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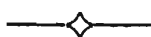
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[illegible]

I NOTES ON THE DEEP-SEA FISH
OBTAINED BY THE R.I.M.S.S. "INVESTI-
GATOR," DURING THE SURVEY
SEASON 1910-11

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During the season 1910-11 opportunities occurred for only four deep-sea trawls. These were all taken off the S. W. coast of India, and the detailed positions are as follows :—

Station 388, 26-iv-11.

$7^{\circ} 44' 10''$ N. }
 $76^{\circ} 35' 45''$ E. } 670 fathoms.
drift during trawl N. 36° E. 4 miles.

Station 389, 27-iv-11.

$9^{\circ} 01' 50''$ N. }
 $75^{\circ} 55' 50''$ E. } 81 fathoms.
drift during trawl N. N. W 1 mile.

Station 390, 27-iv-11.

$9^{\circ} 09' 00''$ N. }
 $75^{\circ} 46' 00''$ E. } 260 fathoms.
drift during trawl N. N. W 4 miles.

Station 391, 27-iv-11.

$9^{\circ} 14' 10''$ N. }
 $75^{\circ} 45' 00''$ E. } 237 fathoms.
drift during trawl N. 36° E. 4 miles.

Although the material obtained was by no means plentiful, several interesting species were found, notably a fine example of *Trachichthys darwinii* and an egg-capsule and the contained embryo of a species of *Rhinochimaera*.

Unfortunately, owing to the presence of a large number of shells of *Xenophora pallidula* in trawl 391, the material obtained was, in several instances, badly damaged; while in trawl 390 the net caught on a rock and was much torn, the only fish obtained being the example of *Trachichthys* that had very fortunately become entangled by its opercular spines in the meshes of the net close to the mouth.

ELASMOBRANCHII.

Plagiostomi.

SELACHII

Family SPINACIDAE.

Centroscyllium ornatum, Alcock.

1899. Alcock, p. 14.

Ill. Zool. Invest., pl. viii, fig. 2 (young).

„ „ „ pl. xxxv, figs. 1—1 b.

A single specimen 15.5 cms. in length (including the caudal fin) was obtained at Station 391.

A careful comparison with Alcock's type specimens failed to reveal any discrepancies.

So far as I am aware, the only previous records of the occurrence of this species are at "Investigator" Station 1—21° 6' 30" N., 89° 30' 00" E.—in 405-285 fathoms, and "Investigator" Station 211—23° 00' 00" N., 66° 08' 00" E.—in 609-620 fms.

HOLOCEPHALI.

Rhinochimaera sp.

A single egg-capsule, in a fresh state and containing an embryo, was obtained at Station 391.

The capsule was black in colour and, as regards general appearance, closely agrees with the description of the capsules of *R. atlantica* obtained off the W coast of Ireland (Holt and Byrne, 1910, p. 22, pl. iv, figs. 4-5).

There is in the Indian Museum an egg-capsule labelled *Rhinochimaera indica* that was obtained by Alcock in 1890 (*Ann. Mag. Nat. Hist.* (vi), vol. viii, p. 21) at St. 112—13° 47' 30" N., 92° 36' 00" E.—in 561 fathoms, and was attributed by him to a species of *Callorhynchus*, subsequently receiving the name of *C. indicus* from Garman in 1899 (*Mem. Mus. Comp. Zool. Harvard*, vol. xxiv, p. 21).

Bashford Dean, who had an opportunity of examining this specimen, has expressed the opinion that it is, in reality, a capsule belonging to a species of *Harriotta* (*Chimaeroid fishes and their Development*, B. Dean, 1906), a view with which I am in complete agreement.

A comparison of the present specimen and Alcock's example showed at once that they could not belong to the same species. In the following table I have given the measurements of both these capsules and, for purposes of comparison, the measurements of one of Holt and Byrne's examples of *Rhinochimaera atlantica*.

	<i>Rhinochimaera atlantica</i> , Holt and Byrne.	<i>Rhinochimaera</i> sp. (present specimen.)	<i>Harriotta</i> sp. Alcock.
Total length ..	204	168 +	130 +
Total length of body and style ..	158	138	120
Length of membrane in front of body.	20	21	10 +
Length of body ..	94	77	64
Length of anterior narrow part of body.	25	20	17
Greatest total width ..	62 +	50	38 +
<i>Dorsal surface.</i>			
Width of anterior part of body	21	15	15
Width at neck ..	19	13	18
Greatest width of body ..	31 ca.	23.5	25
Width of style at origin ..	9	6	7.5
Width of style at its middle .	5	3.5	4.7
Width of posterior end of style	10	8.5	6.5
<i>Ventral surface.</i>			
Width between (including) ridges at anterior end.	13	10.5	8
Width between (including) ridges in front of patch of byssus.	19	15.5	12
Width between (including) ridges at neck.	15	13	11
Greatest width of body between (including) ridges.	25	19	17
Width of gutter between ridges 8 in middle of style.	? (very narrow)	1.5 mm.	5.3
Colour ..	Black.	Black.	Pale bottle green.
Patch of byssus	19 mm. square	14 mm. square	7.5 mm. square

Unfortunately both ends of the capsule are somewhat torn, the lateral margins are, however, entire and are, as usual, ridged—presenting in all from 48—50 ridges. The lateral lips of the mouth are smooth and free from the “ruffle-like serrulae” present in *Harriotta*.

The neck is distinct and narrower than either the head or body, a point in which it differs from Alcock's example of *Harriotta*, in which the neck is much less marked and, as will be seen by a reference to the preceding table, wider than the head portion.

The style is narrow and widens out posteriorly into a spatulate tip which is produced in a lanceolate tag of delicate membrane. On either side of the style close to the line of origin of the lateral membrane is a distinct ridge, the posterior two-thirds of which is transversely ribbed by the caudal pores. In this respect the capsule closely resembles that of *R. pacifica* (Bashford Dean : “Notes on the long-snouted Chimaeroids of Japan,” *Journ. Coll. Sci. Tokyo*, xix, Art. 4, p. 19, pl. ii, fig. 12a). The pores, however, are continued further forward along the style.

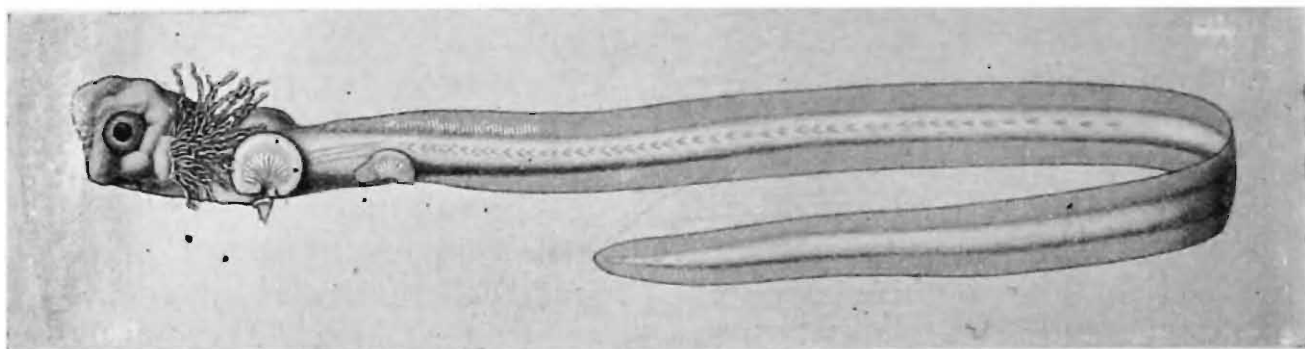
A point of difference between this specimen and other previously described examples of *Rhinochimaera* capsules is the presence,

on the posterior half of the rounded body, of a low but distinct median ridge on either side of which the body wall is pushed slightly inwards forming a shallow concavity.

The embryo when first obtained, was attached to a large yolk-sac, and the whole was floating in a creamy fluid caused in all probability by the fragmentation of the yolk as has been described by Dean (*l.c.*, p. 41) in the case of *Chimaera colliei*.

Unfortunately, it was impossible to examine the embryo in detail at the time of its capture and before an opportunity arose the embryo and yolk-sac had become separated, owing to the rupture of the yolk-duct.

The embryo had apparently reached very much the same stage as that shown in Bashford Dean's monograph (*l.c.*, plate viii, fig. 49). The first thing that strikes one is the extreme length of the tail. The total length of the embryo was 63.5 mm. and the distance between the anterior end and the anus 12 mm., hence the proportional lengths of body and tail are as 1:4.3. In this respect it presents a marked difference from the embryo of *Chimaera*



Embryo of *Rhinochimaera* sp., $\times 3$.

colliei, in which, according to Dean's figure (he does not give any measurements), the proportions are 1:3.1.

The head. As in *Chimaera* the most anterior part of the head is not formed by the olfactory region and fore-brain, but by a large projection, circular in outline when viewed from the side but compressed somewhat laterally, which probably represents the rudiment of the elongated snout of the adult.

Just posterior to this on the dorsal surface is a second rounded and much smaller projection (corresponding to the mid-brain) which is apparently not represented in *Chimaera* embryos, and this again is succeeded by a large and very thin-walled, semi-transparent projection—the hind brain.

The olfactory region forms a well-marked rounded prominence on the ventral aspect, and the olfactory pits have already become separated from the mouth, although a faint surface groove can be made out connecting them. Between the olfactory pits in the middle line a bilobed projection can be distinguished probably corresponding to the underlying rostral cartilage.

The mouth is large and has broken through, and is bounded posteriorly by a complete lower jaw, the two mandibles having united in the middle line, and the point of union being marked by a rounded backwardly directed projection.

The eyes are large and bulge prominently on each side of the head; their maximum diameter is 1.5 mm. and the interocular diameter of the head 3 mm. Below the eye, between it and the mouth, is a small and not very distinct depression, corresponding in position almost exactly with the aperture described by Dean (*l.c.*, p. 104, pl. viii, fig. 49 d) in *Chimaera* as the rudimentary spiracle—a most unusual situation for it, if this view be correct.

Balfour in his classical work on the development of the Elasmobranchs (Humphry and Turner's *Journal of Anatomy and Physiology*, vol. x, pl. xxv, M and M') has figured a young embryo of *Pristiurus*, which shows a well-marked triangular depression between the eye and the mouth in a situation precisely similar to Bashford Dean's "spiracle." (The true spiracle is shown to be present, much more posteriorly, between the eye and the 1st gill-cleft.) This depression, the morphological significance of which seems to have been erroneously interpreted by Bashford Dean, is apparently formed by the forward extension of the 1st visceral or mandibular arch on either side of the primitive mouth.

McIntosh and Prince (1890, p. 751) have shown that, in Teleosts, the mandibular arch, though originally single, subsequently splits into two, an anterior palato-quadrato portion and a posterior true mandibular part. The former, apparently, at a somewhat later date extends forwards below the eye on either side of the mouth and finally unites with the olfactory region of the snout. Judging from Balfour's figures and description (*l.c.*, p. 563) a precisely similar process occurs in *Pristiurus*.

What happens in *Chimaera* (and in all probability in *Rhinichimaera* also) is, so far as one can tell, that this palato-quadrato portion of the mandibular arch grows forwards and, when it reaches the lateral part of the olfactory region, fuses with it, leaving, as Bashford Dean has shown, an aperture between the mouth and the exterior just below the eye, in a position exactly analogous to the lachrymal duct in higher vertebrates. This canal subsequently disappears, only a trace of it being visible, as a shallow depression, in embryos that have reached a stage of development corresponding to Balfour's stage M in the shark (Balfour, *l.c.*, vol. x, pl. xxv). It is obvious from Bashford Dean's figures that his so-called "spiracle" lies not only in front of the mandible but even anterior to the palato-quadrato or maxillary offshoot from this arch and hence cannot possibly be the true homologue of the spiracle, *i.e.*, a gill-cleft immediately anterior to the 1st gill-arch between it and the mandibular arch.

The Gills. Five gill-arches are present and project markedly at the side of the head; they are fringed with long external gill-filaments in which the vein and artery can be distinctly made out

coiling spirally around each other. These filaments are much longer, apparently, than in *Chimaera colliei*, being at least twice the length of the interocular diameter of the head. In the fresh state they were covered with small masses of yolk that appeared to be more or less adherent to their surface.

There are only four gill-clefts actually present, for the 5th although being represented by a deep groove has apparently not yet broken through.

Anterior to and covering over the upper part of the 1st gill-arch is a delicate crescentic fold of membrane—the rudimentary operculum. This bulges out somewhat prominently from the side of the head and lying just above and in front of it and between it and the eye is a slight angular depression. Judging from its situation I should have, without hesitation, considered it to be the spiracle, but under the present circumstances one can only await further researches before definitely deciding on this point.

The Fins are well established and—in the case of the paired fins—remarkable for the degree of development to which they have already attained. The pectoral and ventral fins are folded dorsally so as to lie flat against the sides of the body and radiating fin-rays can be easily made out. The first dorsal fin is completely separate but as yet no trace of a dorsal spine exists. The second dorsal has not yet separated off from the remainder of the long median dorsal fin and is continuous around the extreme tip of the tail with the median ventral fin which extends as far forward as the posterior border of the paired ventral fins.

No trace of claspers could be detected, but possibly the specimen is a female.

Between the ventral fins is a small but distinct anal papilla.

The lateral line could be traced back to a point a short distance behind the ventral fins and traces could be made out on the head of the cephalic system of mucous canals.

The pedicle by which the embryo had been attached to the yolk-sac was broken but appeared to have been very short and of narrow diameter: it arose from the body midway between the two pectoral fins.

The *yolk-sac* appeared to be completely enclosed in the blastoderm and was roughly trilobed in shape: its dimensions were 25 mm. $\times$ 18 mm.

The main features in which this embryo differs from those of *Chimaera colliei* are as follows:—

1. The much greater length of the tail region.
2. The projection of the mid-brain dorsally.
3. The greater length of the gill-filaments.

The occurrence of this egg-case and embryo is of extreme interest, as it is, so far as I am aware, the first occasion on which an embryo of *Rhinochimaera* has been obtained, and it affords undoubted evidence of the occurrence of this genus in Indian waters.

Teleostei.*ACANTHOPTERYGII.***Trachichthys darwinii**, Johnson.

1895. Goode and Bean, p. 188, fig. 207.

1899. Alcock, p. 35.

A single specimen was obtained at Station 390. In the fresh state the colour was a uniform scarlet, fading to a pale silvery tint on the abdomen.

Family CYTTIDAE.

Antigonia capros, Lowe.

1887. Günther, p. 44.

1895. Goode and Bean, p. 229, fig. 235.

1899. Alcock, p. 44.

A single specimen was obtained at Station 389. The height of its body exactly equalled the length of body (without the caudal fin). Only three examples were known from previous "Investigator" researches, and in all four specimens slight differences existed from the figure given by Goode and Bean. The head, when viewed in profile, shows a well-marked convexity between the eyes, not a uniform concavity as they figure it, and the eye is distinctly larger.

In the two small specimens there is present a well-marked vertical black streak running upwards from the orbit.

Family ZOARCIDAE.

Neobythites macrops, Günther.

Three small specimens ranging from 86 to 135 mm. in total length (without caudal) and a single large example, 233 mm., were obtained at Station 391.

*PEDICULATI.***Lophius lugubris**, Alcock.

1899. Alcock, p. 55; and *Ill. Zool. Invest.*, Fishes, pl. xiv, fig. 1.

1908. Brauer, p. 314.

A single example, obtained at Station 391, is referred to this species. A careful comparison with Alcock's type specimens revealed a very close resemblance, the only appreciable difference being in the diameter of the eyes, which was considerably greater than in the type; but this may very possibly be due to shrinkage in Alcock's specimens caused by prolonged immersion in spirit.

Brauer (*l.c.*) obtained a single small specimen, which he considers must belong to this species, off the N. W. coast of Sumatra: he states that there were only two spines, instead of

three as described by Alcock, on the superior margin of the orbit. In all four specimens in the Indian Museum three spines are present in this situation, but the most anterior is smaller than the others and may conceivably be occasionally absent altogether.

Chaunax pictus, Lowe.

1899. Alcock, p. 58.

Three specimens, ranging from 59 to 137 mm. in length, were obtained at Station 391. In the smallest example the body was covered on the upper surface with large and indistinct dark spots; the mouth was almost completely occupied by a free tongue and the ventral fins arose at the bottom of two small pits on the ventral surface.

Halicmetus ruber, Alcock.

1899. Alcock, p. 66.

Ill. Zool. Invest., Fishes, pl. xix, fig. 5.

Six specimens, ranging in length from 35.3 to 69.3 mm., were obtained at Station 391.

An examination of these and other specimens—thirteen in all—in the Indian Museum reveals the fact that there is a very considerable degree of variation in the species in the relative proportions of the disc. In the following table I have given the results obtained by measuring the greatest breadth of the disc between the prominent lateral spines and comparing this with the total length (without the caudal fin):—

No. of specimen	1	2	3	4	5	6	7	8	9	10	11	12	13
Total length	45.7	44.5	44.5	29	40	75	40.5	58	55.5	42.3	55.5	59	35.5
Maximum breadth of disc.	37.6	34.5	33	21	28	52	27	38	34.5	25	32	34	17
Ratio	.. 1.22	1.3	1.35	1.38	1.42	1.44	1.5	1.5	1.6	1.69	1.73	1.74	2.09

Lloyd (1909, p. 171) has shown that a similar variation is present in the closely-allied genus *Malthopsis*.

Family GOBIIDAE.

Callionymus carebares, Alcock.

1899. Alcock, p. 73.

Ill. Zool. Invest., Fishes, pl. xx, fig. 4.

Two small specimens, obtained at Stations 388 and 389 respectively, are referred to this species.

Callionymus kaianus, Günther.

1887. Günther, p. 44, pl. xix, fig. B.

1899. Alcock, p. 74.

1907. Tate Regan, p. 248.

Two examples of this rare species, measuring respectively 93 and 96 mm. in length, were obtained at Station 389.

Tate Regan (*l.c.*) erroneously states that, previous to the Percy Sladen expedition, this species was known only from the type specimen; two examples, however, were obtained by the "Investigator" in Indian waters prior to the date of this expedition at Station 258, 23-iv-99—8° 23' 00" N., 76° 28' 00" E.—in 102 fathoms, and are recorded by Alcock (*l.c.*).

In the present specimens, as in the single example described by Tate Regan, the 1st dorsal fin ray is not prolonged as described by Günther in the type specimen: in all other respects, however, they agree both with the description and the two specimens already in the Indian Museum.

ANACANTHINI.**Macrurus nasutus**, Günther.

M. nasutus, 1877, Günther, p. 440.

" " 1887, Günther, p. 132, pl. xxx, fig. B.

M. brevirostris, 1889, Alcock, p. 393.

" " *Ill. Zool. Invest.*, Fishes, pl. xiii, fig. 3.

M. nasutus, 1899, Alcock, p. III.

M. brevirostris, 1908, Brauer, p. 263.

Two examples obtained at Station 391 are referred to this species. Though rare in Indian waters examples have been previously obtained and were described by Alcock under the name *M. brevirostris*. He subsequently, however, arrived at the conclusion that *M. brevirostris* was really only a synonym for *M. nasutus*, Günther.

Brauer has again tried to separate the two species and has pointed out several discrepancies between the two accounts. I have carefully compared all the specimens in the Indian Museum, which include one of the "Challenger" duplicates from Japan, and can find no difference between them.

As regards the points which Brauer mentions, I would point out that:—

1. The anus in the Challenger specimen is midway between the base of the ventral and the anal fins. In the Indian examples it may be either midway between or slightly nearer the ventrals.
2. The outer row of teeth in all the specimens is enlarged—as described by Alcock.
3. The number of scales between the 1st dorsal fin and lateral line is the same in all the specimens; between the 1st

dorsal ray and the lateral line, there are 7-8 rows, the lower five or six are large and resemble those found all over the body, the upper two rows are composed of small scales, about half the size of the others, and somewhat overlap the bases of the fin rays; between the last dorsal ray and the lateral line there are six rows of scales in all.

4. In all specimens the distance of the 2nd dorsal fin from the last spine of the 1st dorsal is approximately half the head length.
5. The 2nd spine of the 1st dorsal fin may vary somewhat in length and its extremity is very thin and easily broken. In all the specimens in which it was entire it is a trifle longer than the head length.

I have therefore come to the conclusion that all the specimens must be considered to belong to the same species, and that *M. nasutus* and *M. brevirostris* are mere synonyms.

Macrurus sp. and Coclorthynchus sp.

Several specimens belonging to these two genera were obtained at Station 391; unfortunately they were so badly damaged that specific determination was impossible.

Family PLEURONECTIDAE.

Boopsetta praelonga, Alcock.

Poecilopsetta praelonga, 1894, Alcock, p. 130, pl. vii, fig. 2.

Boopsetta praelonga, 1899, Alcock, p. 126.

Poecilopsetta maculosa, 1894, Alcock, p. 130, pl. vii, fig. 1.

Boopsetta maculosa, 1899, Alcock, p. 127.

Boopsetta praelonga, 1908, Brauer, p. 295.

Ill. Zool. Invest., Fishes, pl. xv, fig. 1; pl. xvii, fig. 5.

A single specimen, 12.5 cm. in length, was obtained at Station 391.

Brauer has expressed some doubt as to the distinction between this species and *B. maculosa*, Alcock. I have carefully examined all the specimens of both types in the Indian Museum and have come to the conclusion that there is no specific difference.

In the following table I have given the measurements of the only two examples of *B. maculosa* and for purposes of comparison have selected four examples of *B. praelonga* of as nearly as possible the same size.

	<i>B. maculosa.</i>		<i>B. praelonga.</i>			
Greatest length (without caudal) ..	8.65	7.4	8.37	8.1	7.25	7
Greatest breadth	4.25	3.95	4.0	?	3.45	3.5
Length of head ..	2.05	2.0	2.3	2.0	2.1	1.9
Diameter of eye ..	0.7	0.7	0.9	0.6	0.8	0.6
Length of snout ..	0.2	0.2	0.35	0.2	0.2	0.2
Length of right pectoral fin ..	0.5	0.4	1.25	0.8	1.0	0.9
Length of left pectoral fin	0.45	0.4	0.9	0.5	0.87	0.55
Length of ventral fin	0.85	0.7	0.8	0.6	0.6	0.7

From the above it is obvious that as regards the size of eye and the proportions of breadth to length it is quite impossible to draw any distinction between the two ; the other characters, such as the length of pectoral fins, though fairly constant, are hardly reliable since in both examples of *B. maculosa* these fins have a ragged and somewhat damaged appearance, and in a large proportion of the smaller specimens of *B. praelonga* the coloration of the upper surface is identical with that of the two examples of *B. maculosa*.

Solea umbratilis, Alcock.

1899. Alcock, p. 129.

Ill. Zool. Invest., Fishes, pl. xv, fig. 4.

Six specimens of this species, the largest measuring 72 mm. in total length, were obtained at Station 389.

HAPLOMI

Family SCOPELIDAE.

Chlorophthalmus corniger, Alcock.

1899. Alcock, p. 155.

1908. Brauer, p. 145.

Ill. Zool. Invest., Fishes, pl. xv, fig. 8.

A single specimen, measuring 11 cm. in total length (without the caudal fin), was obtained at Station 391 and was referred to this species.

*Scopelus*¹ *engraulis*, Günther.

1887. Günther, p. 197, pl. li, fig. c.

1899. Alcock, p. 161.

¹ An attempt has in recent years been made to change the generic name to *Myctophum*. For the purposes of this paper, however, I prefer to use the generally accepted and more widely known term *Scopelus*.

A large number of examples, the majority, unfortunately, in a badly damaged condition, were obtained at Station 391.

Brauer (1908, p. 217) has provisionally placed *S. engraulis* as a synonym of *S. (Myctophum) coeruleus*, Klunzinger.

Although agreeing very closely with the description of *S. coeruleus*, the specimens in the Indian Museum, which I refer to *S. engraulis*, differ in a few points, especially in—

- (1) The greater number of rays in the pectoral fin: in all examples there are 12 present, whereas in *S. coeruleus* there are only 10.
- (2) The greater relative length of the dorsal fin: this was invariably greater than the length of the anal fin, not *vice versa* as in *S. coeruleus*.

In the present state of our knowledge I consider that it is not advisable to unite the two species.

(I would remark in passing that the smaller of the two specimens referred by Alcock to *S. engraulis* and obtained at Station 115, 9-xii-90—11° 31' 40" N., 92° 46' 40" E.—188-220 fathoms, off the Andaman Islands, is undoubtedly an example of *S. (Myctophum) splendidus*, Brauer.)

APODES.

Family ANGUILLIDAE.

Coloconger raniceps, Alcock.

1899. Alcock, p. 196.

Ill. Zool. Invest., Fishes, pl. vii, fig. 4.

A single specimen measuring 19.1 cm. in total length was obtained at Station 391.

Uroconger lepturus (Richardson).

Congrus lepturus, 1844, Richardson, p. 106, pl. 56, fig. 1—6.

Uroconger lepturus, 1870, Günther, vol. 8, p. 44.

„ „ 1908, Brauer, p. 124.

Uroconger vicinus, 1899, Alcock, p. 200.

A single example, measuring 55 cm. in total length (including caudal), was obtained at Station 388 and was referred to this species. Brauer (*l.c.*) considers that the specimens obtained by Alcock and described by him under the name *U. vicinus*, Vaillant, are in reality not members of that species.

As he points out, in *U. vicinus* the proportion of head length to total length is 1:11, whereas Alcock gives it 1:7-8 in his specimens—a fact which I have verified.

The points on which Alcock relies to separate his examples from *U. lepturus* are: (1) the reduced number and larger size of the vomerine teeth; (2) the widely separated gill-openings; and (3) the increased distance from gill-opening to dorsal fin. Brauer

has shown that as regards the vomerine teeth, the number present in *U. lepturus* may vary from 1—3. Alcock's specimens all possess two which vary very considerably both in size and position.

The gill-openings are also separated by a distance somewhat greater than their long diameter, in this respect closely resembling Brauer's specimens, and as regards item 3 I can find no other reference to it in the literature at my disposal.

I give below measurements of my example and the two larger of Alcock's specimens, and for purposes of reference have also given Brauer's measurements of his example of *U. lepturus*:—

		<i>U. lepturus</i> , Brauer.	<i>U. vicinus</i> (?), Alcock.		<i>U. lepturus</i> , Sewell.
Total length	..	70	63	61	55
Greatest height of body	..	6·1	?	?	5·6
Length of head	..	9·8	7·7 +	8·3	8·5
Length of snout	..	2·7	2·25	2·25	2·3
Diameter of eye	..	1·4	1·25	1·25	1·15
Distance from snout to anus		26·5	22	22	24
Length of pectoral fin	..	3·9	3·4	3·4	3·15

One cannot help being struck by the very close agreement of these figures, the only marked difference being the head-length; this is in part due to a shorter snout length and also to a shrinkage of the soft parts in front of the gill-opening which causes these to gape somewhat. When it is considered that Brauer's and my measurements were taken on comparatively fresh specimens, whereas those obtained by Alcock have now been in spirit from 14—19 years, these slight differences lose any importance that might otherwise have been attributed to them.

I consider that all the specimens in the Indian Museum must be regarded as examples of *U. lepturus*.

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II NOTES ON DECAPODA IN THE INDIAN MUSEUM

III. THE SPECIES OBTAINED BY R.I.M.S.S. 'INVESTIGATOR' DURING THE SURVEY SEASON 1910-II.

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(Plate i.)

During the season 1910-II it was unfortunately only possible to make four hauls of the trawl in deep water ; but at one of the stations a large number of interesting Decapod Crustacea were obtained and, inasmuch as many of these species appear to be rare, we have thought it as well to draw up a few notes on the collection.

The only species hitherto undescribed is a Macruran of the genus *Merhippolyte*, the first representative of the family Hippolytidae which has yet been found in deep water off the coasts of India. A small crab, allied to the genus *Carcinoplax*, also seems to belong to a species as yet unknown ; this specimen is being referred to Col. Alcock and is not included in the present account.

Of the others in the collection perhaps the most interesting is the male of *Aristeomorpha rostridentata* (Bate), a species previously known from females only. *Pentacheles hextii* of Alcock is identified with the Atlantic and Mediterranean *Polycheles typhlops* and our knowledge of the distribution of several other scarce forms has been considerably extended.

The stations at which the collection was made are all situated off the S.W. coast of India ; they are—

St. 388. 26-iv-II. $7^{\circ} 44' 10''$ N., $76^{\circ} 35' 45''$ E. 670 fathoms.

St. 389. 27-iv-II. $9^{\circ} 01' 50''$ N., $75^{\circ} 55' 50''$ E. 81 „

A considerable number of corals (Caryophyllinae) were obtained at this station.

St. 390. 27-iv-II. $9^{\circ} 09' 00''$ N., $75^{\circ} 46'$ E. 260 fathoms.

On this occasion the net caught on a rock and was badly torn.
No Decapoda were taken.

St. 391. 27-iv-II. $9^{\circ} 14' 10''$ N., $75^{\circ} 45'$ E. 237 fathoms.

This haul was remarkable for the large number of the Gastropod, *Xenophora pallidula*, which were obtained. The majority of the Decapoda which form the subject of the present paper were found at this station.

Only a few of the more important papers dealing with deep-sea Decapoda are cited. The date appended to an author's name affords reference to the short bibliography at the end of the paper.

DECAPODA NATANTIA.

Tribe **Penaeidea.**

Family **PENAEIDAE.**

Sub-family **PENEINAE.**

Peneopsis coniger var. **andamanensis** (Wood-Mason).

Metapeneus coniger var. *andamanensis*, Alcock, 1901, p. 17, and 1906, p. 27, pl. iv, fig. 13.

Peneopsis coniger var. *andamanensis*, de Man, 1911, p. 61.

Eleven males and nineteen females were obtained at St. 389.

The distinctions between the variety and the typical form which are afforded by the thelycum are well marked and apparently constant. The form found in the variety has been illustrated by Alcock and we take this opportunity of giving a similar figure of the thelycum of the typical *P. coniger* (pl. i, fig. 7).

In males we have been unable to detect the pair of spines which de Man mentions at the base of the second peraeopods.

Parapeneus rectacutus (Bate).

Peneus (*Parapeneus*) *rectacutus*, Alcock, 1901, p. 17, and *Ill. Zool. Invest.*, Crust., pl. xlix, fig. 5.

Parapeneus rectacutus, Alcock, 1906, p. 33, pl. vi, figs. 19, 19a-b, and de Man, 1911, pp. 78, 82.

A much damaged female from St. 391 may safely be referred to this species. The station represents the most westerly point at which *P. rectacutus* has been observed.

With reference to de Man's notes on this species (*loc. cit.*, p. 82) we would observe that the minute rudiments of exopods on the thoracic legs, mentioned by Wood-Mason and Alcock (1891, p. 274), can be detected in examples preserved in the Indian Museum. The ridge defining the anterior part of the cervical groove agrees precisely with Alcock's figure, but in some females the spine which is stated to occur on the basis of the second peraeopods appears to be missing. The last pair of legs fails to reach to, or slightly exceeds, the apex of the antennal scale. There is no sharp spine at the distal end of the lobes of the petasma.

Haliporus aequalis, Bate.

Haliporus aequalis, Alcock, 1901, p. 23, and de Man, 1911, p. 32.

Seven males and fourteen females were obtained at St. 391.

***Aristaeus semidentatus*, Bate.**

Aristaeus semidentatus, Alcock, 1901, p. 31, and *Ill. Zool. Invest.*, Crust., pl. xlix, fig. 3.

? *Aristeus semidentatus*, de Man, 1911, p. 29.

Six males and eleven females were obtained at St 391. They agree precisely with Alcock's account and with other specimens in the Museum collection. The pleurobranchs in advance of somite xiv are the merest rudiments, minute papillae without trace of pinnae.

It would appear doubtful whether the specimens obtained by the 'Siboga' really belong to this species, for de Man states that the pleurobranchs above the base of the first four pereopods are "distinct filaments, similar to those of *A. virilis*"; whereas the difference in this respect between the present specimens and the examples which Alcock referred to *A. virilis* is most marked.

***Hemipeneus crassipes* (Wood-Mason).**

Hemipeneus crassipes, Wood-Mason and Alcock, 1891, p. 281, fig. 7; Alcock, 1901, p. 33, and *Ill. Zool. Invest.*, Crust., pl. xlix, figs. 1, 2.

A single male, 77 mm. in length, was found at St. 388.

Among the males of this species preserved in the Indian Museum, two different types of modification are observed in the ultimate and penultimate segments of the external maxillipeds. The differences are shown in pl. i, figs. 8 and 9. In one form (fig. 9), that which is shown in the 'Investigator' illustrations, the penultimate segment is cylindrical and swollen and the ultimate segment is dilated at the base with the distal part curved outwards and provided with a spatulate tip. In the other type (fig. 8) the penultimate segment is flatter and less swollen and is produced distally as a strong acuminate process in front of the insertion of the ultimate joint. The latter is curved as in the type figured by Alcock; but it is not dilated at the base.

It is with the second of these two types that the specimen from St. 388 corresponds, and it is possible that the form deserves recognition as a distinct variety. The material at our disposal is not, however, in good condition and we are content to leave the matter pending the acquisition of further specimens.

***Aristaeomorpha rostridentata* (Bate).**

Aristaeus (Aristaeomorpha) rostridentata, Alcock, 1901, p. 39, and *Ill. Zool. Invest.*, Crust., pl. ii, fig. 1.

Two males, obtained at St. 391, unquestionably belong to the same species as the female example recorded by Alcock and Wood-Mason under the name of *A. rostridentata*, and there can be

little doubt that all are correctly referred to the species described in the 'Challenger' Report.

The resemblance of the species to the well-known Mediterranean form, *A. foliacea* (Risso), is very striking and Bouvier in his account of the Peneidae collected by the Prince of Monaco (1908, p. 56) was unable to determine the distinctions with any degree of precision. On comparing the two species, however, several characteristic differences may be observed.

The rostrum in both sexes is shorter in *A. rostridentata* than in specimens of *A. foliacea* of larger size. In the single female example of the former species, the rostrum trends more strongly upwards towards the apex than in specimens of *A. foliacea* of the same sex, while in male *A. rostridentata* it reaches only to the end of the basal joint of the antennular peduncle and its lateral carina is straight, or slightly concave ventrally, showing no trace of the sinuosity seen in male *A. foliacea*.

But perhaps the most important distinction is to be found in the areolation of the carapace. The pterygostomian region is much broader in proportion to its length in *A. rostridentata* than in *A. foliacea* and the same is true of the branchial region, though the differences in this case are not so well-marked. In *A. rostridentata* the length of the pterygostomian region (measured from the antero-lateral margin of the carapace to the postero-dorsal end of the hepatic groove) does not exceed 2.5 times its greatest breadth, while it is more than 3.5 times as long as broad in *A. foliacea* (cf. figs. 5 and 6, pl. i). The ridge defining the upper boundary of the branchial region is, moreover, slightly less sinuous in the Indo-Pacific species.

The specimens examined yield the following measurements (in mm.) :—

	<i>A. rostridentata</i> (Bate).			<i>A. foliacea</i> (Risso).			
	♀	♂	♂	♀	♀	♀	♂
Sex	♀	♂	♂	♀	♀	♀	♂
Total length	149	ca. 125	ca. 119	ca. 215	ca. 215	170	137
Length of rostrum	29	11.5	10.5	45+	49+	41+	14
Length of carapace	43	40.5	37	57	55.5	41	38.5
Length of pterygostomian region	17.3	16.5	15.7	25.5	23.5	18.3	17
Breadth of pterygostomian region	7.3	7.2	7	6.5	6.5	4.5	4.5
Ratio of length to breadth of pterygostomian region.	2.4	2.3	2.2	3.9	3.6	4.0	3.8

In other respects there appears to be an extremely close resemblance between the two forms, but the dactyli of the last two pairs of peraeopods, which, in the specimens of *A. rostridentata*, are unfortunately broken off in all but two instances, appear to be longer than in *A. foliacea* and measure more than half the length of their respective propodites. The telson, also,

seems to be longer in *A. rostridentata* than in *A. foliacea*. In the former species it reaches exactly to the apex of the inner uropod, the slightly greater length shown in the 'Investigator' Illustrations being due in all probability to a perspective effect.

We have been unable to find any distinctions between the two species in regard to the form of the oral appendages or of the thelycum and petasma.

Bouvier (*loc. cit.*, p. 53) states that the branchial formula of *Aristaeomorpha* is the same as that of *Benthescymus*; but Alcock notes the presence of two arthrobranchiae at the base of the penultimate pair of pereopods, which, according to Bouvier's account (*l. c.*, p. 17), do not occur in the latter genus. Examination of the specimens in the Indian Museum shows that these branchiae occur both in the Indo-Pacific and in the Mediterranean species of *Aristaeomorpha*.

In the Indian Museum no specimen of *Aristaeomorpha* can be found bearing the name *A. giglioliana*, but the example figured by Wood-Mason under this name is undoubtedly that which is preserved in the collection with the label "'Washington,' St. xiv, 13-viii-81; 39° 01' 28" N., 9° 30' 19" E. 772 metres. Enrico H. Giglioli." It is evident that Wood-Mason figured this specimen from the Mediterranean for comparison with *A. rostridentata*, but his reasons for assigning it a new specific name remain obscure, for he never published any description. The measurements of the specimen, a female 170 mm. in length, are shown on p. 18; it is unquestionably an example of *A. foliacea*.

Family SERGESTIDAE.

Sergestes bisulcatus, Wood-Mason.

Sergestes bisulcatus, Alcock, 1901, p. 49; *Ill. Zool. Invest.*, Crust., pl. 1, figs. 1, 1a-b, and Stebbing, 1905, p. 87, pl. xxiv A.

A small female, about 46 mm. in length, is referred to this species. It was obtained at St. 388 and was almost certainly caught during the ascent of the trawl.

S. bisulcatus is very closely allied to the Atlantic *S. robustus*, Smith, but is readily distinguished by the sharply cut cervical groove, which is specially distinct on the dorsum of the carapace.

Tribe Caridea.

Family PASIPHAEIDAE.

Sympasiphaea annectens, Alcock.

Sympasiphaea annectens, Alcock, 1901, p. 63, and *Ill. Zool. Invest.*, Crust., pl. lii, fig. 7.

A large female, 91 mm. in length, was obtained at St. 388.

The rostrum is more strongly elevated at the apex than in the type and the epipod at the base of the second maxilliped,

though small, is well formed and could hardly be described as a mere papilla.

Hitherto this species was only known from a single specimen ; but a third example is preserved in the Museum collection. This specimen measures 76 mm. in length and was obtained at St. 297. 13-iv-02. Gulf of Oman; $25^{\circ} 11' 30''$ N., $57^{\circ} 15'$ E. 689—700 fathoms.

Family *HOPLOPHORIDAE*.

Hoplophorus gracilirostris, A. Milne-Edwards.

Hoplophorus gracilirostris, Alcock, 1901, p. 73.

A single male, about 55 mm. in length, was taken at St. 391.

Family *PANDALIDAE*.

Pandalus (Plesionika) martius, A. Milne-Edwards.

Pandalus (Plesionika) martius, Alcock, 1901, p. 95.

Three damaged specimens, one an ovigerous female, appear to belong to this species. They were obtained at St. 391.

Heterocarpus gibbosus, Bate.

Heterocarpus gibbosus, Alcock, 1901, p. 103.

Three small specimens were found at St. 391. In all these examples the rostrum is considerably longer than in adults and exceeds the median length of the carapace.

Family *HIPPOLYTIDAE*.

Merhippolyte calmani, sp. nov.

(Pl. i, figs. 1—4.)

The general form is slender and the surface of both carapace and abdomen is glabrous and without trace of punctation. The rostrum is twice, or rather more than twice, the length of the carapace, straight to the end of the second joint of the antennular peduncle and thence to the apex very strongly ascendant. The vertical height of the apex above the dorsal line of the carapace continued forwards is about equal to the carapace-length. At its base the rostrum is armed with three large and almost equidistant teeth; the median one is situated directly over the orbit, while the anterior one reaches about to the end of the eyes. At the extreme apex there is a small dorsal tooth but the upper margin between this point and the eyes is wholly unarmed. On the ventral edge there are ten teeth, large and closely set towards the base, smaller and more distant towards the apex. Between the proximal teeth of both margins there are a few setae. All the teeth are fixed. The rostral carina is continued backwards

on the carapace and disappears before reaching the posterior third. The antero-inferior angle of the carapace is rectangular—not spinous (fig. 4).

The abdominal terga are all smoothly rounded dorsally. The sixth somite is longer than the telson excluding its terminal setae and is more than twice the length of the fifth. The telson is a little shorter than the inner uropod; its apex is very narrow and is furnished with two pairs of spines the outer of which is more than twice the length of the inner. The upper surface of the telson is slightly flattened and is provided with two pairs of dorso-lateral spinules. There is no movable spine at the base of the uropods.

The cornea of the eye is greatly expanded; it is much wider than the stalk and its breadth is fully a quarter the median length of the carapace. In the entire absence of an ocellus the species differs markedly from *M. agulhasensis*.

The antennular peduncle reaches to about half the length of the antennal scale. The basal joint is long and bears a sharply-pointed lateral process which reaches nearly to its distal end; the second and third segments are very short and subequal. The antennal scale is distinctly shorter than the carapace. Its outer margin is slightly concave and terminates in a short spine which fails to reach the apex of the lamella.

The mandible is provided with a large incisor process and a three-jointed palp. The basal segment of the latter is distinctly longer than the second (fig. 3). The first and second maxillipeds each possess an exopod and an epipod and the second maxilliped in addition bears a large podobranch. The third maxilliped also possesses both an exopod and an epipod, the former reaching to about half the length of the antepenultimate segment.

The first peraeopod reaches almost to the end of the antennular peduncle; the carpus is about the same length as the chela and the fingers are less than half the length of the palm. On the internal surface of the carpus near its distal end is an excavated notch, margined with setae and having a stout spine at its proximal end. The apparatus resembles a comb and is perhaps used for cleaning the antennae or other appendages (fig. 2).

The second peraeopods reach beyond the end of the antennal scale by almost the whole length of the propodus. The carpus is composed of 14 or 15 segments, the ultimate of which is only a trifle shorter than the chela.

The third peraeopod reaches beyond the apex of the scale by the length of the dactylus. At the distal end of the merus are two stout spines. The fourth peraeopod reaches only to the end of the antennular peduncle and is shorter than the fifth which reaches to the tip of the spine at the distal end of the antennal scale—on the distal half of the merus of these two last pairs there are a few large spines the number of which seems subject to considerable variation. The dactyli of the last three pairs bear from four to six strong spines.

The branchial formula is as follows:—

		VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Pleurobranchiae	..	..	..	..	I	I	I	I	I
Arthrobranchiae	..	..	..	2	I	I	I	I	..
Podobranchiae	..	..	I	..	..	..	..	..	..
Epipods	..	I	I	I	I	I	I	I	

So far as we are aware only two species belonging with certainty to this genus have been described, *M. agulhasensis*, Bate, the type of the genus, and *M. orientalis*, Bate. Calman, in his valuable contribution to our knowledge of this family (1906), has pointed out that Hodgson's *M. australis* is in reality a species of *Nauticaris* and has also suggested that Milne-Edward's *Hippolyte spinifrons*, which G. M. Thomson referred to *Merhippolyte*, is in all probability a species of *Alope*. With this suggestion we were inclined to concur; but Chilton (1911, p. 547) has recently recorded four specimens of *M. spinifrons* from the Kermadec Is. and it is clear from his paper that the species is quite distinct from *Alope palpalis*. *M. spinifrons*, however, still stands in urgent need of redescription.

From both the species in the 'Challenger' Report and from *M. spinifrons* the present species is readily distinguished by the peculiar form of the rostrum and by many other less conspicuous characteristics. Though it agrees almost exactly with Miss Rathbun's account of *Spirontocaris kawaiensis* from the Hawaiian Islands (1906, p. 913) the resemblance must be entirely superficial. The carpus of the second peraeopods in *Spirontocaris* is composed of only six or seven segments and it is to be assumed that such a number occurs in *S. kawaiensis*—it is not mentioned in the description. Apart from this feature the two genera are readily distinguished by the gill-formula and by the number of segments in the mandibular palp.

Two specimens of *Merhippolyte calmani*, 50 and 56 mm. in length, were obtained at St. 391. Both examples are female and in the larger, which is ovigerous, the eggs measure .46 × .39 mm. in their longer and shorter diameters.

Family CRANGONIDAE.

Aegeon (*Parapontocaris*) *bengalense*, Wood-Mason.

Aegeon (*Parapontocaris*) *bengalense*, Alcock, 1901, p. 122, and *Ill. Zool. Invest.*, Crust., pl. ix, fig. 1.

Two male specimens, measuring 29 and 30.5 mm. in length, were obtained at St. 391.

Except for the customary sexual distinctions in the second pair of pleopods and in the outer ramus of the antennular peduncle, the specimens closely resemble the females described by Alcock we would note, however, that in both sexes there are very frequently two or three spines on each carina of the sixth abdominal somite in addition to the terminal one.

Two other samples of this species, hitherto unrecorded, are preserved in the Indian Museum—

St. 136. 4-v-92. $15^{\circ} 41' N.$, $72^{\circ} 43' E.$ 444 fathoms. One female; about 41 mm. in length. Regd. No. $\frac{7056}{10}$.

St. 279. 18-iii-11. $11^{\circ} 35' 15'' N.$, $80^{\circ} 02' 15'' E.$ 300 fathoms. Two males, four females (one ovigerous); 30—48 mm. in length. Regd. Nos. $\frac{4080-5}{10}$.

DECAPODA REPTANTIA.

Tribe Eryonidea.

Family ERYONIDAE.

Genus POLYCHELES, Heller.

The majority of recent authors have not followed Spence Bate in the recognition of distinct genera, *Polycheles* and *Pentacheles*, and there can be no doubt that, as many subsequent authors have shown, the distinctions employed in the 'Challenger' Report are untenable.

Alcock, however, in 1901 again recognized the two separate genera, distinguishing them by the characters afforded by the epipodites of the third maxillipeds and of the peraeopods. Unfortunately at the date when he was writing, little was known as regards these structures in the case of *Polycheles typhlops*, the type of the genus *Polycheles* and the first recent species of Eryonidea to be described.

By actual comparison of specimens we have been able to convince ourselves that Alcock's *Pentacheles hextii* must be regarded as a synonym of *Polycheles typhlops* and this, if two genera are to be recognized, necessitates the transposition of the names *Polycheles* and *Pentacheles* as applied by him. In *P. typhlops* the epipod at the base of the third maxilliped is small; but the distinction in this respect between the genera seems of little moment. More important by far is the condition of the epipods at the base of the peraeopods and in *P. typhlops* these structures agree precisely with those of specimens which Alcock referred to *Pentacheles* and with the account contained in his description of that genus.

Faxon, however, in 1895 (p. 118) remarks that "an examination of a large number of species discloses a gradual transition in the development of the epipods from large well-developed organs, through small, delicate thin ones, to merest rudiments

in the shape of small expansions at the base of the stem of the gill." While this is not the case with the Indian species—Alcock found that they fell readily into two groups—the passage quoted above, coming as it does from a high authority on crustacean morphology, seems to show that the two groups merge in the Eastern Pacific and we propose, therefore, to combine once more the genera *Polycheles* and *Pentacheles*.

***Polycheles typhlops*, Heller.**

Polycheles typhlops, Heller, 1862, p. 389, pl. i, figs. 1—6, and Senna, 1903, p. 332, pl. xviii, figs. 1—11.

Pentacheles hextii, Alcock, 1894, p. 237; 1901, p. 172, and *Ill. Zool. Invest.*, Crust., pl. x, fig. 2.

One female, 70 mm. in length, was obtained at St. 391.

This specimen agrees in all its characters with examples described by Alcock under the name of *P. hextii*; but we are of the opinion that the form which has received this name is identical with the older *Polycheles typhlops* of Heller, a species hitherto known only from the Mediterranean and East Atlantic.

We have closely compared specimens of *P. hextii* with two examples of *P. typhlops* obtained by the 'Talisman' expedition off the Cape Verde Islands and with a large drawing of a specimen from the W coast of Ireland. The only difference that we have been able to discover is that the epipod at the base of the outer maxillipeds is a trifle larger in the Atlantic specimens; but the spinulation and proportions of examples from the two localities and the peculiar character of the orbit correspond so precisely that the specific identity of the two forms cannot be doubted.

The species affords yet another illustration of the wide-spread distribution of many deep-sea Crustacea.

***Polycheles phosphorus*, Alcock.**

Polycheles phosphorus, Alcock, 1901, p. 168, and *Ill. Zool. Invest.*, Crust., pl. viii, fig. 2.

A female, 74 mm. in length, was found at St. 388.

***Anomura*.**

Tribe Galatheidea.

Family GALATHEIDAE.

***Munida microps*, Alcock.**

Munida microps, Alcock, 1901, p. 240, and *Ill. Zool. Invest.*, Crust., pl. xiii, fig. 5.

A single male, 36 mm. in length when fully extended, was obtained at St. 388.

Munida andamanica, Alcock.

Munida andamanica, Alcock, 1901, p. 242, and *Ill. Zool. Invest.*, Crust., pl. xii, fig. 2.

Two females and one male were taken at St. 391. The length of the specimens, when fully extended, ranges from 38 to 52 mm. ; the largest example is an ovigerous female. To the abdominal sterna of the two smaller individuals an interesting parasitic Isopod, belonging to the family Liriopsidae, is attached.

Family *UROPTYCHIDAE*.

Ptychogaster investigatoris, Alcock and Anderson.

Ptychogaster investigatoris, Alcock, 1901, p. 281, and *Ill. Zool. Invest.*, Crust., pl. xlv, fig. 1.

One female, slightly larger than the type and only other known specimen, was found at St. 391. The two individuals are in closest possible agreement.

Tribe **Paguridea**.

Family *PAGURIDAE*.

Sub-family *PAGURINAE*.

Paguristes puniceus, Henderson.

Paguristes puniceus, Alcock, 1905, p. 38, pl. iii, fig. 6, and *Ill. Zool. Invest.*, Crust., xxxii, fig. 1.

Fourteen specimens, three of which are ovigerous females, were obtained at St. 391. The majority inhabited shells of *Xenophora pallidula* ; but one was found in *Ranella perca*, and one in a species of *Pleurotoma*.

Two females are parasitized by *Peltogaster*, a genus of Rhizocephala not hitherto recorded from Indian seas.

Sub-family *EUPAGURINAE*.

Parapagurus andersoni, Henderson, var. **brevimanus**, Alcock.

Parapagurus andersoni var. *brevimanus*, Alcock, 1905, p. 103.

Two males, inhabiting shells of *Solariella infundibulum*, were found at St. 388.

Tomopaguroopsis lanata, Alcock.

Tomopaguroopsis lanata, Alcock, 1905, p. 137, pl. xiii, fig. 4.

A single male was obtained at St. 391 in a shell belonging to the genus *Pleurotoma*.

Sympagurus arcuatus, Milne-Edwards and Bouvier,
var. **monstrosus**, Alcock.

Sympagurus arcuatus var. *monstrosus*, Alcock, 1905, p. 104, pl. x, fig. 5.

Six specimens in *Cancellaria cretacea*, Smith, *Pleurotoma* sp. and in other gastropod molluscs, were taken at St. 391. The majority of the shells are encrusted by an anemone.

Nematopagurus indicus, Alcock.

Nematopagurus indicus Alcock, 1905, p. 109, pl. xii, fig. 4.

Two specimens, a male and an ovigerous female obtained at St. 391, are referred to this species.

They agree with Alcock's description and with the type specimens in every particular except the eyes. These extend only to the end of the proximal third of the ultimate segment of the peduncle and are slightly shorter and very distinctly stouter than in the type. We have been unable to find any other distinctions and we are convinced that the specimens are correctly referred to this species.

Bouvier (1900, pp. 194, 198, and 1894, p. 69, pl. xi, figs. 2—6) has shown that in *Sympagurus bicristatus*, Milne-Edwards, and *S. gracilipes*, Milne-Edwards, there is considerable variation in the size of the eye. In the case of the former species Bouvier notes that in examples from comparatively shallow water the cornea is as a rule more dilated than in those from greater depths; in *S. gracilipes*, however, he is of the opinion that no such correlation exists.

The present specimens were found in 237 fathoms and it is interesting to note that in these examples the eyes are more dilated than in the type specimens obtained at a depth of only 102 fathoms. The case, so far as the evidence goes, is therefore precisely the reverse of that found in *S. bicristatus*; but many instances of a parallel development in one direction or the other might be cited and it is no more difficult to believe that a shallow water species migrating to greater depths would find it more advantageous to increase its corneal area than that another species also migrating in a similar manner should in this respect, retrogress, finding that its other senses rendered ocular vision a secondary consideration.

The specimens were found in shells of *Nassaria coromandelica*, Smith.

Brachyura.

Tribe **Dromiacea.**

Family **HOMOLIDAE.**

***Homola megalops*, Alcock.**

Homola megalops, Alcock, 1899, p. 9; 1901, p. 62, and *Ill. Zool. Invest.*, Crust., pl. xiv, figs. 1, 1a.

Nineteen males and ten females (five ovigerous), ranging in length of carapace from 12.5 to 54 mm., were obtained at St. 391.

Many of these specimens are of considerably greater size than those which afforded Alcock material for his original description and we notice that *large* males differ from his account in the following features:—

The chelipeds are both longer and stouter; the merus and carpus are distinctly broader than the meri of the ambulatory legs and the chela may reach to the end of the propodus of the **next limb**.

The whole under surface of the chela, except for the extreme tips of the fingers, is clad in a thick and deep, dark brown velvety pubescence which is not present in females.

The palm is very conspicuously longer than the dactylus and at the base of the latter, on the inner edge, there is a stout tooth which is not found in females or young males.

The spines on the anterior region of the carapace, though always distinct, are less prominent in large individuals.

Measurements of the carapace (including rostrum) and chelipeds of forty-two examples of this species, show that whereas in the female the growth of the cheliped is proportional to that of the carapace throughout the whole period of its existence, this, as in many other species of *Brachyura*, is by no means the case with the male. In young examples of the latter sex, in which the carapace does not exceed 30 mm. in length, the cheliped has the same proportions as in females; but, as growth continues, there is a relatively greater increase in the length of the chelate leg. In females and young males the proportion of cheliped-length to carapace-length is approximately 1.5, whereas in large males it may reach as much as 2.0.

This marked difference between the sexes is illustrated in the accompanying figure (p. 28).

Tribe **Oxystomata.**

Family **DORIPPIDAE.**

***Ethusa andamanica*, Alcock.**

Ethusa andamanica, Alcock, 1899, p. 33, and *Ill. Zool. Invest. Crust.*, pl. xiv, fig. 8.

It is with some doubt that a single ovigerous female from St. 391 is referred to this species.

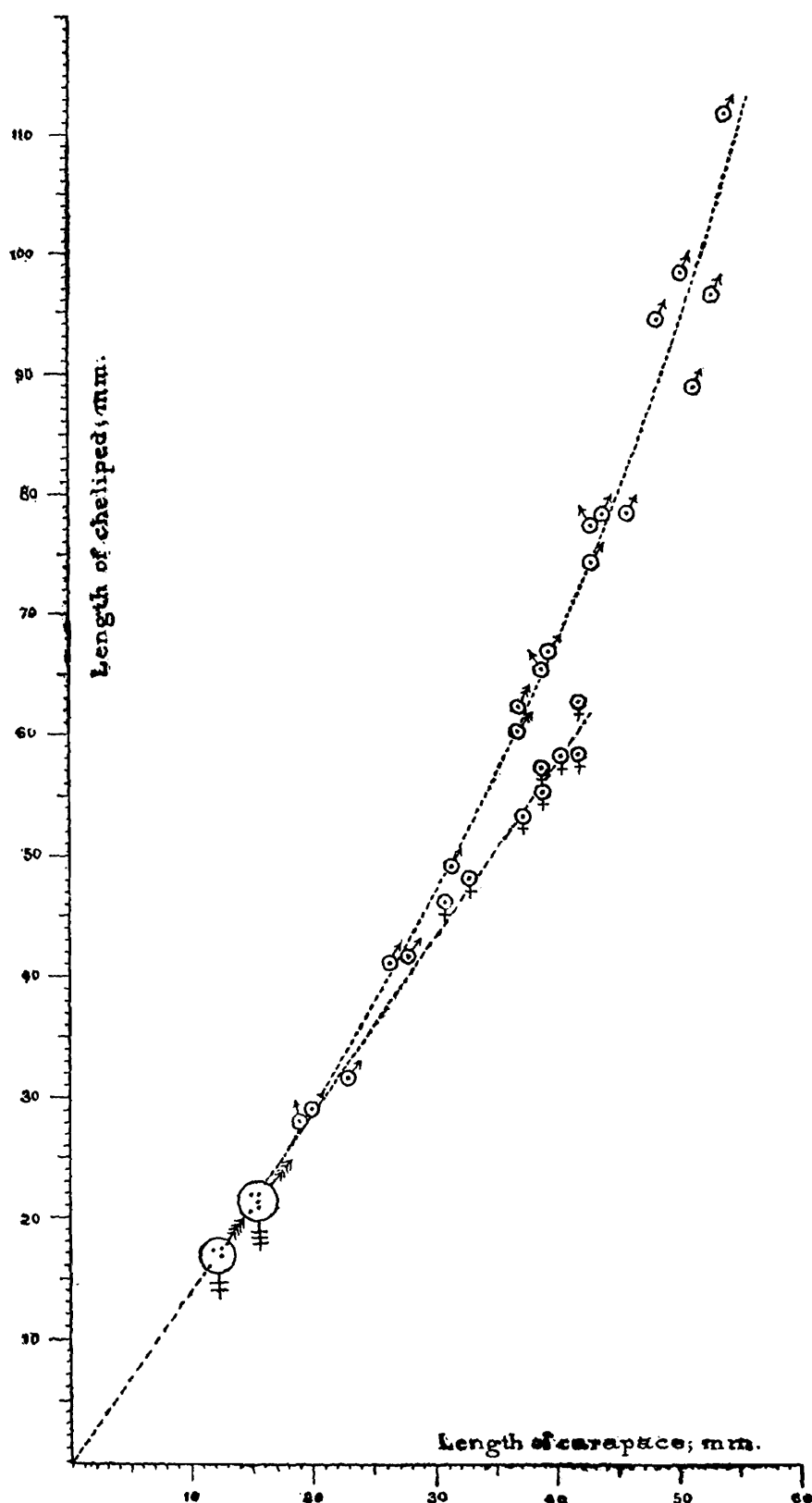


Diagram showing the relation between length of carapace and length of cheliped in forty-two examples of *Homola megalops*. The two large circles at the base of the curve represent respectively, the upper circle four males and three females, the lower four males and two females.

The carapace, which is 10 mm. in length, corresponds closely with that of Alcock's types; but it is perhaps not quite so strongly narrowed anteriorly.

The posterior parts of the carapace and the whole frontal border are beset with long setae and in the possession of such an investment on the former region the specimen approaches *E. hirsuta*, McArdle (1900, p. 474, and *Ill. Zool. Invest.*, Crust., pl. lxxii, fig. 1, 1a). In *E. hirsuta*, however, the external orbital spines are longer than in *E. andamanica* and have a different form, though they do not always reach beyond the tips of the frontal teeth as stated in McArdle's description. The external orbital angle is much broader in *E. andamanica* than in *E. hirsuta* and its internal margin is markedly sinuous in the former, straight or slightly concave in the latter.

Except for the hairs on the cardiac and branchial regions we are unable to differentiate our specimens from the types of *E. andamanica* and the possibility that such a character was originally present in the latter specimens, but was lost before they were examined, cannot be overlooked.

The species which Doflein (1904, p. 27, pl. xiii, figs. 7, 8) describes under the name of *E. andamanica* seems to differ in several material respects from the type specimens of that species. In the original examples the external orbital angle is decidedly broader than is shown in Doflein's figures and the dactyli of the second and third peraeopods are longer than their propodites.

Family RANINIDAE.

Lyreidus channeri, Wood-Mason.

Lyreidus channeri, Alcock, 1899, p. 38, and *Ill. Zool. Invest.*, Crust., pl. lxxiii, figs. 1, 1a.

A single specimen, with carapace 19 mm. in length, was obtained at St. 391.

Family CALAPPIDAE.

Mursia bicristimana, Alcock and Anderson.

Mursia bicristimana, Alcock, 1899, p. 23, pl. iii, fig. 3.

Eight specimens, ranging in length of carapace from 10.5 to 23 mm., were obtained at St. 391. Doflein (1904, p. 41) regards this form as merely a sub-species of De Haan's *M. armata*.

Family LEUCOSIIDAE.

Randallia lamellidentata, Wood-Mason.

Randallia lamellidentata, Alcock, 1899, p. 26, and *Ill. Zool. Invest.*, Crust., pl. v, figs. 5, 5a—b.

Nine males 13—23 mm. in length, and one huge ovigerous female, measuring 35 mm., were obtained at St. 391. The latter

specimen, the only known example of its sex, differs from the males in the following features:—

1. The spine on the carapace at the posterior end of the intestinal region is blunt—little more than a tubercle—and cannot be said to overhang the posterior margin.
2. The lamelliform teeth which fringe the lateral and posterior margins of the carapace are much less conspicuous.
3. The 4th—6th abdominal terga are fused and the sutures partially obliterated; but the telson is freely movable. All the segments are covered with vesiculous granules and at the distal end of the sixth there is a blunt tubercle comparable with that found in the male but by no means so evident.
4. The coxal joints of all the legs are elevated on either side of the abdomen and form a thin outstanding crest.

The close-set tubercles which cover both surfaces of the chelipeds and the upper portions of the merus, carpus and propodus of the ambulatory legs are in both sexes much more conspicuous than is shown in plate v of the “Investigator” Illustrations.

Tribe **Brachygnatha.**

Family **GONOPLACIDAE.**

Sub-family **CARCINOPLACINAE.**

Psopheticus stridulans, Wood-Mason.

Psopheticus stridulans, Alcock, 1899, p. 73; 1900, p. 309, and *Ill. Zool. Invest.*, Crust., pl. v, fig. 1.

One specimen, a female with carapace 11 mm. in length, was found at St. 391. *P. stridulans* has, hitherto, only been recorded from the Andaman Sea and S. W. of the Great Nicobar.

Family **MAIIDAE.**

Sub-family **INACHINAE.**

Physachaeus ctenurus, Alcock.

Physachaeus ctenurus, Alcock, 1899, p. 40; *Ill. Zool. Invest.*, Crust., pl. xviii, figs. 1—1b, and Doflein, 1904, p. 71, pl. xxiv, figs. 1—4, pl. xlii, figs. 1—7, pl. xlvi.

Two males and one ovigerous female were obtained at St. 391.

Sub-family **PISINAE.**

Sphenocarcinus aurorae, Alcock.

Sphenocarcinus aurorae, Alcock, 1899, p. 84.

Twelve males and fifteen females (ten ovigerous) were obtained at St. 391. A drawing of this species, which has not hitherto been figured, will be found on pl. i, fig. 10.

Sub-family MAIINAE.

Maia gibba, Alcock.

Maia gibba, Alcock, 1899, p. 56, and *Ill. Zool. Invest.*, Crust., pl. xxi, figs. 5, 5a.

Ten specimens, ranging from 18 to 40 mm. in the length of the carapace and rostrum, were found at St. 391.

In the smaller examples four spines in the median line of the carapace are decidedly longer than in larger individuals, in which they are scarcely distinguishable from the general tuberculation of the surface. In young specimens also five spines on the lateral margin of the carapace are more conspicuous than in the adult and thus resemble *M. miersi*, Walker (1890, p. 113, pl. vi, figs. 1—3), though the distinctions between the species still remain quite definite.

Maia gibba was hitherto known only from the three type specimens obtained in the Andaman Sea.

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EXPLANATION OF PLATE I.

Merhippolyte calmani, sp. nov.

- FIG. 1.—Lateral view of one of the type specimens, $\times 2\frac{1}{2}$.
,, 2.—Carpus of the first peraeopod showing the excavation on the internal margin.
,, 3.—Mandibular palp.
,, 4.—Antero-lateral margin of carapace.

Aristaeomorpha foliacea (Risso).

- FIG. 5.—Carapace of a male in lateral view.

Aristaeomorpha rostridentata (Bate).

- FIG. 6.—Carapace of a male in lateral view.

Peneopsis coniger (Wood-Mason).

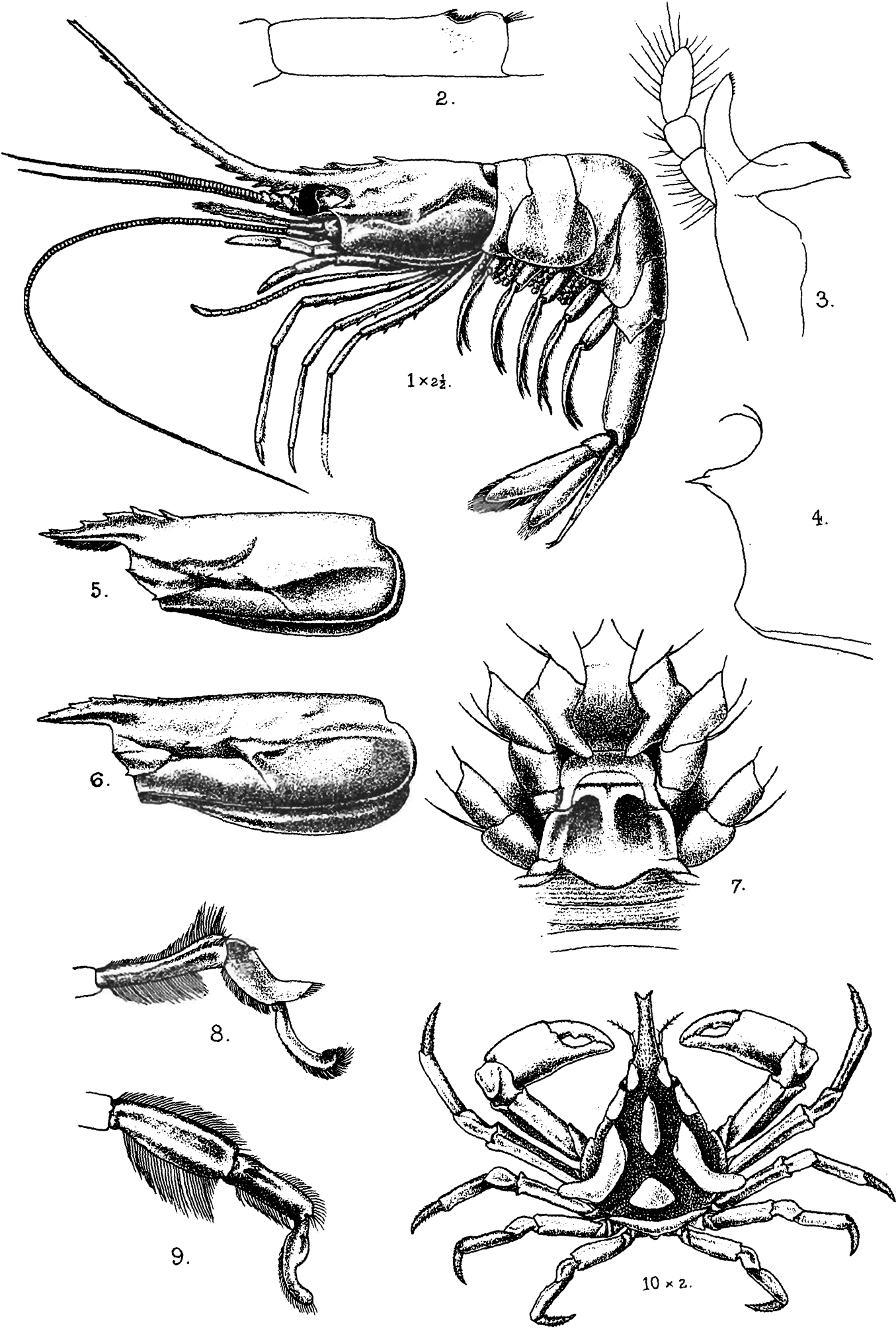
- FIG. 7.—Thelycum of a typical specimen.

Hemipeneus crassipes (Wood-Mason).

- FIGS. 8, 9.—Last three segments of external maxillipede of the male showing the two different types of structure.

Sphenocarcinus aurorae, Alcock.

- FIG. 10.—Dorsal view of a male specimen, $\times 2$.



A. C. Chowdhary, del. et lith.

DEEP-SEA DECAPODA.

III NOTES ON THE FAUNA OF PARÉS-NATH HILL, WESTERN BENGAL

By N. ANNANDALE, D.Sc., F.A.S.B., Superintendent, Indian Museum.

Parésnath Hill, the highest mountain in Bengal apart from the Himalayas, is situated in the district of Hazaribagh (Chota Nagpur) and is separated from the foot-hills of Nepal by a distance of about 180 miles in which the whole width of the Ganges valley is included. Isolated to a considerable extent from the other, lower hills and ridges of the district, the mountain rises to a height of 4,800 feet above sea-level. Its flanks and crest are covered with dense jungle which periodical forest fires prevent from reaching any great height, and its atmosphere though damper (at any rate near the summit) than the atmosphere of the surrounding country owing to the clouds which it attracts, does not possess the humidity of that of the Eastern Himalayas, resembling rather that of the slopes below Naini Tal in Kumaon.

The fauna of Parésnath has hitherto received little attention, although Blanford and Stoliczka collected molluscs, crustacea and lizards upon it many years ago. The following notes are based mainly on collections made by Dr. J. Travis Jenkins and myself in April and May, 1909.

I.—A LIST OF SPECIES IDENTIFIED.

(The names of the species as yet known only from Parésnath are marked with a *.)

MOLLUSCS.

The land molluscs of Parésnath exhibit a tendency to form separate species and races such as usually occur in isolated areas of a mountainous nature.

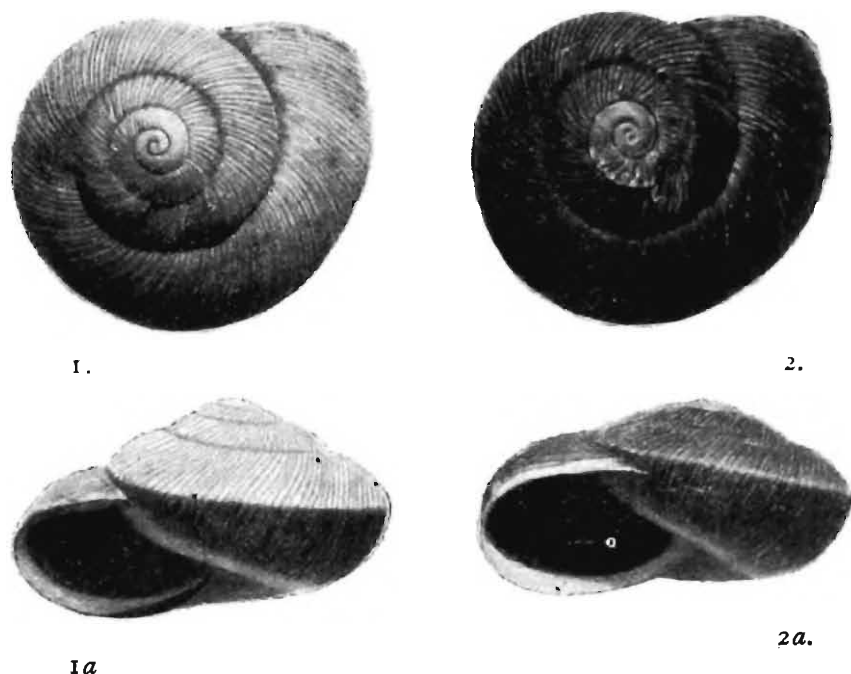
Family ZONITIDAE.

1. *Ariophanta interrupta* (Bs.) subsp. *sacra*., nov.

Blanford and Godwin-Austen, *Fauna Brit. Ind.*—Moll., i, p. 31.

As is pointed out by the authors cited, Parésnath shells of this species represent a local race distinguished from the typical

form by its larger size (on an average) and greater depression (maximum breadth 34 mm., depth 17 mm.). I found several dead specimens of this shell on the northern slope of the hill at different altitudes and there are others in the Indian Museum from Stoliczka's collection. The typical form is widely distributed in Bengal, the northern part of the Madras Presidency and Central India.



FIGS. 1, 2.—Shells of *Ariophanta interrupta*.

Figs. 1, 1a.—An unusually large (somewhat faded) specimen of the typical form from Calcutta.

„ 2, 2a.—Type of the race *sacra* from Parésnath.

(Both the figures are slightly magnified, to the same extent.)

2. *Macrochlamys sacrata*,* G. A.

Godwin-Austen, *Land and Freshwater Moll. Ind.*, ii, p. 244, pl. cxxviii, fig. 3, pl. cxxix, fig. 4.

This snail, which was doubtfully attributed to *M. lecythis* (a species found on the Rajmahal Hills) by Stoliczka, is apparently endemic on Parésnath. I found numerous individuals, most of them immature, on the north side of the hill at altitudes of from 4,000 to 4,500 feet. They were aestivating under stones at the time of my visit (April, 1910) and had their shells closed by a wad of dried slime, but on being brought into the moister climate of Calcutta they resumed active life.

3. *Macrochlamys perplana*, G. A. (Nevill MS.).

Blanford and Godwin-Austen, *Fauna Brit. Ind.*—Moll., i, p. 99.

Numerous specimens of this snail were found together with those of *M. sacrata* in similar circumstances and condition. The

species is also known from Manbhum and Panchet Hill near Raniganj in Bengal.

4. *Microcyrtina cryptomphalus*,* G. A.

Blanford and Godwin-Austen, op. cit., p. 257.

We did not take this shell, which was obtained on Parésnath at an altitude of 4,480 feet.

5. *Kaliella barrakporensis* (Pfr.).

Blanford and Godwin-Austen, op. cit., p. 258.

Specimens of this widely distributed species were obtained on Parésnath by Stoliczka and also by myself. My specimens were taken on the north side at an altitude of 4,350 feet. *K. barrakporensis*, which occurs practically all over Peninsular India and also in Madagascar, is not uncommon in pine-woods round Simla at altitudes of 7,000—8000 feet.

Family HELICIDAE.

6. *Glessula praelustris* (Bs.).

Hanby and Theobald, Conch. Ind., p. 9, pl. xvii, p. 6.

Some dead and partly incinerated shells of this species were found among the ashes of a jungle fire under a stone on one of the ridges of the hill (alt. 4,000—4,500 feet) and have been identified for me by Col. Godwin-Austen, to whom I am indebted also for confirmation of the other identifications of the land shells here recorded. *G. praelustris* is also known from Orissa.

Family CYRENIDAE.

7. *Pisidium* prox. *atkinsonianum*, Theob.

In a small spring situated on the north side of the hill at an altitude of about 4,000 feet I found numerous specimens of a minute *Pisidium* which my friend Mr. G. H. Tipper has examined. He informs me that they resemble specimens of *P. atkinsonianum* from Gangtok in Sikkim so closely that they should probably be regarded as representing a local race of that species. They differ considerably from *P. clarkianum*, Nevill, the common species of the plains of Bengal.

EARTHWORMS.

Dr. W. Michaelsen writes as regards the earthworms collected on Parésnath:—

“Unfortunately none of them is quite mature. In consequence I can only partially determine them, hardly being able to denominate the genus.

“The worms ‘from a small stream’ [Sita Nullah, on the lower slopes of the hill] belong to two species, the larger being a ‘*Glyphidrilus* sp.’ (perhaps the same as that from the Himalaya, which was not determinable) and two specimens of an Ocnerodrilid with one gizzard, viz., a *Gordiodrilus* or a *Kerria*. The worms ‘from mud at the edge of small spring’ [alt. ca. 4,000 feet] belong to *Perionyx* or *Perionychella* (probably *Perionyx excavatus*, E. Perr., which is so often found immature and so widely distributed).”

At the time Dr. Michaelsen wrote this note only one species of Microchaetinae had been recorded from India, namely an indeterminate young form of *Glyphidrilus* from the Simla Himalayas. More recently he has described the same or an allied species, from mature specimens taken in the plains of Travancore, under the name *G. annandalei*.¹

CRUSTACEA.

Family POTAMONIDAE.

Paratelphusa (*Barytelphusa*) *jaquemontii*, Rthbn.

Alcock, Cat. Ind. Dec. Crust., i (fasc. ii)—Potamonidae, p. 79, pl. xii, fig. 55.

There are numerous specimens in our collection obtained on Parésnath by Stoliczka, and I found several myself in the small spring (alt. ca. 4,000 feet) to which allusion has already been made. They were unusually small although apparently adult. *P. jacquemontii* is widely distributed in Peninsular India but appears to be rather commoner in the western and the southern districts than in Bengal.

Family PALAEMONIDAE.

Palaemon (*Brachycarpus*), sp.

In a jungle stream running down the north slope of the hill and known as Sita Nullah I found, at an altitude of about 2,000 feet, numerous specimens of a small prawn belonging to the subgenus indicated. It is remarkable for its dark green, almost black colour and has the thick-set appearance often possessed by prawns of the genus from mountain streams. The species is probably undescribed as yet but, should this prove to be the case, will be described later by Mr. S. W. Kemp. It appears to differ considerably from the species common at similar altitudes in jungle streams in the Darjiling district, but may be identical with one that occurs in the R. Tista at Jalpaiguri.

A few terrestrial isopods were also obtained but have not been identified.

¹ “Die Oligochätenfauna der vorderindisch-ceylonischen Region,” *Abh. Naturwis. Verein Hamburg*, xix, Heft 5 (1910), p. 89.

MYRIAPODA and ARACHNIDA.

Family SCOLOPENDRIDAE.

Cormocephalus dentipes, Poc.

A specimen of this scarce species, which is only known from Bengal,¹ was taken at an altitude of about 4,300 feet under a stone. The only other specimen in our collection is from Calcutta.

Family GALEODIDAE.

Galeodes orientalis, Stoliczka.

Pocock, *Fauna Brit. Ind.*—Arachnida, p. 138, fig. 48.

A single specimen was taken under a stone at an altitude of between 4,000 and 4,500 feet. This species is perhaps the most widely distributed of the North Indian Solifugae. It was originally described from Central Bengal and Delhi and specimens in the collection of the Indian Museum prove that its range extends all over the drier parts of northern India from Cutch to the W Himalayas and to Assam. A subspecies (*rufulus*, Poc.), distinguished chiefly by its darker coloration, occurs in Bombay. *G. orientalis* is common in a house situated near Giridih some miles from the base of Parésnath.

Several spiders and millipedes were also collected but have not yet been identified.

INSECTS.**ORTHOPTERA.**

Small Acridiids, mantises and cockroaches are common on Parésnath, but the only Orthopteron identified with certainty is the large and powerful grasshopper *Mecopoda elongata* (Linn.), a species found throughout the Oriental region and also in Japan and Australia. In India it is common among brushwood on hillsides whereon the jungle is dense. The elytra of the two forms, a green form and brown one, closely resemble leaves in different stages of decay. Both were found in April on Parésnath.

HYMENOPTERA.

Only the Aculeate specimens in the collection have as yet been examined. Of these Mr. C. A. Paiva has identified those that represent species described in the late Col. Bingham's volumes in the "Fauna," but there are also a considerable number which represent forms not described in these volumes and probably new to science. The following have been identified:—

¹ Gravely, *Rec. Ind. Mus.*, v, p. 171.

Family SCOLIIDAE.

1. *Myzine petiolata*, Smith.

One specimen taken at an altitude of between 4,000 and 4,400 feet (15-iv-09). A rare species recorded by Bingham from Barrackpore near Calcutta.

Family POMPILIDAE.

2. *Pseudogenia tincta* (Smith).

Two specimens (10 and 15-iv-09) taken at an altitude of between 4,300 and 4,400 feet. A rare species in the plains of Bengal but also recorded from the "North-West Provinces," Sikhim and Burma.

3. *Pseudogenia alaris* (Sauss.).

One specimen from an altitude of between 4,000 and 4,400 feet (12-iv-09). There is a specimen in our collection from the environs of Calcutta (24-viii-04) and the species has been recorded from Sikhim, Burma and Ceylon.

4. *Salix madraspatanus*.

One specimen (4,000 to 4,400 feet, 13-iv-09). The species is common all over the Indian Empire and in Ceylon.

Family SPHEGIDAE.

5. *Sceliphron violaceum* (Fabr.).

Parésnath, 4,400 feet (11-iv-09). Another common species, its range extending from S. Europe to Australia.

6. *Sphex umbrosus*, Christ.

Parésnath, 3,000 feet (15-iv-09). Also a common species, ranging all over the Oriental region and to Japan, Australia and Africa.

7. *Sphex aurulentus* var. *ferrugineus*, Lepel.

Parésnath, 4,000 feet (9-iv-09). Another common form; widely distributed in the Oriental region and found in China and N. Australia.

8. *Cerceris unifasciata*, Smith.

A specimen from Parésnath differs somewhat in colour from specimens from Assam and may represent a distinct variety or a local race. The species occurs in Sikhim, Assam, Upper Burma and China and also in Calcutta. It appears to be found chiefly in mountainous regions but probably not at great or even considerable altitudes.

Family EUMENIDAE.

9. *Eumenes flavopicta*, Blanch.

Parésnath, 4,000—4,400 feet (12-iv-09). A common species throughout Peninsular India, Burma, Ceylon and the Malay Archipelago, but not a mountain species.

10. *Rhynchium brunneum* (Fabr.).

Parésnath, 4,300 feet (10-iv-09). Also a common and widely distributed species; found on the lower slopes of the Himalayas but apparently not at great altitudes.

11. *Rhynchium metallicum*, Sauss.

Parésnath, 4,000—4,400 feet. Widely distributed in India and Burma. The Indian Museum possesses specimens from Karachi, Sind; Lucknow; Oncha Gaon, base of W. Himalayas; Siliguri, base of E. Himalayas; Dalsingh Serai, N. Bengal; Ranchi, Chota Nagpur; Margherita and Sibsagar, Assam; Sikhim; Bangalore, Mysore State, S. India; Maymyo Road, Upper Burma; Mergui, Lower Burma, and Perak, Malay Peninsula. Apparently not a mountain species.

12. *Odynerus bipustulatus*, Sauss.

Parésnath, 4,000—4,400 feet (13-iv-09). Widely distributed in N. India, Assam and Burma. The Indian Museum possesses specimens from Calcutta and Manipur.

Family VESPIDAE.

13. *Icaria ferruginea* (Fabr.).

Parésnath, 4,000—4,400 feet (10—14-iv-09). A common species in Sind, Bombay, the United Provinces, Bengal, Mysore, Madras, Burma and the Malay Peninsula. In the Himalayas only found at low altitudes.

Family COLLETIDAE.

14. *Prosopis mixta*, Smith.

Parésnath, 4,000—4,400 feet (13-iv-09). Bingham gives the habitat as "India" but there is in the Indian Museum a specimen collected by him at Shwegyin in Tenasserim.

15. *Prosopis strenua*, Cam.

Parésnath, 4,000—4,400 feet (10-iv-09). Only recorded hitherto from Barrackpore near Calcutta.

Family APIDAE.

16. *Normia westwoodi*, Grib.

Two specimens from Parésnath, 4,000—4,400 feet (15-iv-09). Only known from Bengal. There are specimens in the Indian Museum from Calcutta.

17. *Anthophora zonata*, Linn.

Parésnath, 4,300—4,400 feet (15-iv-09). “Throughout India, Burma, Tenasserim and Ceylon, extending through the Malay regions to Australia” (Bingham).

18. *Xylocopa amethystina*, Fabr.

Parésnath, 4,000—4,400 feet (12-iv-09). Although this species occurs in Calcutta and other places in the plains of Bengal, it penetrates further into the Himalayas than any other of the genus. The Indian Museum possesses specimens from Gilgit and Srinagar (Kashmir) and from the hills of Chota Nagpur and Upper Tenasserim; it also occurs in Bombay, Malabar and Ceylon. In May, 1911, I saw a *Xylocopa* which probably belonged to this species in a Simla garden situated at an altitude of slightly over 7,000 feet.

19. *Apis dorsata*, Fabr.

Parésnath; common in April. One of the commonest Indian bees; northwards its range extends into Tibet, eastwards to China and the Malay Archipelago; southwards to Tenasserim and the Malay Peninsula.

Family CHRYSIDIDAE.

20. *Stilbum cyanurum*, Först.

Parésnath (12-iv-09). A cosmopolitan species.

21. *Chrysis oculata*, Fabr.

Parésnath, 4,300—4,400 feet (15-iv-09). Widely distributed in the plains of India and in Assam.

DIPTERA.

I am indebted to Mr. E. Brunetti for the identification of most of the following Diptera. The Trypetinae, which were unusually well represented, are now being worked out by Prof. Bezzi, who has found no less than five new species in the Parésnath collection.

Family PSYCHODIDAE.

1. *Phlebotomus major*, Annandale.

Annandale, Rec. Ind. Mus., iv, pp. 46 and 320.

A single male was taken in a bungalow situated at an altitude of 4,500 feet on Parésnath (April). The species is otherwise only known from the Himalayas and the Nepal terai. It is common both in the Simla and the Darjiling districts, especially at the end of June and in July, at altitudes of from 4,500 to 9,000 feet.

Family TIPULIDAE.

2. *Geranomyia semistriata*,* Brunetti.

Brunetti, Rec. Ind. Mus., vi, p. 277 (1911).

Several specimens of this species were obtained in herbage round a well situated at an altitude of about 4,300 feet. Three other Indian species are represented in the collection of the Indian Museum and have been described, together with the one from Parésnath, by Mr. Brunetti. The genus is widely distributed both in the Oriental Region and elsewhere.

Family LEPTIDAE.

3. *Atherix intermedia*,* Brunetti.

Brunetti, Rec. Ind. Mus., iii, p. 211 (1909).

Numerous specimens of this species were seen on rocks at the edge of the stream Sita Nullah (alt. 2,000 feet) on April 4th. In India the Leptidae appear to be confined to mountainous regions, and *A. intermedia* is the only species I have seen in numbers. The genus *Atherix* occurs both in the Himalayas and in Ceylon, and is widely distributed both in the Oriental Region and in other parts of the world.

Family BOMBYLIDAE.

4. *Exoprosopa niveiventris*,* Brunetti.

Brunetti, ibid., p. 214.

Two females and a male, apparently of the same species, were taken near the base of the hill (alt. ca. 1,000 feet). *E. niveiventris* has not been taken elsewhere.

5. *Argyramoeba distigma* (Wied.).

Brunetti, ibid., p. 221.

Common all over the hill, hovering a short distance above the ground. This is one of the least scarce of the Indian Bombylidae, occurring chiefly in the plains. It has also been recorded from several of the islands of Malaysia.

ACALYPTERATA, subfamily SEPSINAE.

6. *Sepsis cynipsea* (Linn.).

A pair were taken on Parésnath in April at an altitude of 4,350 feet. This common Palaearctic species occurs all along the Himalayas and is also found in the hills of Assam, but does not occur in the plains except just at the base of the Himalayas.

Numerous other Diptera were taken but have not yet been identified.

COLEOPTERA.

Although a considerable collection of beetles was made on Parésnath, it has been only possible to get a few species identified as yet. The most striking form was *Thysia wallichii*, Hope, a large Longicorn rendered conspicuous by its barred elytra and tufted antennae. This species was common at an altitude of 4,400 feet on the hill and was often observed on the wing. It is equally abundant at about the same altitude in the E. Himalayas, and its range extends eastwards through Assam and Upper Burma into China. Other conspicuous forms were the Cetoniinae *Clinatesia klugii* (Hope) and *C. hearsiana*, Westw., which were found together in very large numbers, devouring the flowers of certain shrubs that grew near the top of the hill. *C. klugii* appears to be restricted to western and central India, while *C. hearsiana* has not been recorded from any other definite locality but Parésnath.

RHYNCHOTA.

The commoner and more conspicuous species of the Heteroptera from our Parésnath collection have been identified by Mr. C. Paiva, while Mr. W. L. Distant has recently described a number of new species. Only the larger Homoptera have yet been named, with the exception of one or two common Jassidae, but a large number of species will, I hope, be dealt with in the appendix to Mr. Distant's account of the Rhynchota in the *Fauna of British India*. Of those that have been identified the most interesting from a geographical point of view are two species of Cicada, both diurnal in habit and each common on the occasion of one visit, viz., *Haphsa nicomache* (Walk.), which was abundant in April, and a new species of *Terpnosia*,¹ which replaced it in May. The range of *H. nicomache*, so far as it is known, extends (apart from Parésnath) from Mussoorie in the W. Himalayas through Sikkim into Assam.

The Heteroptera of Parésnath appear to fall for the most part into one of two categories—either they are common and widely distributed species or else they have not yet been found except on the hill. This, however, is the case as regards most newly explored localities in India, and it would appear to be a fact that species of this suborder are as a rule either very widely distributed or else quite local in their distribution. The number

¹ *T. jenkinsi*, Dist., *Ann. Mag. Nat. Hist.*, 1912.

of hitherto undescribed forms found on Parésnath was considerable. It seems unnecessary to give a list of those that have been identified; several of the new species are described by Mr. Distant in *Ann. Soc. Ent. Belgique*, liii (1909), pp. 361, 362, etc.

LEPIDOPTERA.

We were not able to pay much attention to the Lepidoptera and only a few species were collected. Mr. Meyrick has recorded two species of Microlepidoptera from Parésnath, namely *Oligophlebia amalleuta** from an altitude of 4,000 feet and *Acrocercops convoluta*. The latter is also known from Kurseong in the E. Himalayas and is fairly common, as Mr. Meyrick informs me, at Maskeliya in Ceylon.

For the following note on the butterflies of Parésnath I am indebted to Capt. G. H. I. Graham, who has visited the hill on more than one occasion in order to collect Rhopalocera:—

List of butterflies caught on Parésnath Hill by Capt. G. H. I. Graham and a native catcher, during the months of April and October, 1908-09.

“ NYMPHALIDAE.

Subfamily I.

Danaïs plexippus	Common.
„ chrysippus	„
„ limniace	„
Euploea core	„
„ mulciber	A few seen on the wing.

Subfamily II.

Mycalesis perseus	Common.
„ mineus	„
„ visala	„
Orsotrioena meda	Uncommon.
Lethe europa	„
„ nilgiriensis ..	Common from 2,000 feet to top of hill.
Ypthima baldus .	Uncommon.
„ inica	„
Melanitis ismene .	Very common.

Subfamily IV.

Charaxes imna .	♀ ♀ more common than ♂ ♂.
„ marmax	Seen but not caught.
„ fabius ..	Very scarce.
Eulepis athamas ..	Fairly common.

Euthalia lubentina	Very scarce.
„ garuda	Fairly common.
„ nais	Very „
Moduza procris	Scarce.
Athyma perius	Very common.
Neptis eurynome ..	„ „
„ columella	Scarce.
Junonia iphita	„
„ lemonias	Common.
„ orithya	Very common.
„ atlites	Scarce.
„ hierta	Very common.
„ almana	„ „
Vanessa cardui	Very scarce.
Hypolimnas bolina	Very common.
„ misippus	♂ scarce, only 2 ♀ ♀ caught.
Kallima inachus	Above 2,000 feet; very common at about 3,000 feet at small stream over which there is a foot-bridge—the only spot on the whole hill I ever saw them. All the specimens taken were quite as large as those from Assam and of a much deeper blue.
Atella phalantha	Very common.
Argynnis hyperbius	Scarce.
Ergolis ariadne	Uncommon.

Subfamily V.

Telchinia violae	Very common.
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NEMEOBIDAE.

Abisara echerius	Very common.
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PAPILIONIDAE.

Papilio aristolochiae	. Common.
„ demoleus	.
„ polymnestor	.. Fairly common at bridge described above.
„ polytes	Common.
„ clytia	. Scarce.
„ dissimilis	..
„ nomius	. Fairly common but difficult to capture; only seen in April.

PIERIDAE.

Leptosia xiphia	. Fairly common.
Delias eucharis	Common.
Huphina nerissa	"
Ixias pyrene	Very common.
Catopsillia crocale	Uncommon.
„ pyranthe	"
„ florella	.
Terias libythea	Scarce.
„ hecabe	Very common.

Some skippers and blues were taken, but I have not yet started on these families, so know little or nothing about them.

G. H. I. GRAHAM."

FISH.

A small collection of fish from a little stream (Sita Nullah) on the north face of Parésnath has been described by Dr. Jenkins in *Rec. Ind. Mus.*, v (1910), p. 128. Only five species were obtained, viz., *Glyptosternum saisii*,* *Nemachilus savona*, *Discognathus lamta*, *Danio dangila*, *Ophiocephalus gachua*. Two of these species (*O. gachua* and *D. lamta*) have a wide distribution in India and even beyond its borders, while two (*D. dangila* and *N. savona*) are common in rocky streams throughout Western Bengal. *G. saisii* has only been found as yet on Parésnath. It belongs to a genus found in the mountains of both northern and southern India, and is allied to *G. pectinopterum*, a species common in the Himalayas from Kangra to Darjiling and also in the hills of the Punjab.

REPTILES and BATRACHIA.

The only frog obtained was *Rana limnochàris*, Wieg., of which several small specimens were taken at the edge of a spring situated on the north face of the hill at an altitude of about 4,000 feet. This species is abundant all over the plains of India and ascends the Himalayas to an altitude of between 5,000 and 6,000 feet.

The following lizards were collected by Dr. Jenkins and myself or subsequently sent to the Indian Museum from Parésnath by Dr. Walter Saise :—

Hemidactylus brookii, Gray.

Hemidactylus gleadovii, Boulenger, *Fauna Brit. Ind.*—Rept., p. 86, fig. 27.

Hemidactylus brookii, *id.*, *Ann. Mag. Nat. Hist.* (vii), i, p. 123 (1898).

Several specimens were taken on the walls of a bungalow situated at 4,500 feet. This lizard is common all over the plains

of India both in houses and in open country, sheltering under stones in the latter situation. It rarely occurs, however, in the Himalayan hill stations.

Calotes versicolor (Daud.).

Common all over Parésnath. The specimens obtained were to some extent intermediate between the form *gigas* of Blyth, which is the common race all over S. India and Ceylon and also in Orissa, and the smaller form with less strongly marked sexual characters which is characteristic of the Himalayas, Lower Bengal and the countries to east of the Bay of Bengal. *C. versicolor* is common in both the East and the West Himalayas up to an altitude of at least 5,000 feet, but Dr. J. R. Henderson tells me that he does not think that it ascends so high in the hills of the Madras Presidency, in which it is replaced at comparatively low altitudes by peculiar mountain species.

Charasia blanfordiana, Stoliczka.

The genus *Charasia* is peculiar to the Indian Peninsula, in which it takes the place of the Ethiopian and Palaearctic genus *Agama* found in the Himalayas as far east as the Little Nepal Valley. Three species of *Charasia* are known, namely, *Ch. ornata*, the range of which extends from Central India to the Ganges Valley in the United Provinces and to Kutch in Sind; *Ch. dorsalis*, which appears to be confined to the hills and tablelands of S. India; and *Ch. blanfordiana*, which is common in the hills of W. Bengal (including the whole of Parésnath), at low altitudes among the hills of S. India and in Travancore along the base of the W. Ghats. It also occurs among low hills in Central India, but I have been unable to find any record of its occurrence in the Bombay Presidency. In S. India it is apparently rare above about 2,500 feet, its place being taken at higher altitudes by *Ch. dorsalis*, which is common in the neighbourhood of Bangalore at an altitude of about 3,000 feet. Dr. J. R. Henderson tells me that he has only seen *Ch. blanfordiana* from low hills in the Chingleput district south of Madras, and he thinks from similar hills in the Nellore and North Arcot districts.

Mabuia carinata (Schneid.).

This common lizard is abundant on the lower slopes of Parésnath. Several specimens from the base of the hill and its vicinity show a tendency for the frontal to split longitudinally.

Lygosoma sikkimense (Blyth.).

Mocoa sacra, *Stoliczka*, *Journ. As. Soc. Bengal*, xli, p. 128, pl. iv, fig. 4 (1872).

Lygosoma sikkimense, Boulenger, *Fauna Brit. Ind.*—Rept., pp. 199-200.

Stoliczka many years ago obtained a single specimen of this species (which he described as the type of a new species, *Mocosa sacra*) from one of the little shrines on the ridge of Parésnath. I was so fortunate as to obtain a second near the summit. Both specimens are in the collection of the Indian Museum and I have compared them very carefully with a large series from Sikkim, Darjiling and Nepal. I can find no constant difference. My specimen has the fourth toe shorter than is usually the case, but one of the supposed specific characters of *M. sacra* was that this toe was longer than in *L. sikkimense*, and in Stoliczka's specimen, although it is not actually longer than in many Himalayan individuals, it is much longer than in mine. There can be no doubt that Boulenger was right in relegating *M. sacra* to the synonymy of *L. sikkimense*.

L. sikkimense is a species otherwise peculiar to the E. Himalayas. We have no evidence that its range extends west of the Nepal Valley, and in the Little Nepal Valley it actually occurs side by side with *L. himalayanum*, a closely allied species that takes its place in the W Himalayas. Moreover, there is no evidence that *L. sikkimense* descends the Himalayas to altitudes of less than 3,000 feet. It is a damp-loving species and, unlike most skinks, is oviparous, laying its eggs in wet moss on tree-trunks during the rains. The eggs have comparatively soft, leathery skins, which shrivel up if they become dry. In these circumstances the embryo perishes.

II.—SUMMARY AND CONCLUSIONS.

The data set forth above must be regarded as extremely imperfect, but, imperfect as they are, they afford evidence of one remarkable fact, namely, that whereas a large proportion of the fauna of Parésnath is identical with that of the Ganges valley and a smaller proportion apparently endemic on the hill, a Himalayan element can also be detected which is totally absent from the surrounding plains. Representatives of this element are *Phlebotomus major* and *Sepsis cynipsea* among the Diptera (both representing families that have been more thoroughly investigated than most in India), *Haphsa nicomache* among the Rhynchota, *Thysia wallichii* among the beetles, and above all *Lygosoma sikkimense* among the lizards. Although winged insects might be blown with comparative ease across the Ganges valley from the Nepal foot-hills to Parésnath, it is quite impossible that a lizard could be carried in this way. It is impossible, moreover, that the eggs of *L. sikkimense* could be transported in a living condition by birds, for they perish within a short period of being removed from the damp moss in which they are laid. We must therefore seek for a geographical explanation of the occurrence of this lizard on an isolated hill-top two hundred miles from its present abode.

It is of course no new discovery that the fauna of hill-tops south of the Ganges valley includes a Himalayan element, and a great deal has been written about this fact with reference to the mountains of the Madras Presidency. A summary of all the more important writings on the subject will be found in the late Dr. W. T. Blanford's classical memoir on the distribution of the Indian vertebrates in the *Phil. Trans. Roy. Soc.*, vol. 194 (B), 1901 (p. 422, etc.).

The generally accepted explanation of distributional phenomena of the kind is that it is due partly to the transport of winged animals or the eggs of non-winged organisms by aërial currents and perhaps occasionally by birds, and partly to changes in the distribution and extent of the glaciers of the higher mountain ranges. Much evidence has been adduced by geologists in support of the belief that the glaciers of the Himalayas, at a period not very remote, extended considerably further south than they do at present. La Touche,¹ however, has recently shown that they cannot have extended as far as the Ganges valley, except possibly at an ancient geological period. It can, I think, hardly be maintained that any of the species common to the Himalayas and Parésnath existed in their present form at this ancient period, and it seems unnecessary to go far back in geological time to search for an explanation of their present geographical distribution. There is no reason whatsoever to think that the individuals living on Parésnath were ever isolated by a ring of ice or driven to the summit by glaciers sufficiently extensive to submerge the base of the hill: but it must be remembered that the secular movements of glaciers are accompanied by profound modifications not only in temperature but also in humidity, and humidity is perhaps an even more important factor in the distribution of reptiles and insects than actual temperature. We must suppose that *Lygosoma sikkimense* once lived in the plains as well as or instead of in the hills, but that a fall in the atmospheric humidity of the former, perhaps due in part to movements of glaciers in the Himalayas, drove it up into the E. Himalayas on the one hand and the summit of Parésnath on the other, or confined it to comparatively high altitudes.

It is perhaps worth noting that the Himalayan element in the fauna of Parésnath appears to be allied to that of the E. Himalayas, whereas that in the flora rather shows affinities with the flora of Kumaon. The climate is, however, very similar to that of the lower slopes of the hills below Naini Tal and we may suppose that seeds brought by winds or birds from that part of the Himalayan ranges would have a better chance of germinating and propagating their species than those from the damper forests of Nepal or Sikkim, which are actually nearer in space. Hooker says of the flora of Parésnath, which

¹*Geological Magazine* (v), vii, p. 193 (1910).

he visited in 1848: "Of plants eminently typical of a moister atmosphere, I may mention the genera *Bolbophyllum*, *Begonia*, *Aeginetia*, *Disporum*, *Roxburghia*, *Panax*, *Eugenia*, *Myrsine*, *Shorea*, *Millettia*, ferns, mosses and foliaceous lichens; which appeared in strange association with such dry-climate genera as *Kalanchoe*, *Pterospermum*, and the dwarf-palm, *Phoenix*. Add to this list the *Berberis asiatica*, *Clematis nutans*, *Thalictrum glyphocarpum*, 27 grasses, *Cardamine*, etc., and the mountain-top presents a mixture of the plants of a damp hot, a dry hot, and of a temperate climate, in fairly balanced proportions. The prime elements of a tropical flora were however wholly wanting on Paras-nath, where are neither peppers, *Pothos*, *Arum*, tall or climbing palms, tree-ferns, *Guttiferae*, vines, or laurels."—*Himalayan Journals*, vol. i, pp. 23-24, footnote.



IV. OBSERVATIONS ON THE SHALLOW-
WATER FAUNA OF THE BAY OF BENGAL
MADE ON THE BENGAL FISHERIES
STEAM-TRAWLER "GOLDEN
CROWN," 1908-1909.

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(Plate iv.)

The investigations carried on by the trawler "Golden Crown" during 1908 and 1909 have thrown some light on the fauna of the upper portions of the Bay of Bengal between the 15- and 30-fathom lines. A few hauls were made in greater and lesser depths, but trawling was mainly carried on within the limits mentioned. The trawl of the "Golden Crown" was of the ordinary commercial type and well calculated to capture any fish or invertebrate living on the bottom or swimming about within seven or eight feet thereof. Occasionally portions of a shoal of pelagic (*i.e.*, non-demersal) fish would be enmeshed when the trawl was being hauled inboard. To this category belong the pomfrets (*Stromateus cinereus*, *niger* and *sinensis*), large hauls of which were made off the Eastern Channel at the entrance to the River Hughli, and the flying gurnard *Dactylopterus orientalis*. The only pelagic fish taken in anything like large quantities was the Silver Pomfret (*Stromateus cinereus*). This species was most abundant in the months from December to April and was met with anywhere between the Mutlah light ship (off the entrance to the Mutlah River) and Puri on the coast of Orissa. It is not infrequently taken in the nets of the local fishermen at the latter place. So far as the "Golden Crown" records show, the pomfret is most abundant in the northern parts of the Bay during the months of January and February, at this time the writer occasionally observed vast shoals of them swimming leisurely past the "Golden Crown" whilst she was going ahead slow with her trawl down. The best catch was made during the voyage which lasted from the 9th to the 15th February, 1909, throughout which period trawling was prosecuted to the south of the Eastern Channel light vessel, the pilot ship of the Bengal Pilot Service being within sight the whole of the time.

A curious feature was that the pomfrets were only caught by daylight. It was customary on the "Golden Crown" to make four hauls *per diem*. The net was shot at 6 a.m., midday, 6 p.m. and midnight and hauled half an hour before those times, so that two hauls were made during darkness (6 p.m. to midnight

and midnight to 5-30 a.m.) and two by day. During the voyage from the 9th to the 15th February, 1909, twenty hauls were made, ten during daylight and an equal number at night. The total weight of pomfrets caught was 2,775 lb., of which only 68 lb. were caught at night. Moreover during the second daylight haul on the 10th February the net was badly torn and a large proportion of the catch, consisting of pomfrets, escaped.

Dactylopterus orientalis was never captured in sufficiently large numbers to be weighed separately as a constituent of the "Golden Crown's" catch. It will be understood that a complete record of the different species of fish captured on each voyage was an impossibility and doubtless many records of this and other species are thus unobtainable. My impression is that *Dactylopterus* was obtained principally off the Madras coast (Ganjam). It is specially recorded in the voyage March 5—16th, 1909, from that locality.

On the whole the explorations of the "Golden Crown" showed that there were four more or less distinct trawling areas or fishing grounds in the northern portion of the Bay. These areas naturally passed gradually into one another, but there are quite distinctive features in each case. These areas (see plate iv) are—

- (1) Extending from the Mutlah light vessel down past the entrance to the Eastern Channel to Pilot's Ridge.
- (2) Off the Arakan Coast from the South Patches light vessel (entrance to the channel leading to Chittagong) to Oyster Island in the neighbourhood of Akyab.
- (3) The coast of Orissa from the mouth of the Devi river to the entrance to Lake Chilka.
- (4) The coast of the Ganjam district of the Madras Presidency from Ganjam to Santapilli light-house in the district of Vizagapatam.

The principal characteristics of these areas and the more noteworthy representatives of the fauna are dealt with below:—

AREA I. MUTLAH LIGHT VESSEL TO MOUTH OF DHUMRA RIVER.

The bottom in this area consisted entirely of a very fine and soft mud, the product of land denudation brought down by the Ganges and its affluents. So soft is this mud that it was always necessary to keep the trawler going at a good speed when the net was out as otherwise the latter would have sunk in the mud and have been lost. The speed was too high to allow of the use of the ordinary surface tow-net.

The principal feature of this mud was the presence of a large number of empty (dead) shells of *Dentalium eburneum*, Linn.

Peculiar rounded balls of mud were frequently brought up in the trawl and these when opened were found to contain a living Lamellibranch, a species of mussel, viz., *Modiola rhomboidea*. On

the whole the Molluscan fauna of this area was not abundant, though specimens of *Murex tenuispina* were not infrequently met with.

Of the Echinoderms, the Holothurian *Aphalodactyla molpadoidea* may be regarded as typical.

Of the Crustacea the two commonest inedible forms were *Thenus orientalis* and *Egeria arachnoides*. Two species of prawn of economic importance were found in this region, as well as an edible crab (*Scylla serrata*).

The prawns consisted mainly of *Peneus semisulcatus* and *Peneus indicus*, but they were not nearly so abundant in this area as off the sandy shores of Orissa (Area III), where large hauls were frequently made.

As a general statement it may be said that the invertebrate fauna of this region was scanty.

The fish-fauna of this muddy area off the Sunderbans is quite distinctive. Although the trawl was not adapted to catch surface-swimming forms, still *Carcharias menisorrhah* and *Chiloscyllium indicum* were commonly taken. Of the Batoidei, *Trygon uarnak* and *Trygon bleekeri* were possibly more characteristic of this region than any other species. The former is a large species of "sting-ray" and individuals measuring 5 feet or more across the back were common. On one occasion (Voyage No. 14, December, 1908) nearly 23 per cent. of the total catch of fish in this area consisted of these gigantic Batoids. Nine specimens of *Trygon uarnak* taken near the Mutlah light vessel on this occasion aggregated 1,360 lb., the average weight being 151 lb. and the extremes 118 and 180 lb. respectively. This species seems to prefer a depth of from 24 to 25 fathoms, and in fact our general experience in this muddy area was that the fish-fauna was more abundant at this depth than on deeper or shallower areas.

Two hauls taken close together on the same day in the same locality bring this contrast out very well:—

December 20th, 1908. Near Mutlah light vessel.

Haul I,—in 14 fathoms of water : from 11-20 a.m. to 3 p.m.

	Wt.
One <i>Psettodes erumei</i>	3 lb.
A few "soles" (<i>Cynoglossus macrolepidotus</i>)	5 „
Prawns (<i>Peneus</i> spp.)	7 „
<i>Arius</i> spp., chiefly <i>dussumieri</i>	30 „
Total weight of catch	. 45 lb.

Haul II,—in depth of 24 fathoms: from 4-15 p.m. to 11 p.m.

Although the net was torn the catch consisted of—

	Wt.
<i>Psettodes erumei</i> . . .	15 lb.
<i>Otolithus maculatus</i> . . .	2 „
<i>Stromateus cinereus</i>	20 „
Prawns (<i>Peneus</i> spp.) . . .	30 „
Sciaenoids, chiefly <i>S. vogleri</i> . . .	80 „
<i>Muraenesox cinereus</i> ..	70 „
<i>Arius</i> spp., chiefly <i>A. dussumieri</i> . . .	60 „
“Soles” (<i>Cynoglossus macrolepidotus</i>)	20 „
<i>Trygon uarnak</i> , 4 specimens weighing	{ 122 „
respectively . . .	
	160 „
	170 „
	180 „
Total weight of catch	929 lb.

The weights give one a very good idea of the relative abundance of the different species of fish.

An extract from notes relating to a series of hauls on a purely muddy area, practically within a few miles of the Mutlah light ship, throws some light on the fish fauna of this area during the month of December.

The notes explanatory of the table on p. 55 are:—

Haul I.—Only one basketful of fish. (The baskets used for weighing the fish on the “Golden Crown” were real baskets, holding when full about 60 to 70 lb. weight of Sciaenoids or Siluroids.)

The chief fish this haul were *Cynoglossus* and *Platophrys*, *Stromateus* sp., *Sciaena* sp., *Ephippas orbis*, *Drepane punctata* and *Lynagris japonicus*. Depth of water 25 fathoms. Bottom “oozy.” When the trawl was shot at midnight on the 17th December Mutlah light ship bore east about 4 miles.

Haul II.—The fish called “Begti” or “Bekti” by the natives on the “Golden Crown” is not *Lates calcarifer* but *Chrysophrys datnia*. This name was afterwards extended by the European crew to include any large Sparoid or Percoid fish. Other fish this haul were *Muraenesox cinereus*, *Pagrus spinifer* (few), *Cynoglossus macrolepidotus*, Siluroids of the genus *Arius*, various species of *Caranx*, a few *Pellona* and *Psettodes erumei*. Fish that were not sufficiently abundant to be classified and weighed separately were returned as “mixed.” These included very different fish. This haul the mixed were almost entirely *Saurida tumbil*.

Inedible fish are not included in the weights in the table. This haul brought up two large *Rhynchobatus djeddensis* not included.

Same ground as in Haul I.

Haul III.—Same ground as before. Mixed fish again = *Saurida tumbil*.

Hauls near Mutlah light vessel. December 1908.

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	HAUL No.																
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Bekti (<i>Chrysophrys datnia</i>)	No edible fish in any quantity.	189	65	93			174		..	..			..	..	..		..
<i>Otolithus maculatus</i> ..		7		25	9	..	102	..	18	25	3	..	2	..		..	..
<i>Caranx</i> (various)		50	48	32				82	3	3	8	..	..		3	62	..
Pomfrets ..		7	8	3		5	5			..	5	..	20		9	49	1
"Congers" (<i>Muraenesox</i>)		53	..	..	30	..		..	47	43	..		70	30	53	23	115
<i>Psettodes</i> ..		9	8	7	10	2	6	..	9	12	5	3	15	5	3	10	8
Prawns (<i>Peneidae</i>) ..		25	..	9	105	20	28	10	70	45	10	7	30	..	10	..	..
"Soles" ..		18	18	4	30	5	20	2	32	30	8	5	20	5	8	8	10
Sciaenoids ..		130	88	179	759	110	163	110	447	183	90	..	80	70	70	80	190
Siluroids ..		80	125	130	170	80	140	115	175	88	90	30	60	23	80	177	125
<i>Trygon uarnak</i> , etc.		130		..	505	180		62	..	118		..	632		9	330	..
Mixed ..		7	5	7		..	26	25	..		15	..	..	..	..	19	4

Haul IV.—Same ground as before. Mixed fish = *Trichiurus haumela*.

The fifth and sixth hauls were on the same ground and the catches similar to the above.

Haul VII.—One large *Pristis pectinatus* in net. Net torn. The cause of the net being occasionally torn on these soft grounds is either a large sawfish or a trunk of a tree brought down by the Ganges and waterlogged and sunken. The mixed fish consisted of 20 lb. weight of *Pellora* and 6 of *Saurida tumbil*.

Haul VIII.—The “skates” or “sting-rays” comprised a medium-sized specimen of *Trygon uarnak*, the balance (12 lb.) being *Myliobatis nieuhofti*. The mixed fish included several specimens of *Chirocentrus dorab*. One *Zygaena blochii* was captured but not included in the weights given in the table.

In both the eighth and ninth hauls five specimens of pomfret (*Stromateus cinereus*) were captured; the weights were not included in the table.

Haul X.—The net was badly torn during this haul. It took an hour and a half for all hands to repair it. One specimen of *Thalassochelys caretta* was captured in this haul. The Carangidae comprised during this and the preceding two hauls *Caranx malabaricus*, *C. atropus* and *C. gallus*.

There were also present (Haul XI) in the “mixed” fish:—*Minous monodactylus*, *Polynemus sextarius*, *Sebastichthys strongea*, *Platycephalus* sp., *Therapon jarbua* and *Mene maculata*. The Siluroid which predominated in all the hauls on this ground was *Arius dussumieri*. Day states that *Therapon jarbua* is not uncommon at Calcutta in the tidal Hughli. Hauls XII and XIII are quoted above (p. 55), the former was in from 14 to 15 fathoms of water, the latter back again in 24 fathoms. In Haul XV the small “skate” was *Myliobatis* sp.

Haul XVI was in deeper water, approximately 40 fathoms. The only remarkable fish not recorded in previous hauls was *Chorinemus lysan*.

Haul XVII was made in the direction of (i.e., towards) the Eastern Channel light vessel. The “mixed” fish were *Elacate nigra*.

AREA II. SOUTH PATCHES LIGHT VESSEL TO AKYAB.

The second area trawled over by the “Golden Crown” was that extending from the South Patches light vessel (off the entrance to Chittagong) down past Oyster Island to the vicinity of Akyab. This area is separated by the “Swatch of No Ground” from Area I. The bottom varied considerably. Near the light ship it was mud, further to the south this was replaced in depths from 8 to 17 fathoms by fine glittering sand, with patches of shells at intervals. Off St. Martin’s Reef in from 10 to 13 fathoms the bottom consisted of shells and fine gravel. Between St. Martin’s Reef and Oyster Island the trawl brought up fossiliferous rocks of

miocene age. The rocky nature of the ground and the consequent damage to the nets led to trawling being abandoned in this area.

The fifteenth voyage of the "Golden Crown" was partly devoted to trawling on this area and details of the hauls are appended.

The first haul was made in muddy grounds in depths varying from 13 to 18 fathoms not far from the South Patches light vessel.

The catch included one very large male *Pristis perottetii*, *Pteroplatea micrura*, *Echeneis naucrates*, *Arius dussumieri*, *Synaptura altipinnis*, *Psettodes erumei*, *Cynoglossus macrolepidotus*, *Pseudorhombus arsius*, *Pellona indica*, *Sciaenoids* (various), *Pagrus spinifer*, *Ephippus orbis*, *Scomber macrolepidotus*, *Stromateus cinereus*, *Pterois* sp., *Caranx atropus*, *Drepane punctata*, *Saurida tumbil*, *Chirocentrus dorab*, *Dactylopterus orientalis*, *Pristipoma maculatum* and *Diodon hystrix*.

Squilla raphidea was abundant on this ground.

Haul II.—On muddy grounds in same neighbourhood in slightly deeper water (average 18 fathoms). Catch included *Cynoglossus macrolepidotus*, *Arius dussumieri*, *Pteroplatea tentaculata*. Two large and one small *Trygon uarnak*, *Elacate nigra* and one *Limulus*.

Haul III.—Muddy grounds. Depth during haul 18, 19 and 20 fathoms. Fish much as before with one large *Rhynchobatus djeddensis*.

Haul IV.—From 20 to 12 fathoms. Mud to fine sand. *Sphyræna obtusata* in "mixed" fish.

Hauls V and VI were made further to the southward. Haul VII was made 15 miles off Elephant Point which bore E.N.E. when the net was shot. There were 21 *Carcharias menisorrah* in this haul.

Haul VIII was in the neighbourhood of St. Martin's Reef, which at 10 a.m. bore E.N.E. 6 miles away. The bottom varied considerably during this haul. At 8 a.m. the sounding gave 12¾ fathoms, shells. At 10 a.m. 10½ fathoms, shells and small stones, at 10-30 a.m. 9½ fathoms, shells and grit.

Haul IX.—The net caught some obstruction on the bottom and was badly torn, both the foot and head ropes being broken. The cause of the damage was the reef of miocene rocks referred to above. In this haul several specimens of *Callionymus longicaudatus* were taken. In the next haul (X), the net was again badly torn for the same reason and specimens of the rocks were again preserved. Antipatharians were also dredged up this haul, Gorgonids and Alcyonarians as well. Large Percoid and Sparoid fish similar to those found in corresponding localities on the other side of the Bay were taken. Of these the most abundant was *Lutjanus annularis*. In Haul XII there were no edible fish, but one large *Tetrodon stellatus* was present.

On a previous voyage to the Arakan coast somewhat similar results were obtained, except that the hauls were confined to the more northern portions of the area where no rocky ground is

encountered. Good catches of *Polynemus plebeius* and *Harpodon nehereus* (the "Bombay Duck") were a feature of this voyage (on 11th November 1908): also large *Pristis cuspidatus*, *Zygaena blochii* and *Pristis perottetii*. *P. cuspidatus* was very prevalent during this voyage.

Rhynchobatus djeddensis common, no less than six large specimens taken in one haul (Haul XIV, November 17th, 1908). Snakes were not infrequent, principally *Enhydrina valakadien*. The fish identified during these hauls were *Chatoessus chacunda*, *Raconda russelliana*, *Platophrys pantherina*, *Synaptura commersoniana*, *Sillago panijus*, *Narcine timlei*, *Hypolophus sephen*, several small *Carcharias laticaudus*, *Stromateus niger* and *Pellona filigera*.

This area was the only one in which large specimens of the estuarine "Sele" fish (*Polynemus plebeius*) were obtained. They were captured in considerable numbers on muddy grounds near the South Patches light vessel. On this ground the Pristidae were unusually abundant in November.

Two Pleuronectids previously described by Alcock from the "Investigator" collections were obtained from the southern portion of this area. These were:—

Rhomboidichthys azureus, previously recorded from Ganjam and Ceylon; and

Rhomboidichthys valde-rostratus, previously recorded from Ceylon only.

Incidentally it may be noted that this area was less explored than any of the other three.

AREA III. FROM THE MOUTH OF THE DEVI RIVER TO THE ENTRANCE TO LAKE CHILKA.

This area off the coast of Orissa was to a large extent explored by the "Investigator" previously to voyages of the "Golden Crown." Moreover a large number of the fish were known owing to the fact that there is a regular coastal fishery carried on by Telugu fishermen at Puri by means of drift- and seine-nets and also by baited hooks.

Most of the shallow-water trawling of the "Investigator" was in this area and there are a number of papers by Alcock¹ which afford us valuable information, more particularly as to the fish.

¹ Vide—Alcock, *A Naturalist in Indian Seas*.

" "On some undescribed shore-fishes from the Bay of Bengal," *Ann. Mag. Nat. Hist.*, December, 1890, pp. 425—443.

" "List of the Pleuronectidae obtained in the Bay of Bengal in 1888 and 1889, with description of new and rare species," *Journ. As. Soc. Bengal*, vol. lviii, pt. ii, No. 3, 1889, pp. 279—295.

" "Descriptions of some new and rare species of fishes from the Bay of Bengal, obtained during the season of 1888-9," *Journ. As. Soc. Bengal*, vol. lviii, pt. ii, No. 3, 1889, pp. 296—305.

The trawl of the "Investigator" was very much smaller than that of the "Golden Crown" and consequently the larger species of Elasmobranchs would not be captured by it. Apart from these gigantic rays and saw-fish there is a marked similarity in the catches of the two vessels. The predominant feature of the bottom in the area trawled over by the "Golden Crown" was sand and, owing to circumstances which need not be specified here, her trawling was carried out on a much more limited area than that of the "Investigator," which worked in this neighbourhood in depths from shoal water up to 100 fathoms. The latter depth may be taken as the limit in a discussion of shallow-water forms. Consequently the faunistic lists of the "Investigator" (apart from records of large species) are much more complete than those of the "Golden Crown." Not only was the latter vessel compelled to trawl in waters where fish might be expected in quantities sufficiently large to make out a case for commercial fishing, but the net used was designed only to catch fish sufficiently large to be marketable. Invertebrates of any kind (except prawns) were regarded as undesirable débris.

No account, however cursory, of this area can be considered complete which omits reference to the shallow-water forms captured by the catamarans and the masula boats of Puri. From the latter vessels, which fish during the period of the N.E. monsoon, a large seine-net of semicircular "sweep" is used. The catching part of the net is of very small mesh so that forms which would pass through the cod-end (tail-end) of the "Golden Crown's" trawl would be enmeshed by this "bara jāl" of the native fishermen at Puri. Consequently forms like *Clupea kunzei*, which are occasionally captured in immense quantities on the shore, are absent or represented only by isolated individuals in trawl net hauls made further out. Hauls made by the seine-net on Puri beach in December 1908 consisted mainly of this species with a few other forms such as *Scomber microlepidotus*, *Upeneoides vittatus* and *Tetrodon lunaris*. *Elacate nigra*, *Cybium guttatum* and a few "skates" (*Myliobatis nieuhofti*) may also be regarded as typical.

The following list, though not to be regarded as complete, gives one an idea of the species most prevalent at Puri at this time of the year (December):—

Elasmobranchii.

Torpedo marmorata.	Myliobatis nieuhofti.
Trygon walga.	„ „ var. cornifera.
„ „ var. imbricata.	

Alcock, "A supplementary list of the Marine Fishes of India, with descriptions of two new genera and eight new species,"
Journ. As. Soc. Beng., vol. lxxv, pt. ii, No. 3, 1896, pp.
301—338.

(The above is not a complete list of Dr. Alcock's papers on Indian marine fish but refers only to those which contain descriptions of or reports on shallow-water species.)

Teleostei.

Clupea kunzei.	Equula lineolata.
Chatoessus nasus.	„ insidiatrix.
Engraulis commersonianus	Chorinemus lysan.
(young only).	Lactarius delicatulus.
Saurida tumbil.	Seriola nigrofasciata.
Arius jatus.	Scomber microlepidotus.
Arius nella.	Cybium guttatum.
Pristipoma maculatum.	Elacate nigra.
Therapon theraps.	Sillago sihama.
Upeneoides vittatus.	Sphyaena obtusata (also a
Sciaena (species not yet deter-	species not yet identified).
mined).	Mugil jerdoni.
Sciaena carutta.	Synaptura commersoniana.
Caranx kurra.	Plagusia bilineata.
„ melampygus.	„ marmorata.
„ atropus.	Triacanthus brevirostris.
„ hippos.	Tetrodon lunaris.
Equula ruconius.	

This list was considerably extended as a result of further observations in March (1909) when fishing, both with the seine-nets in the masula boats and with the drift-nets of the catamarans, was carried on. The pomfrets (both *Stromateus cinereus* and *S. niger*) were present in large numbers. On this occasion these fish were captured in the drift-nets as the weather was too rough for the masula boats. In this net there were also present *Cybium guttatum*, *Trygon gerrardi* and *T. imbricata*, *Chiloxyllium griseum*, *Dussumieria acutus* and species of *Minous* and *Trichiurus*.

The sea-snake *Distira robusta* was represented by a specimen 174.5 cms. (68 inches) in length. *Trygon alcockii*, a new species of sting-ray, was captured in a seine-net at Puri at this time.

The "Golden Crown" rarely trawled in muddy ground in this area, though occasionally in deeper water mud was met with; but this mud was invariably of a harder consistency than that in Area I. Off the Black Pagoda (Konarak) there is a reef composed of a recent conglomerate of sand and decomposed shells, and the trawl net was on one occasion lost on this reef. Off the Devi river turtles were unusually abundant, no less than six being taken in one haul of the trawl. The forms represented were *Thalassochelys caretta* and *Chelone imbricata*.

Invertebrates were not uncommon; of the edible species the "prawns" (Peneidae) predominated. The largest hauls made by the "Golden Crown" were made in this area and in Area IV. In September 1909 no less than 2½ tons weight of prawns were caught in seven days fishing. Of other Crustacea probably *Calappa lophos* is the commonest.

Mollusca are more abundant than on the muddy grounds off the Sunderbuns. A spiny species of *Murex* (*M. tenuispina*), several species of *Chama* and *Dolium* are typical. *Astropecten* and

Squilla were typical representatives of the Echinoderms and Crustacea respectively. The typical fish of this area are the Sparoids, the "red flat" of the "Golden Crown" (*Pagrus spinifer*) and particularly large specimens of *Drepane punctata* being obtained. Shoals of *Scomber microlepidotus* were occasionally met with. The Carangidae, too, were unusually abundant in this area. Of other forms the red mullet (*Upeneoides guttatus*) and species of *Triacanthus* were noticeable. The latter was caught in large quantities off the entrance to Lake Chilka, and it is interesting to note that it is also caught right up on the landward side of the lake by the Ooriya fishermen near Balugaon.

It is interesting to compare Alcock's notes¹ on the shallow-water forms obtained by the "Investigator" in this region and Area IV with the "Golden Crown's" collections.

"Four months regular trawling off the Orissa Coast, or rather off the eastern coast of the peninsula between False Point on the north and Gopalpur on the south—a region nearly corresponding with the debouchment of the Máhánaddi delta.

"The physical features here are those of all Indian deltas where the land is making precarious advances on a shoaling muddy sea. Low-lying wastes of drifting sand alternate with still lower-lying estuarine swamps; the coast line presents the unbroken level of a recently formed alluvium, the bed of the sea is an almost imperceptible slope of fine sand and mud, and the more or less turbid waters are consequently so shallow that the twenty-fathom line is distant from five to thirteen miles from shore, while the hundred-fathom line ranges from fifteen to twenty-two miles, as was determined by the "Investigator" in her recent survey. Towards the south, the sea deepens and the bottom becomes sandy.

"The waters of this region swarm with crustaceans and fishes. Penaeidae, Paguridae, and numerous families of the Brachyura exist in the greatest abundance, while the surface waters are crowded with the lower crustacea and with crustacean larvae. The commonest fishes are *Sciaena*, *Kurtus*, *Polynemus*, *Equula*, *Arius*, *Pellona*; *Carcharias*, *Scyllium*, *Trygon*; and, among the Pleuronectids, *Pseudorhombus* and *Cynoglossus*."

If one compared the "Golden Crown" hauls (which were confined to a more limited area) with this, the two leading Pleuronectids would undoubtedly be *Cynoglossus* in the deeper and *Plagusia* in the shallower water. The three leading genera of Elasmobranchs would be *Trygon*, *Pteroplatea* and *Myliobatis*, and the half dozen most abundant Teleosts *Arius*, *Sciaena*, *Caranx*, *Scomber*, *Pagrus* and *Drepane*.

AREA IV THE NORTHERN SIRCARS COAST.

This area extends from the entrance of Lake Chilka to Santapilli (in the Madras Presidency). Trawling was carried on in

¹ "List of Pleuronectidae obtained in the Bay of Bengal in 1888 and 1889," *Journ. As. Soc. Beng.*, vol. lviii, pt. ii, No. 3, 1889, p. 280.

depths of 24 to 35 fathoms off the coasts of the districts of Ganjam and Vizagapatam, but principally off the former. The twenty-four to thirty-fathom grounds off Ganjam, Gopalpur, Sonapur, Baruva and Kalingapatam were thoroughly explored. These grounds were stocked with good edible fish, Percidae for the main part. The net was frequently torn and damaged in these waters owing to the presence of rock-like masses consisting of shells of *Siliquaria cochlearis* and *Spiroglyphus cummingi* interwoven with a Lithistid sponge.¹ One of these reefs was located when hauling off Gopalpur light which bore N.N.E. about 18 miles. The depth of water was 26 fathoms and the reef extended in a W.S.W. direction from that point. The solid nature of the ground in this neighbourhood furnishes a holding place for gigantic fan-like Antipatharia. Other typical forms of this area are *Solenocaulon*, *Rhipidogorgia* and *Eunicella*.

The fish of this area are quite distinct from those of the other three areas explored. Of the Trygonidae, for instance, *Trygon kuhlii* and *T. zugei* are the most characteristic, the latter apparently not being found further north. *Trygon microps*, the largest of the Indian sting-rays, was frequently taken here. On the 9th March 1909, about half-way between Rati beacon and Pundi one was captured which weighed over 400 lb. The bony fishes serve to differentiate this region from those further north, and whole families are met with here which are only represented by isolated individuals or are entirely absent in the other areas. The Centriscidae, for example, are represented by the curious shrimp-fish, *Amphisile scutata*, which was not obtained in Areas I or III, but was occasionally met with on the Arakan Coast.

The Percidae were far more abundant off the Ganjam district than elsewhere and in particular *Serranus pantherinus* and *S. latifasciatus* were typical. Two others that might be mentioned are *Lutjanus marginatus* and *Scolopsis vosmeri*. The Chaetodontidae were first recorded in the "Golden Crown's" hauls from this area, and in particular *Chaetodon vogabundus* var. *pictus*, *Heniochus macrolepidotus* and *Holacanthus xanthurus* were frequently present. These fish are of small size and bright coloration. They are typical coral-reef denizens.

Of the Sciaenidae, the genus *Umbrina* replaces the genus *Sciaena* of more northern waters. *Umbrina macroptera* was only recorded from this area. The Acanthuridae are also typical, the two leading forms being *Acanthurus punctatus* and *A. gahm*.

Two species of Muraenidae were captured here. Both belonged to the genus *Muraena*, the only species identified being *Muraena punctata*. Other families though not restricted to this area were far more common here than elsewhere. Amongst these may be mentioned the Berycidae with *Holocentrum rubrum* and *Myripristis murdjan*, the Sphyraenidae (Barracutas) with *Sphyraena jello* and

¹ For a detailed description *vide* Annandale, "Some sponges associated with gregarious molluscs of the family Vermetidae," *Rec. Ind. Mus.*, vol. vi, p. 47.

S. obtusata and the Balistinae with *Ballistes stellaris*, and *Ostracion turritus*.

The predominant Holothurian was *Colochirus violaceus*. The edible spiny lobster (*Panulirus polyphagus* and *P. homarus*), the crabs *Neptunus pelagicus*, *N. sanguinolentus* and *Charybdis crucifera* represented the Crustacea. Of the Molluscs species of *Arca*, *Chama*, *Fusus*, *Melina*, *Nassaria* and *Pleurotoma* may be regarded as typical.

In conclusion I have to thank Dr. N. Annandale, Mr. S. Kemp and Mr. B. L. Chaudhuri for much assistance in the identification of species mentioned in this paper.

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Bengalichthys impennis, gen. et sp. nov.
Trygon favus.
„ *alcockii*.
„ *jenkinsii*.
Urogymnus laevis.
Narcine brunnea.
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Oxynaspis celata sub-sp. *indica*.
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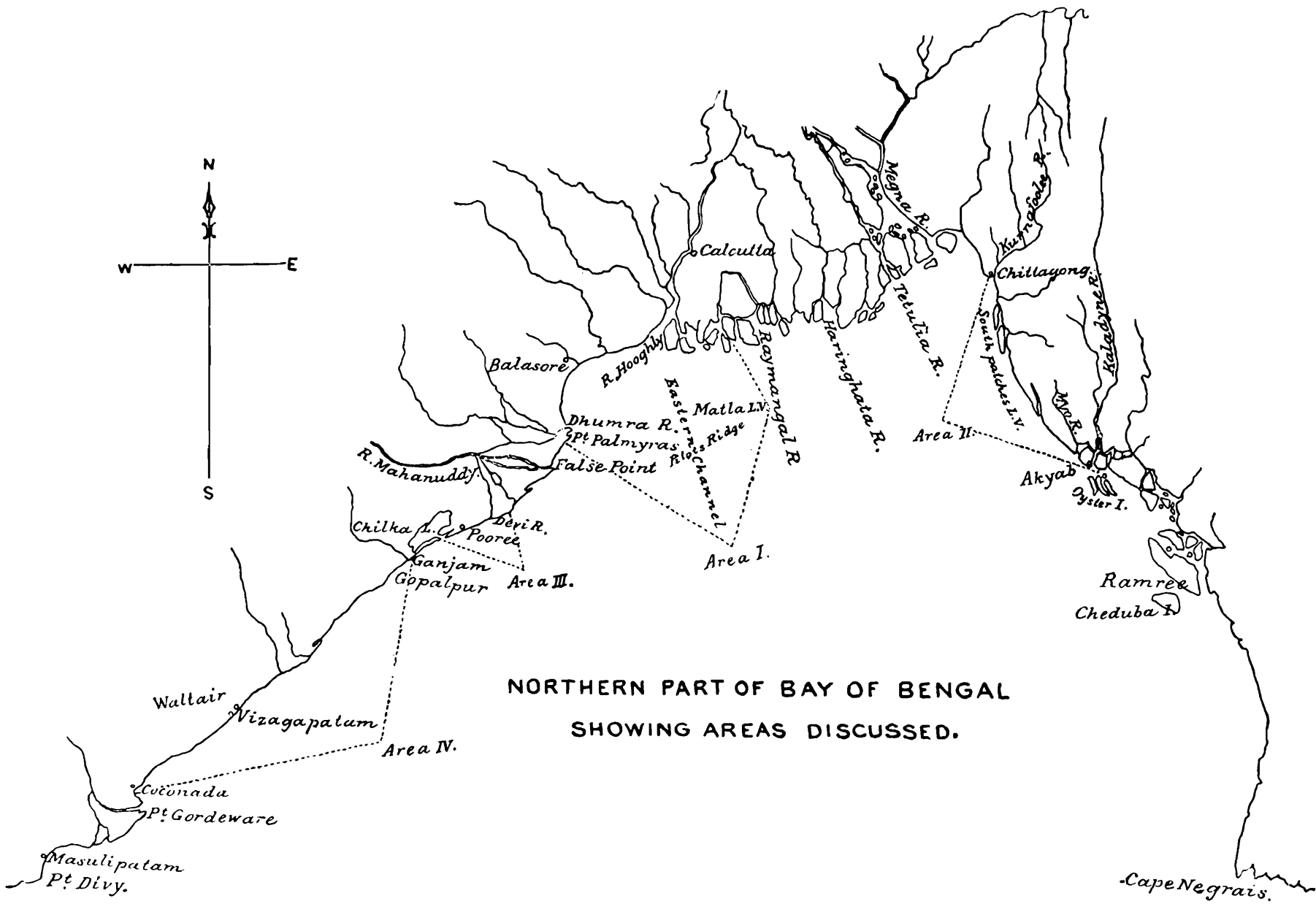
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- „ "Descriptions of five new species of marine shells from the Bay of Bengal." *Rec. Ind. Mus.*, vol. v, p. 117.
(*Drillia ganjamensis*, *Nassa ariel*, *Pteronotus annandalei*, *Martesia delicatula* and *Pandora perangusta*.)

COELENTERATA.

- Annandale, N. "A pelagic sea-anemone without tentacles." *Rec. Ind. Mus.*, vol. iii, p. 157.
(Specimens of this new form *Anactinia pelagica* were taken on the "Golden Crown.")

SPONGES.

- Annandale, N. "Some sponges associated with gregarious molluscs of the family Vermetidae." *Rec. Ind. Mus.*, vol. vi, p. 47.
(Describes as new—
Racodiscula sceptrellifera var. *spiroglyphi*.
Racodiscula sceptrellifera var. *siliquariae*.)



V NOTES ON THE COLLECTION OF
COCCIDAE IN THE INDIAN MUSEUM
(CALCUTTA)

I.—THE GENUS *MARGARODES*.

By E. E. GREEN, F.E.S., F.Z.S.

(Plates ii, iii.)

Margarodes Guilding, *Trans. Linn. Soc. Lond.*, xvi, p. 115 (1828).
Porphyrophora Brandt, *Mediz. Zool.*, ii, p. 355 (1833).
Sphaeraspis Giard, *Compt. Rend. Soc. Biol.*, Paris (10), No. 25,
p. 683 (1897).

The genus *Margarodes*, originally erected to contain the single species *formicarum* and, for a long time, restricted to that species, is now justly considered to include *Porphyrophora* of Brandt. *Sphaeraspis* was suggested, by Giard, as a subgeneric name to contain the species *vitium* and *capensis*, but there seems no good reason to separate these from the other typical species.

At the present date eleven reputed species are recognized, of which the recorded distribution is as follows:—

Europe:—*gallica*, *polonicus*, *perrisii* and *mediterraneus*.

Turkey in Asia (Armenia):—*hamelii*.

Africa:—*capensis*, *trimeni*.

United States and West Indian Islands:—*formicarum*, *rileyi*,
hiemalis.

Chili:—*vitium*.

Dr. Giard, in a manuscript note to a paper on the geographical distribution of *Margarodes*, mentions the receipt of a species (allied to *formicarum*, *trimeni*, etc.) from Madagascar. In the same paper he states, on the authority of Trimen, that there are certain indications of the existence of the genus *Margarodes* in Australia.

In addition to the above localities, Mrs. Fernald—in her Catalogue—attributes *capensis*, *rileyi* and *hamelii* to Europe, *polonicus* to Central America, and *formicarum* to the East Indies; but I can find no authority for these records, and am inclined to believe that they have been inserted in error, or owing to faulty identification. The species *capensis* is certainly confined to South Africa: *rileyi* is similarly peculiar to Central America, unless—as suggested by Giard—it is identical with *hiemalis* of Cockerell. I am uncertain about *polonicus*, but it seems extremely doubtful that it should occur in such widely separated countries as Europe and Mexico. It is equally doubtful if *formicarum* (or any other species of *Margarodes*) has ever been found in the East Indies.

This being so, there has hitherto (with the exception of my short note in the *Journal of the Bombay Natural History Society*, vol. xix, No. 3, p. 761) been no satisfactory record of a *Margarodes* from the Indian Region. The insect presently described under the name of *M. indicus* at least supplies the first indubitable record from India proper.

Before proceeding to describe the Indian representative of *Margarodes*, a brief account of the life history and development of the remarkable insects of this genus will be necessary.

According to Giard, who observed the process in living examples, the eggs are deposited underground, in a mass of waxy filaments secreted by the adult female. From these emerge larvae of a more or less typical form. They are normally hexapod, but Silvestri has described a species (*mediterraneus*) in which the larvae have a single (anterior) pair of legs. The larval antenna appears to be normally 6-jointed, but the abnormal larva of *mediterraneus* exhibits only three antennal joints. The larvae, according to Mayet, attach themselves to the roots of plants and increase in size. Whilst growing (again according to Mayet) they secrete the envelope of the cyst that subsequently encloses the nymph.

It is this second (encysted) form that has attracted the attention of many observers by the wonderful pearly lustre which has gained for the insects the popular name of "Ground Pearls"—as suggested in the generic name *Margarodes*. These pearl-like cysts are found in the soil and were originally supposed to be associated with ants (hence the name of the type species—*formicarum*), but this observation requires corroboration. There is, however, nothing improbable in such an association, very many Coccidae being attended by ants for the sake of their sugary excretions. Giard has determined a species of *Brachymyrmex* as attending *M. vitium*, in Chili. The cysts may occur in enormous numbers. Riley (*Insect Life*, vol. iv, p. 359) states that, in certain parts of Florida, they compose over half the soil. Long before the nature of the organism was recognized, the cysts were used for ornamental purposes, being strung into necklaces and manufactured into various fancy articles. The cysts, when fully developed (see pl. ii, fig. 8, and pl. iii, figs. 9, 16, 17, and 18), are of irregular form, and are composed of overlapping closely applied laminate brittle scales which give to the object somewhat the appearance of a miniature fir-cone or of the fruits of certain palms. They vary in colour from pale yellow to deep bronzy brown, these differences being apparently due to age rather than to species. The lustre also varies with age, and is brightest in individuals that have lost some of the superficial laminae. Any determination of species based solely upon the character of the cysts must be extremely unreliable.

The nymphal insect contained in these cysts may well have perplexed the earlier entomologists. It consists of a globular sac, without any superficial indications of structural characters. It shows neither eyes, limbs, nor any of the usual organs. By very

careful microscopical examination, minute rudiments of antennae may be distinguished, but of buccal apparatus there is practically no sign, though Giard asserts that it exists and is functional. He remarks:—"The suctorial filaments are completely retractile in the active larva, as also in the nymph. Consequently, the very small mouth is easily overlooked, especially in *M. vitium* where the buccal plates are completely rudimentary and where nothing in the general form of the insect reveals the position of the opening. The sucking tubes are shed at each moult, but the animal never becomes really astomatous until the last transformation." The mouth-parts are, however, so very much reduced, that it is difficult to believe that much nourishment can be taken in by the usual means during this stage. Mayet suggests that the insects may absorb liquid food (? by osmosis) through the skin.

Coccidae are peculiar amongst the natural order Rhynchota, in that the males normally undergo a complete metamorphosis, passing through an active larval and a passive pupal stage before appearing in the adult winged form. But, with the exception of *Margarodes* and its allies (included in the subfamily Margarodinae), the female Coccid, though undergoing certain changes of form, continues to feed and grow throughout its development. In the case of *Margarodes*, after remaining for a considerable period (possibly extending over years, in adverse conditions) in this resting stage, the female eventually breaks through the cyst and reappears as a normal hexapod insect (see fig. 15). The anterior limbs are specially adapted for digging. Their femora are greatly thickened: the tibia and tarsus are fused together for greater strength, and terminate in a stout horny claw (figs. 19 to 22). The antennae of the adult female are comparatively short and stout, gradually tapering to the extremity, of from 7 to 9 joints.

All observers agree that the adult female has no trace of a rostrum or buccal apparatus of any kind. It would appear, therefore, that the insect must take in a sufficient store of nutriment during the larval stage (which is probably prolonged for some time after the formation of the cyst) to sustain it during the succeeding nymphal and imaginal stages. We find a similar condition in certain Lepidoptera in which the adult insects take no food.

The early development of the male insect has apparently never been observed. Whether the male larva proceeds to secrete a cyst similar to that of the female, or whether it constructs a specialized puparium, is not known. The males are scarce, in collections, and have usually been captured on the wing, or running on the ground. If it were not for the characteristic front legs, there would be little reason to connect these males with the female *Margarodes*. Fortunately this connection has been actually established. Prof. Cockerell (*The American Naturalist*, vol. xxxiii, No. 389, p. 415) describes the discovery of "a couple of small winged insects, hurrying to and fro (on the ground) as if they had lost something. Presently, one of them began to dig into

the earth, and in a moment completely buried itself, leaving only the tips of its long abdominal filaments visible." Prof. Cockerell dug it out and discovered the object of its search, which proved to be an adult female *Margarodes*. The appearance of a male *Margarodes* may be gathered from fig. 1, and from the subsequent description of *M indicus*.

In my study of this interesting genus I have unfortunately not had access to the earlier authors: but Signoret, in his classical *Essai sur les Cochenilles*, has given a useful resumé of the previous work on the subject. I append a list of the publications that I have been able to consult.

- | | | |
|----|---------------------|--|
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| 2. | Riley, C. V | " <i>Margarodes</i> in the United States,"
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Cochenilles du Genre <i>Margarodes</i> et sur
deux Espèces nouvelles de ce Genre,"
<i>Compt. Rend. Soc. Biol.</i> , Paris (July
1897). |
| 9. | Cockerell, T. D. A. | "On the Habits and Structure of the
Coccid Genus <i>Margarodes</i> ," <i>American</i>
<i>Naturalist</i> , vol. xxxiii, No. 389 (May
1899). |

Amongst a collection of Coccidae submitted to me by the Superintendent of the Indian Museum, I found three examples of a male Coccid that I at once recognized as belonging to this genus. The remarkable fossorial front limbs and the presence of long tufts of silky filaments on the abdomen permitted of no doubt as to the systematic position of the insect. Subsequently, several small parcels of empty nymphal cysts of a *Margarodes*, collected at various Indian localities, were received from the same source. From one of these cysts I extracted a fragmentary and decayed example of the adult female insect.

In the absence of complete examples of the adult females, it is impossible to say with certainty that the cysts are all of the same species, or that they are specifically connected with the males first examined. The probabilities, however, are in favour of their being so. With one exception (a single large nodular example, fig. 14), the cysts—though varying in size and form—are all of a similar structure.

From such meagre material it may, perhaps, be considered imprudent to describe the insect as a new species: but as it is equally impossible to assign it with certainty to any of the known species, and in consideration of its geographical position, I have ventured to do so,—principally in the hope that the publication may attract attention to the existence of the genus in India, and so lead to fresh discoveries and a better knowledge of the habits of this interesting insect.

Margarodes indicus, sp. nov.

Adult σ (pl. ii, figs. 1 to 7): described and figured from dried (pinned) examples, partially restored by boiling in caustic potash.

Colour dark brown. Details of body segments not absolutely determined.

Antenna with 13 subequal joints: 1st shortest, cylindrical, remainder obconical to oval, 3rd joint largest: all the joints (except 1st) with fine hairs, not arranged in whorls. The antennae spring from two broad plates which might, perhaps, be considered as basal joints, in which case the number of antennal joints would be taken as 14.

The normal number of antennal joints in male Coccidae, of all subfamilies and genera, is 10. A few abnormal species (usually apterous forms) have a less number, but in no other genus than *Margarodes* has a greater number than 10 been observed. In fact, this is the first indubitable record of a greater number. Signoret, in attributing 13 antennal joints to the male of *Margarodes* (*Porphyrophora*) *hamelii*, on the authority of Brandt, expresses a doubt as to the correctness of the observation. In the light, however, of this Indian species, it is quite probable that Brandt has given the correct number for his species.

Head almost entirely occupied by the large compound eyes, which meet below and are separated by a narrow channel above (fig. 2). A single ocellus, rather larger than one of the facets of the compound eye, can be distinguished on each side, impinging upon the margin of the compound eye.

Wings large and ample: semi-hyaline, very slightly fuscous. Venation obscure, but apparently more complex than in other Coccids. Costal area (from base to two-thirds of length) semi-opaque, brownish red; apparently enclosed by a distinct nervure which throws off a short branch from near its base, towards the costa. There appear to be four other nervures (see

fig. 1), but they are ill-defined and colourless and are demarked chiefly by ridges of the wing membrane.

Halteres narrow, each terminating in a single hooked bristle (fig. 6).

Legs stout, the femora very broad. Anterior limb (fig. 4) evidently fossorial: the tibia and tarsus short and stout, the strong claw firmly fused to the tarsus without any definite line of demarcation: tibia, tarsus and claw of approximately equal length. In the other limbs (fig. 5), the tibia and tarsus are normal and the claw articulated to the latter: tibia more than twice length of tarsus: a minute unguis on claw of mid and hind legs, none on claw of front leg.

Abdomen broad, with a strong fold on each side: 7th and 8th abdominal segments dorsally prominent, each with a dorsal tuft of long glassy filaments (equal in length to the whole body of the insect) which are directed upwards and backwards, arising from transverse bands of crowded polygonal cells (fig. 7): terminal segment shovel-shaped, the intromittent organ slender, forming a backward loop within the body before passing through the genital sheath (fig. 3).

Length 2.75 to 3.25 mm. Expanse of wings approximately 8 mm.

Locality: Jahada, Nepal, India, 14-ii-1908. Coll. Indian Museum.

When boiled in potash, the insect gave out a bright crimson stain.

Adult ♀ A fragmentary example of an adult female was extracted from one of the cysts from Bangalore (sample 2), described below. Judging from the dried remnants, the insect was probably yellow in life. Owing to the decayed and imperfect condition of the specimen, few details of the body can be made out; but there are many large and stout hairs (almost spines), both on the dorsum and venter, and numerous bluntly pointed conical spines (fig. 23) on the marginal area. Fortunately one of the anterior limbs remains intact. This leg (fig. 19) is of the typical fossorial form: the femur very broad and robust, with a few longish stout hairs on its inner area: the tibia small and triangular, with two long stout hairs on its inner margin: the tarsus and claw closely fused together, curved, tapering to a sharp point, with two stout lateral hairs near the base, and three or four stout curved hairs on the inner margin corresponding to the unguis digitules.

In the development and position of the hairs on this limb, *M. indicus* approaches *M. formicarum* (fig. 20), rather than the two African species (figs. 21 and 22): but differs in the greater number and size of the unguis hairs. It will be observed that it is very much smaller than the corresponding limb of the other species with which I have been able to compare it (*vide* figs. 19 to 22, all enlarged by 50 diameters). But the whole insect is proportionately small. The imperfect condition of my example

prevents an accurate determination of its dimensions, but I estimate that its total length cannot have been more than 2 mm., while *M. capensis* measures approximately 6 mm. in length, and *M. trimeni* 4.5 mm.: the length of *M. formicarum* is given, by Signoret, as 5 mm. Size, however, appears to be an unreliable character. Giard, in his "Third note on the genus *Margarodes*," remarks: "According to the conditions of nutrition in which the nymph finds itself, the latter is able to transform itself into an adult female of very different sizes. Certain adult females of *M. vitium* are no more than 2 mm., while others attain a length of 5 or even 8 mm. As a result one often finds adult females smaller than some of the larvae."

The Indian Museum collection contains several small gatherings of empty nymphal cysts of *Margarodes* which, in the absence of evidence to the contrary, may be considered to belong to this same species. They are described separately, according to the circumstances of their collection.

- (a) A small tube containing 4 cysts (immature examples).
Label:—6804/16, Bangalore, S. India, ca. 3000 ft., 12-X-1910. "Among weeds in Service Tank, Bangalore. N. Annandale."

These examples vary in size from 1 to 1.75 mm. (long. diam.). They are irregularly ovoid: of a bright golden yellow colour to rich golden castaneous, with iridescent lustre. Shell thin: one with traces of overlapping scales on one side, the others without scales.

- (b) A tube containing about 45 cysts. Without a label, but believed to be part of the gathering from Service Tank, Bangalore.

Size ranging from 0.75 to 2 mm. Colour varying from very pale yellow to dark castaneous brown: intermediate forms with bright iridescent lustre. Many of the smaller and all the larger cysts with well-developed overlapping scales (fig. 9). The largest cyst (fig. 8) with the scales overlapping in opposite directions from the two extremities, possibly a composite cyst. Most (especially the smaller) have a short conical process on the lower surface, which probably marks the point of attachment to the root of some plant (fig. 10).

- (c) A small tube containing more or less fragmentary cysts
Label:—4319/4. "Madras, Editor of *Asian*."

Length of largest example 2.5 mm. Form elongate oval: with large overlapping scales (fig. 11). Colour golden bronzy yellow, with iridescent lustre.

- (d) Small bottle containing numerous decomposed cysts filled with earthy matter.

Label:—"Pearl-like globules. Received 12-XI-1891 through Dir. L.R. & A., Bombay, from the Collector

of Khandesh. They were found in the ground and are thought to be of similar origin to the 'Ground Pearls' of the West Indies." These examples are very old and decomposed and consist mostly of an earthy core slightly overlaid with nacreous matter. Average diameter 3 mm. Surface nacreous, whitish, opaque, rather furfuraceous (from decay), with slight lustre, covered with an intricate network of fine cracks: inner surface more distinctly lustrous. A few examples with traces of one or two large overlapping scales (fig. 12): others smooth (fig. 13). The loss of colour is evidently due to exposure and decay, and the opacity to the presence of air between the laminae.

- (e) Pill-box, containing 15 cysts (and some small seeds and shells of small molluscs).

Label:—4146/16. "Surface of flood-water, edge of the River Hoogley, at Tribeni (near Calcutta), 31-vii-1909." Size varying from 1 to 5 mm. There are a few only of the smaller size, the greater number ranging from 2 to 2.5 mm. Colour of average examples pale yellow to bright golden yellow, iridescent. Form and character of overlapping scales similar to the specimens described under (b).

A single large example of exceptional form (fig. 14). Size 5 mm.: colour dull castaneous, without lustre: of very irregular form, nodular, overlapping scales almost completely obscured. This example may be of compound origin, and is possibly of a distinct species.

Any attempt to differentiate the species by the form, size, colour or structure of the nymphal cysts is unsatisfactory. All these characters are inconstant and vary indefinitely in a single parcel. Such differences probably depend very largely upon the age and development of the individual. *M. mediterraneus* appears to be exceptional in being devoid of overlapping scales throughout its development. In *M. rileyi* (fig. 18) the scales are larger and somewhat looser than in *trimeni* (figs. 16, 17) and the West Indian forms. The Indian examples that I have seen are, on the average, considerably smaller than those from the African and American regions; but it would be possible to match individuals from India with particular examples of *formicarum*, *trimeni* or *rileyi*, in size, colour and structure.

The characters of the adult females, where known, are more reliable. There are slight differences in the pelage and other dermal characters, and in the size and proportions of the limbs. The enlarged front legs, in particular, afford useful characters. Thus, in *capensis* (fig. 21), the tibio-tarsus and claw are proportionately shorter and more robust than in *trimeni* (fig. 22). In the

few examples that I have had under observation I notice a marked difference in the pelage of the anterior femora. In *formicarum* (fig. 20) there are many long stout hairs on the inner area of this joint: in *trimeni* (fig. 22) there are a few short stout hairs: in *capensis* (fig. 21) these hairs are more numerous but very short and fine: while in *indicus* (fig. 19) there are five or six stout longish hairs. It is possible, however, that the greater development of the hairs, as shown in the figures of the anterior limb of *formicarum* and *indicus*, may be partly due to the fact that my examples of these species were extracted from unopened cysts, while those of *capensis* and *trimeni* had emerged naturally. It is conceivable that the hairs may be quickly worn down, in life, owing to the fossorial habits of the insects.

The formation of the overlapping scales in the nymphal cysts is difficult to understand. Fissures, resulting from internal pressure, followed by the exudation of fresh liquid secretion from inside (as has been suggested by some authors) could not possibly result in this structure. Mayet explains the process as follows:—“All the time that they are growing, the larvae secrete the envelope of the cyst which, formed of juxtaposed lamellae, enables them to develop by the sliding of these lamellae one over the other.” But against this explanation is the fact that the smaller and presumably younger cysts are composed of a homogeneous envelope, devoid of overlapping scales which appear only at a later period. Having only dead and dried cysts at my disposal, I am unable to suggest any alternative explanation. The solution of the mystery can be resolved only by a close study of living examples, from the earliest stage of development.

It is greatly to be desired that *Margarodes indicus* should be traced to its actual habitat. The true origin of the examples that have hitherto been collected in India is obscure. One parcel was collected on flood-water and these examples may have been transported for many miles before coming to rest. Another gathering was made in the Service Tank, Bangalore, and had probably been carried there by the action of water. The most definite information is in connection with the sample “from the Collector of Khandesh.” These are said to have been “found in the ground.” But the examples show unmistakable evidence of exposure and decay. Nothing is known of the plant or plants upon the roots of which it lives. The subterranean habit of the insect makes its discovery more or less of an accident. The adult winged males are the most likely to be observed. The other stages of the insect should be searched for in the locality that gave birth to the males. Possibly the male insects themselves (as in the instance described by Prof. Cockerell) may afford a clue to the exact position of the females.

SUPPLEMENTARY NOTE.

Since the foregoing remarks on the genus *Margarodes* have been in the press, additional material has been received from Mr. L. C. Coleman, Entomologist to the Government of Mysore.

This material consists of two very distinct species, both of which appear to differ widely from typical *M. indicus* and cannot be identified with any previously known species. One of them may possibly represent fresh examples of the form (*d*) received from Bombay. The other (represented by nymphal cysts only) is totally unlike any recorded species of the genus.

Though the material to hand is not complete enough to permit of a full description, the characters are sufficiently distinct for a preliminary definition of the species.

Margarodes papillosus, sp. nov.

Nymphal cyst globular, smooth; the nacreous covering brittle, very thin, transparent and colourless, revealing the reddish yellow

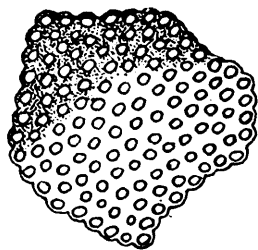


FIG. 1.—*M. papillosus*. Fragment of derm of nymph, $\times 450$.

body of the enclosed nymph. Diameter 2 to 2.5 mm. Cuticle of nymph closely crowded with minute translucent dermal cells (text-fig. 1): when the tissue is torn, the fracture follows the contour of the cells. Rostrum distinct, but doubtfully functional. A minute tubercle bearing a single stout seta, on each side of the rostrum, probably represents rudimentary antennae. The four principal spiracles are situated on the venter of the thorax, far from the margin, and there is a supplementary series of smaller spiracles situated submarginally on each side of the abdomen.

One of the cysts contained a female imago, almost ready to emerge; but the limbs are not fully chitinized and are consequently

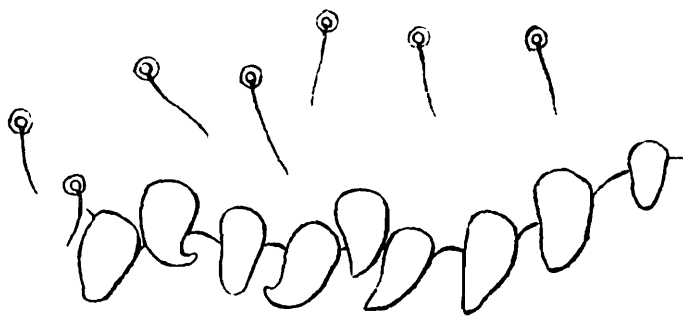


FIG. 2.—*M. papillosus*. Part of one of the median groups of papillae, adult female, $\times 450$.

unsuitable for accurate comparison with other species. Body broadly ovoid; strongly convex; lateral margins of abdominal segments slightly prominent. Antennae 7-jointed; broad at base,

tapering gradually to extremity, terminal joint subglobular: a few spiny hairs at apex of 7th and on anterior margins of 3rd to 6th joints. Front legs very stout and dense: tibio-tarsus terminating in a long curved claw. Intermediate and hind limbs smaller and more slender. Thoracic spiracles large and conspicuous, situated close to the coxae of the anterior and intermediate legs. Dorsum of abdomen with eight transverse series of bluntly pointed papillae which are disposed in three groups—one median and two lateral—on each segment. The median groups each consist of a single row of papillae (text-fig. 2): those of the lateral groups are crowded and spring from polygonal cells (text-fig. 3) which are less noticeable

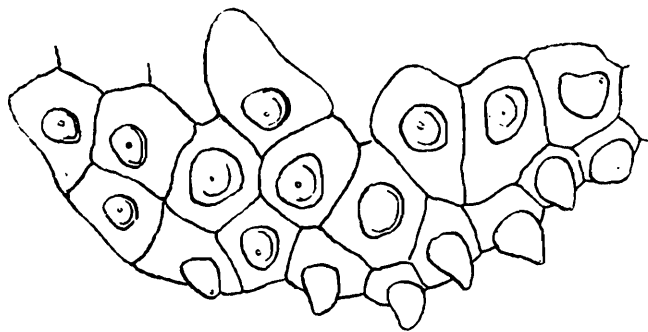


FIG. 3.—*M. papillosus*. Part of one of the lateral groups of papillae, adult female, $\times 450$.

in connection with the median groups. There are a few small hairs immediately anterior to each of the median groups of papillae, and a few ill-defined translucent areoles are scattered irregularly over the body. The submarginal area, on each side of the thorax, is roughened by minute prominent rounded dermal cells. Length 3 mm., breadth 2.25 mm.

Described from 3 nymphs and 1 female imago. Found "near egg-cocoons of Acridiid grasshoppers;" Bellary District, Madras, Others reported to have been found under rose trees; Bangalore, Mysore. The association with eggs of grasshoppers is probably accidental.

The nymphal cysts of this species resemble those of *M. mediterraneus*, Silvestri, from which species they differ by the coarser punctuation and the presence of conspicuous translucent dermal cells. The adult female is sufficiently characterized by the dorsal groups of papillae.

Margarodes niger, sp. nov.

Nymphal cyst practically naked, the usual nacreous envelope being represented only by a few whitish fragments closely adherent to the dense chitinous derm of the encysted nymph. Form globular: diameter 7.25 mm. Colour opaque dull black. The surface appears smooth to the naked eye, but under magnification is found to be minutely and regularly pustulate, the pustules of equal size and contiguous. The cyst contains a white creamy

liquid, permeated by numerous tracheae. Rostrum internal, the tentorium strongly chitinized. After boiling in caustic potash, the black derm becomes partially decolorized and separates into two layers. The outer layer swells and becomes rugulose but still retains its pustular structure. The inner layer is minutely granular.

Mr. Coleman informs me that he dissected fresh cysts of this form, and disclosed an insect with fossorial front limbs similar in every respect to those of *Margarodes*. Unfortunately these specimens were not preserved.

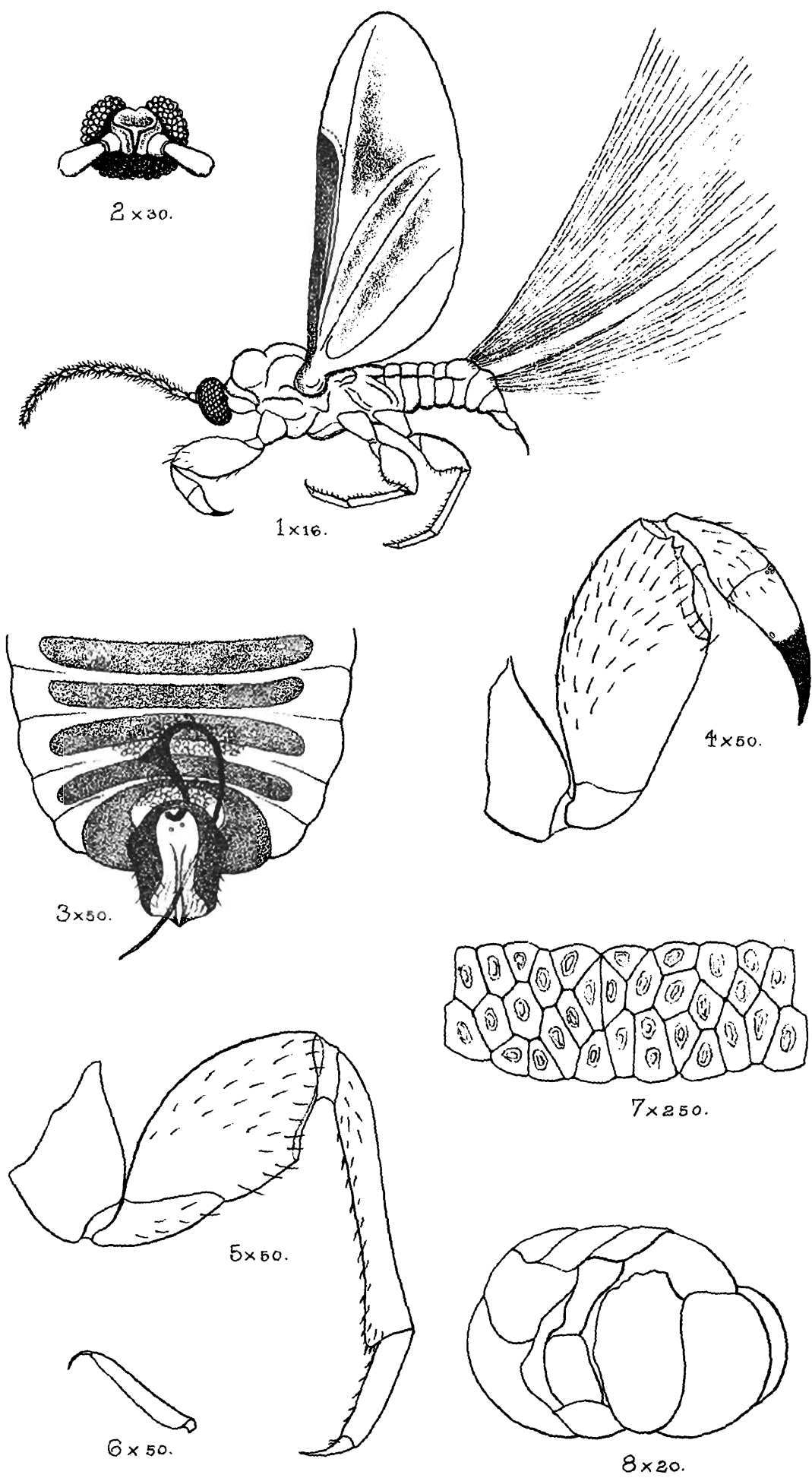
Described from 2 nymphal cysts. Found in soil, associated with egg-cocoons of grasshoppers; Bellary District, Madras.

The globular black cysts might easily be mistaken for the seeds of "Indian Shot" (*Canna indica*).

EXPLANATION OF PLATE II.

FIG. 1.—*Margarodes indicus*, adult male, $\times 16$.

„ 2.—	„	„	„	head, front view, $\times 30$.
„ 3.—	„	„	„	abdomen, from below, $\times 50$.
„ 4.—	„	„	„	anterior leg, $\times 50$.
„ 5.—	„	„	„	posterior leg, $\times 50$.
„ 6.—	„	„	„	one of the halteres, $\times 50$.
„ 7.—	„	„	„	part of secretory area, from dorsum of abdo- men, $\times 250$.
„ 8.—	„	„	„	nymphal cyst (Bangalore), $\times 20$.

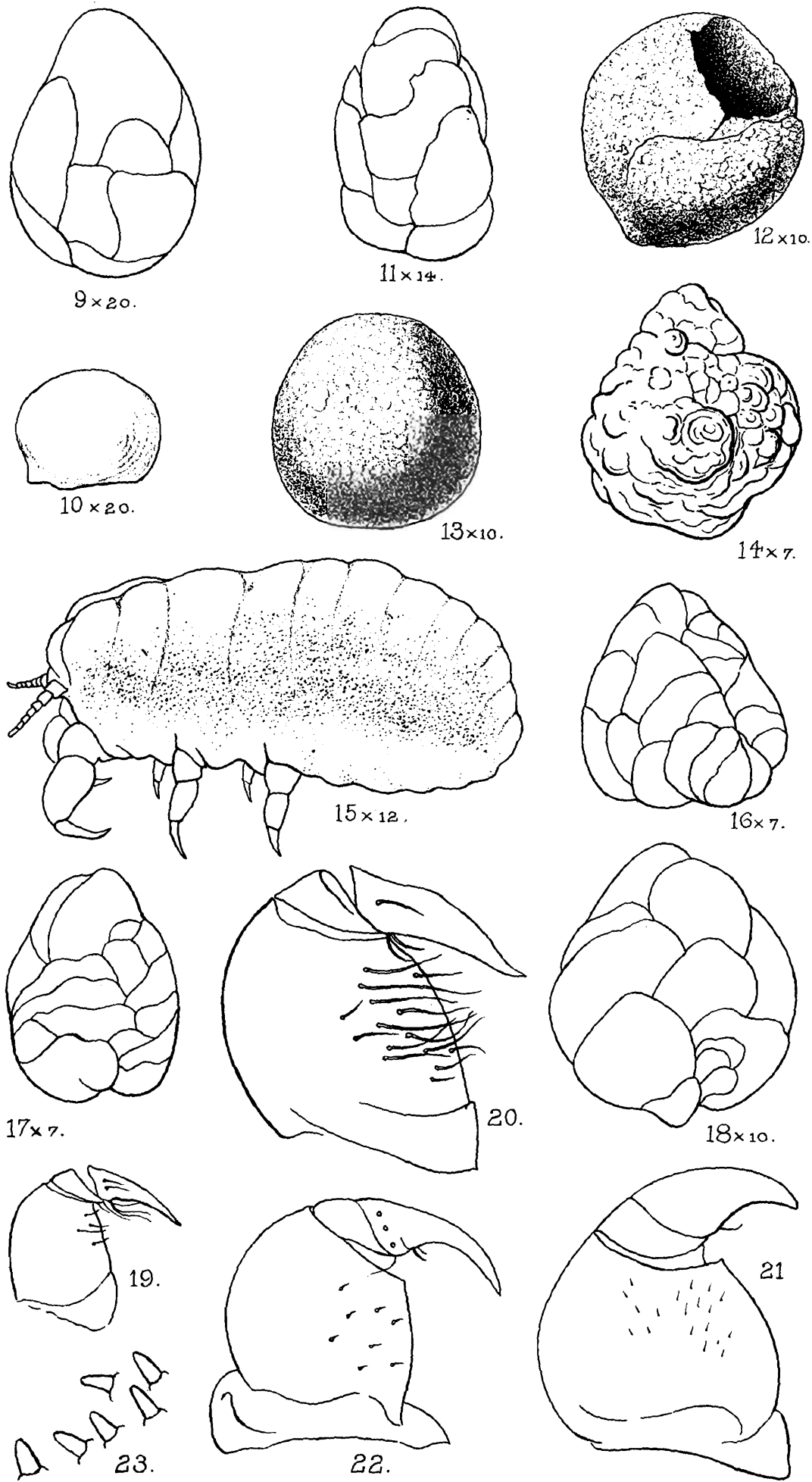


E.E. Green, del.

A.C. Chowdhary, lith.

EXPLANATION OF PLATE III.

- FIG. 9, 10.—*Margarodes indicus*, nymphal cysts (Bangalore), $\times 20$.
 „ 11.— „ „ „ „ (Madras), $\times 14$.
 „ 12, 13.— „ „ „ „ (Khandesh), $\times 10$.
 „ 14.— „ „ „ „ (Calcutta), $\times 7$.
 „ 15.—*Margarodes trimeni*, adult female, side view, $\times 12$.
 „ 16, 17.— „ „ nymphal cysts, $\times 7$.
 „ 18.—*Margarodes rileyi*, „ „ $\times 10$.
 „ 19.—*Margarodes indicus*, anterior limb, $\times 50$.
 „ 20.—*Margarodes formicarum*, „ „ $\times 50$.
 „ 21.—*Margarodes capensis*, „ „ $\times 50$.
 „ 22.—*Margarodes trimeni*, „ „ $\times 50$.
 „ 23.—*Margarodes indicus*, dermal spines of adult female, $\times 450$.



VI. ON THE NERVOUS SYSTEM OF *AMPULLARIA GLOBOSA*.

By EKENDRANATH GHOSH, *Assistant Professor of
Biology, Medical College, Calcutta.*

The present animal is a common pond-snail of Bengal, and can be procured in any number from the ponds in the suburbs of Calcutta. Having access to an ample supply of specimens, I availed myself of the opportunity of studying the nervous system by dissecting a large number of them.

The comparative anatomy of the genus *Ampullaria* was studied by Prof. E. L. Bouvier, who published an excellent monograph [1] on the subject in connection with other Prosobranchiate Molluscs in 1887. He described the nervous system and general morphology of *Ampullaria carinata*, which differs from the present species in several interesting points. In 1910, Capt. R. E. Lloyd described the anatomical features of the present species in his *Introduction to biology for students in India* [2]. The book, being meant for the junior students of biology, dealt with the matter in a concise form, and did not enter into any detail. The present article is meant to describe the subject in some detail.

General.—The cerebral ganglia are widely separated by a ribbon-shaped inter-cerebral commissure. The cerebro-pleural and cerebro-pedal commissures are long, while the pleuro-pedal commissure is practically absent, the ganglia being closely apposed to, although distinct from, each other; this constitutes a “hypoathroid condition.” The supra-intestinal nerve passes from the right pleural over the oesophagus to the supra-intestinal ganglion also connected to the pleural ganglion of the left side by a secondary commissure forming a zygoneurous type [2]. The infra-intestinal nerve passes from the left pleural ganglion to the infra-intestinal, being connected to the pleural ganglion of the other side on its way to the latter. The pedal ganglia are connected to each other by an inter-pedal commissure.

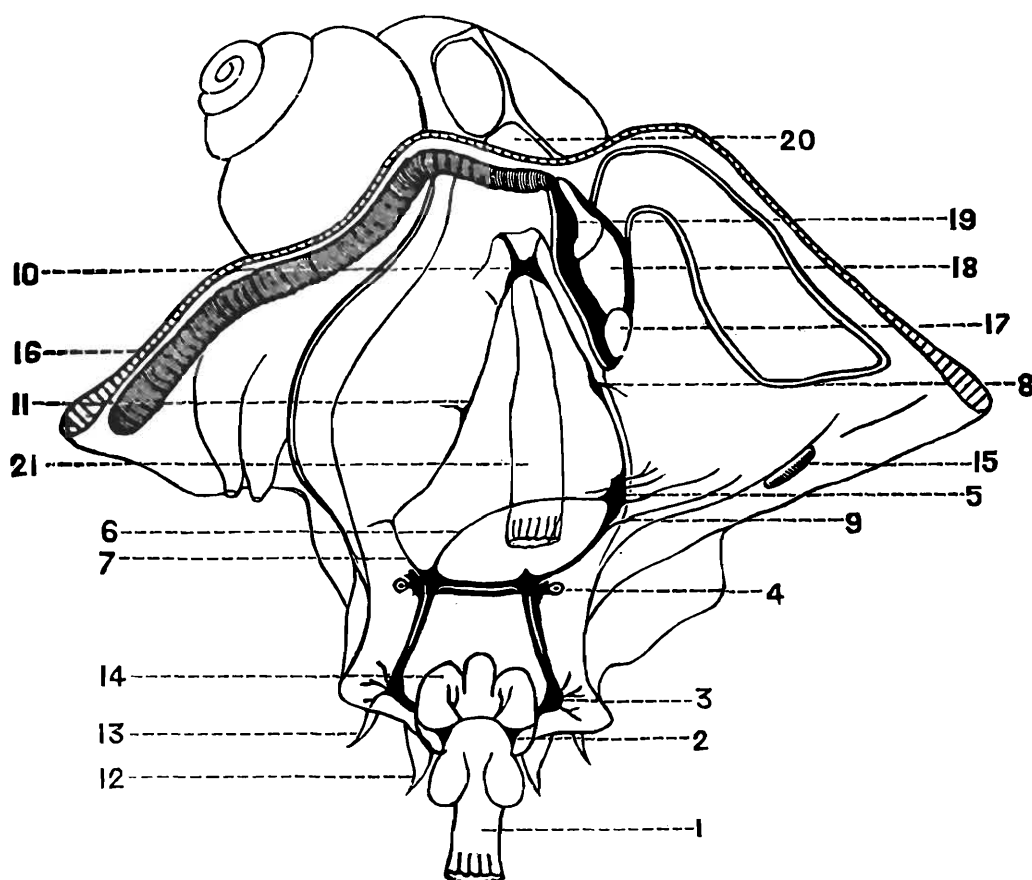
Each cerebral ganglion gives off a fine nerve connected to the buccal ganglion of the same side through the intervention of a small nerve from the latter.

Cerebral ganglion.—Each ganglion is triangular in shape and is situated on the sides of the buccal bulb on its dorsal aspect. From the antero-superior angle of the ganglion is given off the flattened ribbon-like inter-cerebral commissure to the ganglion of the opposite side. The connective lies at the anterior end of the buccal bulb and on its dorsal surface. From the postero-inferior

angle of the cerebral ganglion and from the point below it are given off the large flattened cerebro-pleural and cerebro-pedal commissures.

The nerves from the cerebral ganglia are :—

- (1) A nerve to the labial palp of the side. It divides into two branches.
- (2) A nerve to the tentacle. It gives off a small branch near its origin to the integument on the outer side of the tentacle.



Dissection of *Ampullaria globosa* :

1, oesophagus reflected forwards; 2, buccal ganglion (left); 3, cerebral ganglion (left); 4, pedal ganglion (left) with otocyst; 5, supra-intestinal ganglion; 6, supra-intestinal nerve; 7, infra-intestinal nerve; 8, accessory supra-intestinal ganglion; 9, pallial nerve (left); 10, visceral ganglion; 11, infra-intestinal ganglion; 12, labial palp; 13, tentacle; 14, buccal bulb; 15, osphradium; 16, gill; 17, ampulla of the heart; 18, ventricle; 19, auricle; 20, kidney; 21, crop.

- (3) A nerve to the eye. It supplies a branch from its outer side to the integument of the head.
- (4) A nerve to the buccal ganglion through the intervention of a nerve from the latter ganglion.
- (5) A nerve to the side of the buccal bulb towards the ventral aspect.
- (6) A nerve from the posterior part of the ganglion near the cerebro-pedal connective to the body wall at the back part of the head.

- (7) Several small nerves from the inner aspect of the lower border of the cerebral ganglion. Some of these supply the small muscular strands from the integument to the buccal bulb, while others end in the ventral wall of the head.

Both the cerebral ganglia give off nerves having similar distribution.

Buccal ganglion.—Each ganglion is triangular in shape, and is placed at the junction of the oesophagus with the buccal bulb towards the ventral aspect. Each is connected to the cerebral ganglion of the same side by means of a fine nerve. It supplies nerves to the buccal bulb, salivary glands and the crop.

The nerves from the buccal ganglion are :—

- (1) A fine nerve from the anterior angle anastomosing with that from the ganglion of the other side. It gives off, a little beyond its origin, a small branch which divides into two branches again supplying the ventral wall of the buccal bulb.
- (2) A nerve from the outer angle running up to the dorsal surface of the buccal bulb ; it communicates with the cerebral ganglion of the same side by a fine commissure.
- (3) A nerve from the posterior angle which passes backwards to supply the salivary gland of the same side and the crop.

The cerebro-pleural and cerebro-pedal commissures are long, thick, flattened commissures passing downwards and backwards from the cerebral to the pleural and pedal ganglion of the same side respectively. They are placed on the side of the buccal bulb.

Left pleural ganglion.—It is placed in close connection with the pedal of the same side so that the pleuro-pedal commissure is practically absent. It is also connected to the supra-intestinal ganglion by a thick secondary connective, and to the opposite pleural ganglion by a portion of the infra-intestinal nerve which passes through the latter in its course to the infra-intestinal ganglion.

The nerves from the left pleural ganglion are :—

- (1) The left pallial nerve which lies at first in the same sheath with the secondary connective between the left pleural and the supra-intestinal ganglion. It then leaves the latter and passes up to the ventral aspect of the mantle flap just behind the thick margin lying in a canal throughout its course. It supplies the mantle and the osphradium. The position of the nerve is marked by a translucent line on the dorsum of the foot.
- (2) A small nerve to the left siphon flap.

- (3) A number of small nerves behind and laterally to the surrounding structures (including the dorsal portion of the foot).

Left pedal ganglion.—This is closely connected with the left pleural ganglion. It is connected to the opposite ganglion by an inter-pedal commissure. The nerves from the ganglion are :—

- (1) A short stout nerve to the otocyst.
- (2) Several stout nerves to the foot.

Right pleural ganglion.—This ganglion is similar to that on the left side. It gives off :—

- (1) A pallial nerve to the mantle and the penis and penial sheath in male.
- (2) The supra-intestinal nerve is given off from the right pleural to the supra-intestinal ganglion.
- (3) A nerve to the small right siphon flap.

Right pedal ganglion.—This is similar to the left one in all respects.

The secondary commissure from the left pleural to the supra-intestinal ganglion is a stout and short nerve which lies in a canal on the left side of the dorsum of the foot in the same sheath with the pallial nerve. The position of the nerve can be clearly distinguished by a translucent line on the integument over it.

Supra-intestinal ganglion.—This ganglion is a fusiform body lying in a small sinus of connective tissue on the left side. The cavity in which it lies is covered over by a thin translucent membrane so that the position of the ganglion can be easily pointed out through the integument. The ganglion receives the supra-intestinal nerve from the right pleural ganglion on its right side and is connected to the left pleural ganglion by a secondary connective. The left visceral nerve arises from its posterior end.

It gives off the following nerves :—

- (1) An accessory pallial nerve. It arises from the left side of the ganglion and passes up to the mantle flap lying just in front of the posterior border of the thick rim, and parallel to the pallial nerve of the same side.
- (2) Two small nerves from the left side of the ganglion passing to the mantle flap. The posterior divides into two branches at a little distance from its origin.
- (3) A fine nerve from the right side to the dorsal integument of the foot.

The supra-intestinal commissure is a fine nerve passing from the left pleural over the anterior end of the crop to the supra-intestinal ganglion. The track of the nerve is sometimes represented by a translucent line on the integument over it.

The left visceral commissure is a stout nerve passing backwards along the left side of the dorsum of the foot to the visceral ganglion. Two small nerves are sometimes given off from it to the floor of the mantle chamber.

Accessory supra-intestinal ganglion.—This is a small fusiform swelling on the left visceral commissure. It is present in many specimens but not in all. When present the ganglion gives off two nerves, one from each side, to the integument on the dorsum of the foot and to the floor of the mantle chamber. These nerves are fairly constant, and are present even when the ganglionic swelling is not noticed.

The infra-intestinal commissure passes from the left pleural to the right pleural ganglion; it then leaves the latter and passes along the line of union of the integument on the dorsum of the foot on the right side, being bridged over by numerous fibrous strands throughout the posterior half of its course. The commissure often presents a ganglionic swelling, sometimes two, between the right pleural and the infra-intestinal ganglion.

Infra-intestinal ganglion.—This is a small ill-developed ganglion lying on the right side beneath the crop. It gives off a small nerve to the integument of the right side. The nerve passes outwards to the base of a long fringe-like ridge in the mantle-cavity on the right side. It then divides into two branches, which pass along the base of the ridge in front and behind.

Accessory infra-intestinal ganglion.—A small triangular body giving off a small nerve to the integument on the dorsum of the foot. It lies on the infra-intestinal commissure a little behind the infra-intestinal ganglion.

A still smaller ganglion is sometimes present on the infra-intestinal commissure behind the accessory ganglion.

The right visceral commissure is a fine nerve from the infra-intestinal ganglion to the visceral, lying on a thin membrane extending from the foot to the base of the visceral hump on the right.

The commissure sometimes presents a small fusiform swelling with two nerves from the right side. A small nerve is sometimes given off from the right side of the commissure just before it ends in the visceral ganglion.

Visceral or abdominal ganglion.—This is a triangular ganglion lying on the right side of the pericardium beneath the integument at the base of the visceral hump and behind the posterior end of the pulmonary aperture.

The nerves from the visceral ganglion are:—

- (1) A small nerve to the heart.
- (2) A stout nerve supplying branches to the stomach, intestine, liver, kidney and reproductive organs.

In conclusion it may be noted that the present species agrees with *Ampullaria carinata* in the general arrangement of the

commissures and of most of the ganglia. But in the present species there is a distinct infra-intestinal (sub-intestinal) ganglion constantly present. Moreover, the presence of one or more accessory infra-intestinal ganglia has been observed in a large number of specimens.

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VII DESCRIPTION OF
APHIOCHAETA FERRUGINEA,
A HITHERTO UNDESCRIBED SPECIES
OF PHORIDAE THAT CAUSES
MYIASIS IN MAN

By E. BRUNETTI.

In the autumn of 1907 I bred a number of specimens of a species of Phoridae from the body of a newly-dead lizard (*Calotes versicolor*, Daud.). This was not intentional, but as no spirit was handy to preserve the lizard, the bottle remained uncorked for a few days, but was closed up as soon as signs were perceived that young larvae were developing.

When the flies appeared, the majority were removed and pinned, and the bottle recorked, but a few were seen to remain, and from these a second generation was bred which emerged August 23—27, 1907. Some notes were kept at the time, but these have been mislaid.

Unfortunately no description of the species was published but a few specimens were sent out to various correspondents under the name of *Aphiochaeta ferruginea*, and it now appears that the species has been recognized to exist in many parts of the tropics outside the Orient.

Mr. F. M. Howlett figures it in Lefroy's "Indian Insect Life," and also Col. A. Alcock in his "Entomology for Medical Officers;" and from co-types sent by the Indian Museum to the British Museum, Mr. E. E. Austen has identified as this species, specimens in the National Collection from West Africa and Central America, in addition to those from Oriental localities. He also records it from Sierra Leone and British Honduras, so that it is apparently generally distributed throughout the whole tropical zone.

From the fact that it has been proved to attack man, infesting the intestines and even able to complete its life cycle as an internal human parasite, considerable interest has centred round it recently, and more than once enquiries have been made of me for the published description. As a matter of fact it has till now been merely a *nomen nudum*, but a belated full description is now provided.

In the Indian Museum are the remains of one or two examples which were sent to that Institution by Dr. Crombie, 5-xi-91, having been "reared from eggs passed with the excrement of a European in Rangoon, eggs, grubs and flies being all voided

together." They were sent to the late M. Bigot for identification, and he returned them as "? *Phora bicolor*, Sch." *P. bicolor*, Sch., renamed *meigeni*, Becher, by this latter author, is now referred to *Aphiochaeta*, and is a species with a reddish brown to blackish thorax and bare arista, and must be, I think, different from my species, although they are evidently closely allied. However, so far as can be ascertained from the remains of Dr. Crombie's specimens, it seems highly probable that they belong to *ferruginea*.

***Aphiochaeta ferruginea*, mihi.**

♂ ♀ India, Ceylon. Long. $2\frac{1}{4}$ —3 mm.

Head.—Brownish yellow, yellowish, often more or less tinged with grey, sometimes entirely greyish. Eyes black, microscopically pubescent, posterior orbit with a row of short black bristles; two strong macrochaetae below the lower angle of each eye; and a vertical row of short bristles on the cheeks. Antennae pale yellowish, varying to brownish yellow, arista long and microscopically pubescent. Palpi brownish yellow or yellowish, with several shorter bristles on outer side, a few hairs on inner side and five or six separated strong spines towards the tip. Frons generally concolorous but sometimes with brownish irregular marks in the middle on a yellowish ground colour, the vertical impressed line sometimes very distinct. The frons is furnished with four rows of four macrochaetae in each. The upper or vertical row are reclinate, equidistant, the outer ones at the upper angles of the eyes, the median pair on the inner side of the two upper ocelli, and slightly below the vertical margin. *Behind* the vertical margin is a bristle on each side, almost immediately contiguous to the outer bristle of the vertical row. These post-vertical bristles are convergent. The 2nd row is just below the lower ocellus, and consists of four equidistant bristles, the median pair fractionally but perceptibly higher on the frons than the outer ones. The bristles in this row are generally reclinate but sometimes are almost at right angles to the frons. The 3rd and 4th rows are so composed as to almost make a single semicircular row of eight. They probably, however, represent two rows of four each, those forming the 3rd row placed thus: the outer pair near the eyes as usual (and immediately under the outer ones of the 2nd row but rather more distant vertically from them than these latter are from the vertical or 1st row); the inner bristles rather closer than usual to the outer ones, leaving a wide space of the frons between the inner pair, which latter are much lower on the frons than the outer pair. Of this row, the outer ones are always reclinate, but the median ones are often more nearly horizontal.

The 4th row is placed wholly on the middle of the frons in a short semicircle, the two median ones the lowest, and the outer ones still proximad of the median pair of the 3rd row. Of this 4th row, the outer ones are more or less horizontal, the median pair always very distinctly proclinate.

In some specimens the outer pair of the 3rd row are rather further removed from the median pair, and in this case these latter alone may be considered as forming the 3rd row, and the median pair, with the outer two of my fourth row, as forming a row of four representing the 4th row. There would then be a pair of additional proclinate median bristles below this fourth row. The previous interpretation of their arrangement is apparently the truer one.

Thorax.—Generally bright ferrugineous or brownish yellow, varying in shades and with or without an admixture of grey: occasionally with two faint greyish dorsal lines. Some strong bristles of unequal length and number laterally from the shoulders (where there is always one strong humeral bristle) to the posterior corners, there being generally four towards the hinder border of the dorsum. Some stronger ones in front of the wings; three small ones close together near the fore coxae, a fan-shaped row of six or more small but distinct ones at the extreme base of the costa, and a similar row behind the base of the wing. Sides of thorax rather lighter; scutellum concolorous, with four strong bristles, the outer pair usually the larger.

The whole surface of the thoracic and scutellar dorsum is covered with minute stiff bristles.

Abdomen.—Dark ferrugineous or brownish yellow, practically bare and *very variable*. Normally brownish yellow, the posterior half (or thereabouts) of each segment black or blackish, but this colour sometimes occupies the greater part or whole of one or more segments; in some specimens a clearer space, more or less oval in shape, remains in the centre of the segments; or the abdomen may be wholly black or blackish, with or without pale edges to the segments, this character itself being present or absent irrespective of other coloration.

Sometimes the abdomen is black or dark reddish ferruginous with the centre part generally pale, forming a light wide irregular dorsal stripe. Belly generally brownish yellow or some kindred shade.

Genitalia in ♂ dark, not prominent, bluntly conical, with a few hairs; in ♀ the ovipositor is subcylindrical, pale yellowish, with two stiff hairs at tip.

Legs.—Pale dirty yellow, minutely pubescent. Coxae with some strong black bristles at tip. Femora without distinct bristles, the hind pair are often paler in colour, and are generally blackish towards the tips, often only very slightly so. Tibiae with a distinct row of short bristles on outer side, the four posterior tibiae with two terminal spurs, the hind pair having a close row of very minute hairs on the outer side, adjacent to the row of bristles. Tarsi slightly blackish.

Wings.—Pale yellowish, a little iridescent, costal border shortly bristly with two divaricating rows as far as the tip of the 3rd longitudinal vein, which, shortly forked, reaches about the middle of the wing, the 1st longitudinal ending just beyond the

middle of the costal cell. Of the light veins, all of which attain the wing-margin, the 1st takes a single, distinct curve upward, the 2nd and 3rd are moderately bisinuate (sometimes much less so), the 4th is nearly straight. Halteres pale yellow.

Described from a good series (mostly ♀ ♀), bred by me in Calcutta from a dead lizard (*Calotes versicolor*, Daud.) which had remained for a day or two in an empty pickle bottle. The first generation appeared early in August and the imagines, not being all removed for a few days, a second generation, bred from the first, appeared from August 23rd to 27th. The description also embodies the examination of a short series bred in the Indian Museum from a water beetle (*Cybister limbatus*, F.) taken at Raniganj (Bengal), these specimens emerging 22 and 23-vii-08. A few other specimens in the Museum collection, and in my own, from various parts of India, have also been examined, from Sylhet, 8-i-05; 23-ii-05, 18-iii-05, [Major Hall]; Calcutta, 21—25-ii-07; and I have one ♂ from Peradeniya (1,500 ft.), Ceylon, taken November 1907.

Notes.—This species is very variable in colour, ranging from bright ferruginous to grey the proportion of black on the abdomen totally altering the general appearance of the insect. The species, however, once well understood, is tolerably easy to recognize, and is apparently of almost world-wide distribution throughout the tropical regions and probably some adjacent portions of the temperate zone also.

MISCELLANEA

GENERAL.

MIMICRY OF A MUTILLID BY A SPIDER.—On a railway embankment about two miles south of Cuttack I recently collected a curious spider which I mistook at first sight for a female Mutillid. It was running about on bare soil in a manner peculiarly like that of a Mutillid; the “cephalothorax” was reddish and the “abdomen” black with white spots. The white spots have unfortunately disappeared entirely in spirit, leaving the “abdomen” uniformly black, but even now the rough red “cephalothorax” blackened over an area in front corresponding to the head of a Mutillid, the apparently velvety (in reality somewhat polished and finely punctured) black “abdomen,” and the general shape of the specimen give it a very *Mutilla*-like appearance. A few minutes before finding this specimen I had obtained a specimen of *Mutilla pondicherensis*, which it resembles closely in form and general colour, differing however in the markings on the abdomen, those of the spider consisting in life, to the best of my recollection, entirely of white spots without any bands. There were, I believe, three (or two?) transverse rows of these round spots, each row consisting of one median and two lateral spots, those of the anterior row being much larger and more widely separated from each other than the rest. The spider and the *Mutilla pondicherensis* found near it are preserved together in spirit, in the Indian Museum collection, and as it is impossible for us at present to get the spider identified I publish this note as a record of its appearance in life for the benefit of whoever may ultimately work out the collection. Mr. E. E. Green informs me that he has observed a similar phenomenon in Ceylon; he has already published a note on it in *Spolia Zeylanica* (vol. iv, 1907, pp. 181-2), and a further note is in preparation which will be accompanied by a coloured figure. My specimens have been submitted to him for examination and he tells me that he believes the spider to be the same as his, in which case its name is *Coenoptichus pulchellus*, Simon (= *Myctocryptus mutillarius* of a later paper by Karsch).

F. H. GRAVELY.

XIPHOSURA.

CAPTURE OF *Limulus* ON THE SURFACE.—From time to time, as more and more observations on the planktonic fauna of the ocean are carried out, the occurrence of unusual constituents are reported and it seems worthy of being placed on record that on the night of the 19th of December, 1911, an adult specimen of *Limulus muluccanus*, Latreille (= *Tachypleus gigas* (Müller)¹),

¹ Vide Pocock, *Ann. Mag. Nat. Hist.* (vii), vol. ix, 1902, p. 262.

measuring approximately 39 cm. in length, was captured in a large surface tow-net by the R.I.M.S.S. "Investigator." The net had been shot at 6-30 p.m., shortly after the ship had been anchored for the night at a spot about 4 miles west of the entrance to Hinzé Basin on the south Burma coast ($97^{\circ} 45\frac{1}{2}'$ E., $14^{\circ} 43\frac{1}{2}'$ N.) in about 10 fathoms, and had been allowed to drift with the tide, being kept on the surface by means of a bamboo float.

How an animal, so obviously a bottom-dweller, had been carried or made its own way to the surface, must, I fear, remain a mystery.

R. B. SEYMOUR SEWELL.

BRACHIOPODA.

NOTE ON THE DEVELOPMENT OF THE LARVA OF *Lingula*.—Up to the present time, of the various contributions to our knowledge of the development of the *Lingula* larva that have been published, only two can be considered in any way to approach completeness, to wit, those of Brooks¹ and Yatsu.² The accounts given by these two observers in the main agree very closely though differing in slight details, of which one of the most important is the length of the peduncle that is formed before protrusion from the shell takes place: according to Brooks the peduncle attains considerable length before it is protruded from the shell, whereas according to Yatsu only a short peduncle is formed. This difference may have been due either to the fact that Yatsu's specimens were kept in captivity during the latter part of their development or to a specific difference in the larvae obtained, those of Brooks's being the larvae of *Glotidia pyramidata*, whereas Yatsu's examples were those of *Lingula anatina*.

During the months of December and February, 1911, several of these larvae were captured in the surface tow-net off the mouth of Hinzé Basin and the neighbouring waters of the south Burma coast about four miles from shore and as they differ in one or two particulars from the previous accounts it has been thought that a brief account of these discrepancies may be of some little value.

The chief differences noted are two in number :—

1. *The stage of formation and protrusion of the peduncle.*—Both Yatsu and Brooks agree in stating that the peduncle first makes its appearance at the end of the 6-, or commencement of the 7-pairs of cirri stage, and the former observer found that in his specimens, in captivity, protrusion took place at the commencement of the 10 p.c. stage. The youngest specimens obtained by me in December had already reached the 9 p.c. stage

¹ W. K. Brooks, "The development of *Lingula* and the systematic position of the Brachiopoda," *Chesapeake Zool. Lab. Scientific Results of the Session of 1878*, p. 35. Baltimore, 1879.

² N. Yatsu, "On the development of *Lingula anatina*," *Journal of the College of Science, Tokyo*, vol. xvii, art. 4.

and in these the peduncle had only just begun to develop, while in the oldest specimen, which had reached the 11 p.c. stage, no sign of protrusion was seen. In February only a single specimen was obtained but this one was remarkable in that it had already reached the commencement of the 14 p.c. stage and the peduncle was still only a small rudiment. In this connection it is interesting to note that as regards the length of peduncle formed, the present specimens agree closely with the description given by Brooks of the larvae obtained by him in America and contrast markedly with Yatsu's specimens from Japan.

Although, so far as I know, no specimens of Brachiopoda have been obtained in the region of Hinzé Basin, several examples of *Lingula anatina* have been found at other parts of the Burma coast and it would seem probable that my larvae are those of this species.

If this be the case, there can, I think, be no doubt that the short peduncle in Yatsu's specimens is a result of confinement in unnatural surroundings and is not a natural condition.

2. *The stage at which the change of shape of the shell takes place.*—Both the above-mentioned accounts agree in stating that the change of shape of the shell from transversely oval to longitudinally oval takes place at the 6-7 p.c. stage, and Yatsu gives the following measurements of his specimens in support of this statement:—

		Length.	Breadth.
5	p.c. stage	313 μ	386 μ
6	p.c. stage	411 μ	444 μ
7-8	p.c. stage	663 μ	615 μ

In the table below I have given the measurements of my specimens:—

Month in which obtained.			Length.	Breadth.	Ratio of hinge to length.	Stage of development.
1	December	..	625 μ	683 μ	1 : 1.97	9 p.c. stage.
2	"	..	629 μ	666 μ	1 : 1.99	" " "
3	"	..	683 μ	633 μ	1 : 2.41	" " "
4	"	..	750 μ	725 μ	1 : 2.90	Commencing 10 p.c. stage.
5	"	..	850 μ	789 μ	1 : 3.00	10 p.c. stage.
6	"	..	875 μ	808 μ	1 : 2.92	" " "
7	"	..	858 μ	808 μ	1 : 3.03	Commencing 11 p.c. stage.
8	"	..	892 μ	775 μ	1 : 2.97	" " "
9	"	..	900 μ	833 μ	1 : 2.99	11 p.c. stage.
10	"	..	908 μ	800 μ	1 : 2.87	" " "
11	"	..	916 μ	808 μ	1 : 3.14	" " "
12	February	..	1114 μ	1114 μ	1 : 3.25	Commencing 14 p.c. stage.

From the above it would appear that this change of shape takes place in larvae, obtained during December at about the 9 p.c. stage but in the 14 p.c. stage in those existing during the month of February.

Another point that seems worthy of note is the season at which these larvae were obtained. Both Brooks and Yatsu obtained their specimens during the month of August and, according to the latter observer, in Japan the breeding season extends from July to the end of August, and at no other period of the year are larvae to be found. The occurrence of larvae during the winter months in the plankton off the Burma coast may be due to either a local peculiarity or possibly to the existence of two breeding seasons during the year, one in the summer months July and August, and a second from December to February, but in either case I attribute the delay in the formation and protrusion of the peduncle and the change in shape of the shell to the less favourable time of year at which the development was taking place.

R. B. SEYMOUR SEWELL.

REPTILES.

Notes on the distribution of some Indian and Burmese Lizards :—

1. DISTRIBUTION OF *Liolepis* IN THE INDIAN EMPIRE.—The large and conspicuous lizard *Liolepis belliana*, Gray, is a characteristic feature of sandy tracts in Tenasserim and has been stated to occur in South Canara. Careful inquiries have convinced me, however, that it does not occur anywhere west of the Bay of Bengal. It is very unfortunate that many of the older records of the occurrence of both reptiles and other animals in the Madras Presidency are equally unreliable. This is owing to two causes :—(i) A considerable number of Burmese specimens have, in at least one instance, been mixed with collections from S. India and all have been attributed to the latter. This has been pointed out by Major F. Wall as regards certain snakes, and it is undoubtedly the case also as regards *Liolepis belliana*. It is a particularly unfortunate occurrence, because there is an actual affinity between the faunas of the mountains of S. India and the countries east of the Bay of Bengal which such mistakes tend to obscure. (ii) In a large number of cases specimens have found their way into public collections labelled *not* with the name of the locality in which they were originally found but with that of the locality of the institution from which they were sent to specialists or museums in Europe. Certain missionary colleges are largely responsible for such mistakes, and old records of such localities as Trichinopoly are worth less, unless they have been recently corroborated.

2. THE DISTRIBUTION OF *Mabuia bibronii* (GRAY).—This very distinct little skink is stated, vaguely, in the "Fauna" to occur in the "Carnatic," but the real interest in its distribution

lies in the fact that it appears to be entirely a maritime species. It is common on sand-dunes by the sea on the Indian shore of the Gulf of Manaar and occurs on the coast of Ceylon. It is common on the shore at Madras and I recently took a specimen in a little banyan-grove on a sand-hill close to the sea on the Orissa coast a few miles north of Puri. I have never seen the species more than a few hundred yards above high-tide mark. A diligent search on the shore at Trivandrum and at other places on the Travancore coast failed to reveal a specimen and I can find no record of the occurrence of the species anywhere in the Malabar zone.

3. A SPECIMEN OF *Gymnodactylus peguensis*, BLGR.—This lizard was originally described from two specimens taken by the late Signor Fea at Palon (*Ann. Mus. Genova*, 2nd ser., vol. xiii, p. 314, pl. vii, fig. 2, 1893) and has since been recorded from Lower Siam (Laidlaw, *Proc. Zool. Soc. London*, 1901, p. 304). Until recently it was not represented in the collection of the Indian Museum, but we have now received a fine specimen from Mr. C. G. Rogers, who took it under a stone in the East Yoma Forest Reserve on the west side of the Pegu Yomas (Thyetmyo district) on Oct. 31st or Nov. 1st at an altitude of about 1,000 feet. Mr. Rogers describes the coloration as being "chocolate brown; spots olive green." In spirit the ground colour is greyish and the spots dark brown. The markings are much more conspicuous than is ever the case with *G. rubidus*, with which Boulenger compares the species.

N. ANNANDALE.
