which represents the common pattern, the median stripe is strongly developed, the component rings or links beginning at VII and forming a continuous chain to XXIV, behind which are several small black spots. On the head the chain structure is lost in a narrow median yellow stripe bordered by black. Intermediate stripes much less developed, beginning at X and extending to XXIII *b3* as a series of generally disconnected shorter and narrower intersegmental annular spots. Between these two stripes are remnants of a pair of paramedian chain stripes, represented asymmetrically by short annular spots on the left side at XIV *b6*–XV *b2* and XVII *b5*–XVIII *b1* and on the right side at the corresponding positions on XVIII–XIX to XXI–XXII. Marginal stripes continuous for the entire length from the post-buccal ring to the vestigial auricles, bordered above and below by the narrow black supra– and submarginal stripes, irregularly beaded by widening dorsad and to a less extent ventrad on *b4* only or *b3* and *b4* of each somite. Venter immaculate. The most extreme departure from the condition described is found on a specimen 34 mm. long which has all five chain stripes strongly and nearly equally developed. The links of the median and intermediate stripes begin on VIII and extend in unbroken chains to XXV and those of the paramedian stripes are mostly connected and occur on both sides of nearly all of the same segments. The frequent variations are the exact somites on which the chain stripes begin and end, the extent to which they become discontinuous posteriorly, the exact form of the links, whether broad or narrow or some of the rings changed to solid black, and most of all in the degree of development of the paramedian stripes. These consist usually of a small number of spots disposed asymmetrically on one side or the other in the posterior half and frequently united with the sides of the median spots. But no two individuals are exactly alike (fig. 9).

Anatomy:—A single dissection of the alimentary canal shows that the anatomy agrees closely with that of *P. meyeri* Bl. Owing to the lack of a dorsal fissure for the median jaw the velum is much more extensively developed than in trignathous land leeches, forming a deep, and thick, continuous, dorsal and a shallower, ventral, fold separated by lateral fissures. Duognathous, the median dorsal jaw totally absent and the ventral pair shifted somewhat dorsad to the opposite ends of the transverse diameter of the pharyngeal sinus. Jaws of the form usual in Hæmadipsinæ but instead of being larger as might be expected in the absence of the dorsal jaw, they are smaller than usual in 3–jawed leeches of equal size. The compressed dentigerous ridge bears about 45 (44–46 in two specimens

counted) small teeth[1]. Pharynx a short, globoid, spongy muscular bulb in VII, followed by a very short œsophagus extending through only 2 or 3 annuli in VII–VIII. Gastric cæca begin in VIII, the first four pairs small and simple, the postgenital cæca large, much lobed and each somewhat overlapping the succeeding one and enclosing the small, nearly simple accessory cæca, which alternate with the large ones. Last pair of cæca arise in XIX and extend to XXIV by the sides of the intestine, with a lateral lobe in each of these somites but the last. Lambert's organ (fig. 10, LO) a soft, dead white, folded sac attached to the tip of each of the cæca of the last pair by a very slender duct. Digestive stomach a somewhat cordate bulb lying between the bases of the last pair of gastric cæca and continued as a tubular intestine, the anterior half of which is somewhat expanded and the narrow posterior half doubled on itself into a sharp S–shaped curve ending in a somewhat bulbous rectum provided on its ventral face with a small pyriform glandular sac (rectal cæcum) attached to the floor of the body by a pair of small divergent muscles.

Reproductive organs (fig. 11) essentially as in typical *Haemadipsa*. In the two fully dissected and the one sectioned, the atrium is embedded almost completely and symmetrically in the muscles and connective tissues of the body floor entirely ventral to the nerve cord, which is somewhat displaced dorsad, subpyriform, with a subcylindrical penis-sac and enlarged prostate fundus. Prostate nearly twice the diameter of the penis sac, somewhat flattened and angulated by pressure of the blood-filled gastric cæca, and covered with a thick layer of glands which form loose tufts about the atrial cornua and cover about 1/3 of the length of the atrium, gradually thinning out below. Ejaculatory ducts or cornua only slightly longer than the diameter of the prostrate, with ejaculatory bulbs little enlarged and of a diameter about twice that of the narrow part of the duct. They are bent at a right angle, the anterior or ectal limb being transverse, the posterior longitudinal and tapered to the epididymis or sperm vesicle. Epididymis the usual compactly folded, irregular, convoluted, soft white tube of a fairly uniform diameter about equal to the narrow part of the ductus ejaculatorius. Vas deferens as usual and testes sacs in one dissected 8 pairs (XIII/XIV to XX/XXI), in the other 9 pairs (the last XXI/XXII) with the left vas deferens extending to a vestigial empty sac at XXII/XXIII as in the sectioned one. Female

1. On most of the specimens examined the teeth are much broken or disintegrated but the apparent number agreed with those on which the whole series could be counted. They are cylindroid with low blunt conical points and in the middle of the series measure very uniformly ·013 × ·007 mm. the exposed point ·0059 mm. high.

organs lie to the right of the nerve cord in one, to the left in the other; vaginal stalk and sac of about equal length, the latter ellipsoidal, between 4 and 5 times the diameter of the former. Unpaired oviduct opens at junction of stalk and sac, about 2/3 as long as latter and sharply bent on itself, with a small oviducal or albumen gland at the junction of the paired oviducts, of which the one that passes beneath the nerve cord is twice as long as the other. Ovisacs spheroidal and 2/3 the diameter of the vaginal sac.

"Gunong Pulai, Johore, 4/34, M. W. F. Tweedie, coll. Infesting a large *Testudo emys*". Type and twenty-two others. Same place and date, one small specimen taken with *Haemadipsa picta* and *H. zeylanica subagilis*.

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EXPLANATION OF PLATES.

PLATE IV.

Limnatis dissimulata, figs. 1–4.

Fig. 1. Venter and dorsum of type specimen, × 1 1/3.

Fig. 2. Dorsum of 24 mm. specimen from Bentong showing color pattern, 2 3/4.

Fig. 3. Dorsal view of digestive tract with cæca filled with blood of specimen from Bukit Sagu, × 2 3/4.

Fig. 4. Genitalia of type as exposed from venter, × 2 3/4.

Fig. 5. *Haemadipsa zeylanica,* color variety, dorsal and ventral aspects, × 2 1/2.

Fig. 6. *Phytobdella catenifera,* ventral aspect of largest specimen, × 2 1/4.

PLATE V.

Fig. 7. *Tritetrabdella scandens,* dorsal aspect of all four specimens to show slight variations in color pattern, type on left, × 2 1/2.

Fig. 8. Same, ventral and lateral aspects of type specimen, × 2 1/2.

Fig. 9. *Phytobdella catenifera,* dorsal aspect of five specimens, showing slight variations in color pattern, × 2 1/4.

Fig. 10. Same, outline of Lambert's organ and end of last cæcum, as seen from the side, × 10.

Fig. 11. Same, reproductive organs, dissected from the dorsum, testes sacs omitted, epididymis of right side partially opened out and drawn to one side, that of left side in normal position × 8.

Lettering: *ac* atrial cornua or ejaculatory ducts, *at* atrium, *ep.* epididymi, *g XI, g XII,* ganglia of ventral nerve cord, *od* paired oviducts, *og* oviducal gland, *ou* unpaired oviduct, *ov* ovisacs, *t* testes sacs, *vs* vas deferens, *vd* vaginal duct, *vc* vaginal sac, ♂ male pore, ♀ female pore.