Report on the Stomatopoda and Macrurous Decapoda collected by Mr. Cyril Crossland in the Sudanese Red Sea.

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(Plates 27, 28.)

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The collections of Stomatopoda and Macrurous Decapoda collected by Mr. Crossland in the Sudanese Red Sea were kindly entrusted to me for examination and report by Professor W. A. Herdman, to whom I desire to express my thanks for the opportunity of examining so interesting a collection. The latter comprises 10 species and varieties of Stomatopoda, and 60 species and varieties of Macrurous Decapoda, 8 of which, viz., 1 *Athanas*, 2 *Alpheus*, 4 *Periclimenes*, and 1 *Nikoides*, I have been unable to determine specifically owing to the defective nature and small number of the specimens. Four species are described as new to science—*Athanas crosslandi*, *Synalpheus quinquedens*, *Periclimenes calmani*, and *Upogebia pseudochelata*, and a further twelve species are new to the fauna of the Red Sea. These latter are *Penæopsis stridulans* (W.-M.), *Eusicyonia carinata* (Oliv.), *Athanas parvus*, De Man, *Synalpheus streptodactylus*, Cout., *Synalpheus hululensis*, Cout., *Alpheus bucephaloides*, Nobili, *Alpheus consobrinus*, De Man, *Harpilius depressus* (Stimpson), *Harpilius gerlachei*, Nobili, *Anchistus inermis*, Miers, *Leander concinnus* (Dana), and *Gonodactylus pulchellus*, Miers.

Among the more interesting points brought out by the material in the collection are :—

The material of *Gonodactylus demani* and its variety *spinosus* suggests that these two forms are constantly distinguished by characters which may ultimately be considered of specific value.

Gonodactylus brevisquamatus, Paulson is represented by nine specimens, and my observations lend support to Mr. Patience's view that *G. fimbriatus* of Lenz is synonymous with Paulson's species.

I am able to supplement Nobili's descriptions and figures of *Penæopsis stebbingi* and *P. vaillanti* in some few points.

My observations on the species of the genus *Athanas* have led me to suggest a slightly different explanation of the so-called "trimorphism" discovered by Kemp in *A. polymorphus* and to show that dimorphism among males is exhibited by at least three species of the genus.

The re-discovery of *Synalpheus savignyi*, Guér., apparently lost sight of for nearly a hundred years, is a point of some interest.

I have suggested that *Pontonia pinnæ*, Ortmann, is a synonym of the earlier described *Anchistus inermis* (Miers).

The examination of the single specimen of *Leander tenuicornis*, Say (= *L. natator*, M.-Ed.) emphasises the necessity of a revision of the genus, with special reference to the number of joints in the mandibular palp and its value as a generic character.

The most recent complete list of Red Sea Crustacea is contained in Nobili's work "Fauna carcinologique de la Mer Rouge," where 142 species of Macrurous Decapoda and 16 species of Stomatopoda are enumerated. Of the Stomatopoda, *Gonodactylus graphurus* is considered by Kemp as a doubtful record, leaving 15 species of this group as members of the Red Sea Fauna, to which the present collection makes no additions beyond recording *Gonodactylus pulchellus*, Miers, definitely from within the Rea Sea proper, this species appearing in Nobili's list on specimens from Aden.

Nobili's list of Macrurous Decapoda omitted the following species recorded by earlier writers :—

(1) *Synalpheus savignyi*, the name given by Guérin to the *Athanas nitescens* of Audouin and Savigny's great work.

(2) *Pterocaris typica* and *Lysmata trisetacea*, both described by Heller from Red Sea specimens.

(3) *Penæopsis velutinus*, Dana, recorded by Paulson in 1875.

(4) *Parabetæus cullierети*, recorded by Coutière (1897 *a*).

(5) *Alpheus djeddensis*, Cout., and *A. macrodactylus*, Ortm., recorded by Coutière (1897 *e*), and *A. malleodigitus* (Sp. Bate) by the same author (1899).

Since Nobili's paper appeared the following additions to the Red Sea fauna have been made :—

(1) Coutière in 1909 added *Synalpheus heroni*, Cout., and in 1910, *Saron neglectus*, De Man ; (2) De Man in 1909 *b* added *Alpheus djiboutensis*, Cout. ; and (3) Balss (1914 *a* & *b*) recorded the following eight additional species : — *Haliporus steindachneri*, Balss, *Parapenæus fissurus* (Sp. Bate), *Parapandalus pristis* (Risso) and *P. adensameri*, Balss, *Dorodotes levicarina*, Sp. Bate, *Ægeon pennatus*, Sp. Bate, *Stenopus spinosus* (Risso), and *Paratypton siebenrocki*, Balss. Admitting the validity of all the old records and with the addition of the 11 species herein recorded for the first time from the Red Sea, and the four new species described below, the total number of Macrurous Decapoda now known from the Red Sea amounts to 176, an increase of 34 on Nobili's total.

The Red Sea in the past has received a considerable amount of attention at the hands of carcinologists, with the result that no fewer than 60 out of

the 176 species (35 per cent.) of Macrurous Decapoda known from its waters have so far not been met with outside that area. In attempting to make a comparison of the species found in the Red Sea with those found in other parts of the Indian and Pacific Oceans, such as has been done by Laurie (1915) for the Brachyura, it at once becomes evident that our knowledge of the Macrurous Decapoda of the Indo-Pacific region is not nearly so complete as it is for the Brachyura. The enquiry is complicated by the intricate synonymy of various species particularly among the Penæidæ and the Alpheidæ, so that an exact knowledge of the distribution of many of the species is not easily come by. The general results which have emerged from my enquiry as to the distribution of the species found in the Red Sea may be stated as follows :—

Persian Gulf. Nobili, 1906 *b*.

26 Red Sea species are recorded in this report from various stations in the Persian Gulf and Arabian Sea =15 per cent. of the total Red Sea species.

Maldive and Laccadive Archipelago. Coutière, 1905.

A comparison between the whole of the Macrura of the Red Sea with those of the Maldives is not possible, but the Alpheidæ of the latter locality have been thoroughly worked by Coutière and afford material for a comparison. 35 out of the 69 species of the Red Sea Alpheidæ or 50 per cent. have been recorded from the Maldive Archipelago.

Ceylon. Pearson, 1905 and 1911. Kemp, 1914.

27 out of 176 Red Sea species or 15·5 per cent. are included in Pearson's papers.

The Alpheidæ again afford a better basis for a comparison, 14 out of 69 Red Sea species, or 20 per cent., having been recorded from Ceylon.

India. Alcock, 1908. Henderson, 1893. Kemp, 1914 & 1915.

A total of 28 Red Sea species out of 176 or 16 per cent. have been recorded from the coasts of India.

The families of the Penæidæ and Hippolytidæ are perhaps the best known of the Indian Macrurous Decapods. Of the former (Alcock, 1906) 7 Red Sea species out of 19, or 37 per cent., are known from India, and of the latter (Kemp, 1914) 7 Red Sea species out of 12, or 58 per cent., are also Indian forms.

Malay Archipelago and Dutch East Indies. De Man, 1887, 1888, 1896–98, 1902, 1911 *a* & *b*.

The waters of this region of the Indo-Pacific have been more thoroughly explored than perhaps any other, and the comprehensive works of De Man afford material for a more exact comparison of the

Macrurous Decapoda of the Red Sea and the Malay Archipelago than is possible for any other region.

57 out of 176 Red Sea species, or 33 per cent., are known from the Malay Archipelago and its adjacent waters. This percentage agrees closely with that given by Laurie for the Brachyura of the Red Sea compared with the Seychelles, Maldive Archipelago, Ceylon, and the Hawaiian Isles.

The Siboga Reports on the Penæidæ and the Alpheidæ provide interesting results.

9 out of 19 Red Sea species of Penæidæ or 47·5 per cent., and 29 out of 69 Red Sea species of Alpheidæ or 42 per cent., were taken by the Siboga Expedition in the waters of the Dutch East Indies.

East Coast of Africa. Borradaile, 1910. Lenz, 1905 and 1910. Miers, 1884. Ortmann, 1894.

29 out of 176 Red Sea species, or 16·5 per cent., are known from this region.

It is obvious from these results that much remains to be done before the Macrurous Decapoda of the Indo-Pacific can be said to be fully known. So far as they go, they support Laurie's contention that the fauna of the Red Sea forms an integral part of the fauna of the Indo-Pacific Ocean.

To save frequent repetition I give a list of stations from which the present collection was made. It has been compiled to suit the present report, from Laurie (1915, p. 419). Crossland (1907) should be consulted for a detailed account of the collecting grounds.

I. Suez. Lat. 28° N.
   - A. Suez mud-flats.
   - B. Suez flats and docks. Dec. 1904.
   - C. Suez mud-flats and dock walls, from yellow sponge.
   - D. Suez, from among coral.
   - E. Purchased, Nov. 1904.

II. Mersa Wadi Lehama, Egyptian coast. Lat. 24° 45′ N.

III. Mersa Abu Hamâma. Lat. 21° 30′ N. 12 fathoms. Mud.

IV. Khor Shinab. Lat. 21° 20′ N. 10–12 fathoms. Mud among sponges and Polyzoa.

V. Khor Dongonab. Lat. 21° 11′ N. to lat. 20° 50′ N.
   - A. Washed from nullipore and branched coral from the reef off Beacon Island. Lat. 20° 55′ N. 26 April, 1905.
   - B. Just west of Beacon Island. Lat. 20° 55′ N. Washed from nullipore dredged in 3–5 fathoms, 26 April, 1905.

C. Engineer Island. Lat. 20° 50′ N. Washed from old coral and weed obtained from Reef Flat.

D. Engineer Island. Lat. 20° 50′ N. Washed from weed and coral dredged in 3 fathoms of water.

E. Khor Dongonab. Among coral on reef.

F. North of the Barrier (see Crossland's map, p. 15), 20 fathoms. Mud.

G. Washed from ribbon-like sponge characteristic of the nullipore beds.

VI. Mersa Ar-rakiya. Lat. 20° 15′ N. Among coral in one fathom of water.

VII. Suakin Harbour. Lat. 19° 8′ N.

A. Suakin Harbour.

B. Suakin Harbour. 26 Jan., 1905.

C. Suakin Harbour. From coral, 1905.

D. From ascidians and barnacles of buoy moored in Suakin Harbour.

E. Washed from sponges.

F. „ „ „ 11 Jan., 1905.

G. Commensal in Black Pinna.

VIII. Shubuk. Lat. 18° 52′ N. to 18° 43′ N.

A. Mersa Makdah in Shab-ul-Shubuk.

B. We Shubuk, south-east corner. 16 Feb., 1905.

C. "Dredge washings, 17 Feb., 1905."

IX. Tella Tella Kebira, a small group of islands in the northern part of the Suakin Archipelago. Lat. 18° 48′ N.

A. Tella Tella Kebira. Washed from the half-loose coral fragments and nullipore which compose the edge of the Southern Reef. 3 March, 1905.

B. Tella Tella Kebira, From sand.

X. Trinkitat Harbour entrance. Lat. 18° 40′ N. 2 fathoms. Rock, weed, and nullipore.

XI. Agig. Lat. 18° 13′ N. From among coral in 4½ fathoms of water.

The distribution of the species in the present collection among the above stations is set forth in the following table, from which it will be seen that the coral reefs at Khor Dongonab and Suakin Harbour were by far the most productive in species.

	Station I. Suez. Lat. 28° N.	Station II. Mersa Wadi Lehama. Lat. 24° 45′ N.	Station III. Mersa Abu Hamâma. Lat. 21° 30′ N.	Station IV. Khor Shinab. Lat. 21° 20′ N.	Station V. Khor Dongonab. Lat. 21° 11′ N. to 20° 50′ N.	Station VI. Mersa Ar-rakiya. Lat. 20° 15′ N.	Station VII. Suakin Harbour. Lat. 19° 8′ N.	Station VIII. Shubuk. Lat. 18° 52′ N. to 18° 43′ N.	Station IX. Tella Tella Kebira. Lat. 18° 48′ N.	Station X. Trinkitat Harbour. Lat. 18° 40′ N.	Station XI. Agig. Lat. 18° 13′ N.	Locality indefinite. Lat. 28° N. to 18° 13′ N.
1. Penæopsis stebbingi (*Nobili*)	×	..	..	..	..	..	..	×	..	×	..	×
2. ,, stridulans (*W.-M.*)	..	..	..	..	..	..	..	×				
3. ,, vaillanti (*Nobili*)	..	..	..	..	..	..	..	×				
4. Trachypenæus anchoralis (*Sp. B.*)	..	..	..	..	..	..	..	×				
5. Penæus japonicus, *Sp. B.*	×	..	..	..	..	..	..	×				
6. ,, semisulcatus, *De Haan*	..	..	..	..	×							
7. Eusicyonia carinata (*Oliv.*)	×											
8. Athanas crosslandi, *Tattersall*	..	..	..	..	×							
9. ,, parvus, *De Man*	..	..	..	..	×	..	..	..	..	..	..	×
10. ,, dimorphus, *Ortmann*	×											
11. ,, sp.?	×											
12. ,, djiboutensis, *Cout.*	..	..	..	..	×	..	×	..	×			
13. Synalpheus gravieri, *Cout.*	..	..	×									
14. ,, streptodactylus, *Cout.*	..	..	..	×								
15. ,, triunguiculatus (*Paulson*)	..	..	..	..	×	..	×					
16. ,, fossor (*Paulson*)	..	..	..	..	..	..	..	×				
17. ,, heroni, *Cout.*	..	..	..	..	..	..	..	..	×			
18. ,, hululensis, *Cout.*	..	..	..	..	..	..	..	..	×			
19. ,, biunguiculatus (*Stimp.*)	..	..	..	..	×	..	..	..	..	×		
20. ,, savignyi (*Guérin*)	..	..	..	..	..	..	×					
21. ,, quinquedens, *Tattersall*	×	..	..	..	×	×	×	..	..	..	..	×
22. Alpheus gracilis, *Heller*	..	..	..	..	..	..	×	..	×			
23. ,, ventrosus, *H. M.-Ed.*	..	..	..	..	×	..	×					
24. ,, microstylus (*Sp. B.*)	..	..	..	..	×							
25. ,, alcyone, *De Man*	..	..	..	..	×							
26. ,, sp.?	..	..	..	..	×							
27. ,, bucephaloides (*Nobili*)	..	..	..	..	×	..	..	..	×			
28. ,, consobrinus, *De Man*	..	..	..	..	×	..	×	..	×			

29.	„ pachychirus, *Stimp.*	..	..	..	..	..	..	..	..	×				
30.	„ insignis, *Heller*	..	..	..	..	..	..	..	..	×				
31.	„ paracrinitus, *Miers*	..	..	..	..	..	..	×						
32.	„ Audouinii, *Cout.*	..	..	..	..	×								
33.	„ strenuus, *Dana*	×	..	..	..	×	..	×						
34.	„ bouvieri, *A. M.-Ed.*, var. hululensis, *Cout.*	..	..	..	..	×								
35.	„ parvirostris, *Dana*	..	..	..	..	×	..	×	..	×				
36.	„ sp.?	..	..	..	..	..	×							
37.	Saron neglectus, *De Man*	..	..	..	..	..	..	..	..	×				
38.	Thor paschalis (*Heller*)	..	..	..	..	×								
39.	Hippolyte proteus (*Paulson*)	..	..	..	..	..	..	..	..	..	..	..	×	
40.	Periclimenes petitthouarsii (*Aud.*)	..	..	..	..	×	..	×	..	..	..	..	×	
41.	„ calmani, *Tattersall*	..	..	..	..	..	..	..	..	..	..	..	×	
42.	„ sp.?	..	..	..	..	×	..	×						
43.	„ sp.?	..	..	..	..	..	..	×						
44.	„ sp.?	..	..	..	..	..	..	..	..	..	..	..	×	
45.	„ sp.?	..	..	..	..	..	..	×						
46.	Coralliocaris superba (*Dana*)	..	..	..	..	×								
47.	„ lucina, *Nobili*	..	..	..	..	×								
48.	Harpilius beaupresii (*Aud.*)	..	..	..	..	..	..	×						
49.	„ depressus, *Stimp.*	..	..	..	..	..	..	×						
50.	„ gerlachei, *Nobili*	..	..	..	..	×								
51.	Anchistus miersii (*De Man*)	..	..	..	..	..	..	×	..	..	..	..	×	
52.	„ inermis (*Miers*)	..	..	..	..	..	..	×						
53.	Conchodytes meleagrinæ, *Peters*	..	..	..	.	..	..	..	..	..	..	..	×	
54.	Palæmonella tenuipes, *Dana*	..	..	..	..	×	..	×						
55.	Leander tenuicornis (*Say*)	..	×											
56.	„ concinnus (*Dana*)	×												
57.	Nikoides sp.?	..	..	..	..	..	..	..	×					
58.	Axiopsis æthiopica, *Nobili*	..	..	..	..	×								
59.	Upogebia pseudochelata, *Tattersall*	..	..	..	..	..	..	×						
60.	„ savignyi (*Strahl*)	×	..	..	..	×	..	×	..	..	..	..	×	
61.	Squilla massavensis, *Koss.*	×												
62.	Pseudosquilla ciliata (*Fabr.*)	..	×											
63.	„ megalophthalma, *Bigelow*	..	..	..	..	..	..	..	..	×				
64.	Lysiosquilla multifasciata, *W.-M.*	..	..	..	..	..	..	..	×					
65.	Gonodactylus chiragra (*Fabr.*), var. smithii, *Pocock*	..	..	..	..	×	×							
66.	„ demani, *Henderson*	..	..	..	..	..	×	×	×					
67.	„ „ „ var. spinosus, *Bigelow*	..	..	..	..	×	..	..	..	..	..	×		
68.	„ glaber, *Brooks*	×	..	..	..	×	..	×	..	..	..	×	×	
69.	„ brevisquamatus, *Paulson*	..	..	..	..	..	..	..	..	×				
70.	„ pulchellus, *Miers*	..	..	..	..	..	..	..	×					

List of Literature.

The following list contains a complete bibliography of all papers as far as I have been able to discover, which deal in any way with material of Macrurous Decapoda and Stomatopoda from the Red Sea. As regards the Penæidæ and Alpheidæ, I have included in the synonymies of the species, as far as possible, references to De Man's Siboga reports, as the last authoritative pronouncement on these two families. In the same way Kemp's paper on the Hippolytidæ (1914) has been used for that family, and the same author's monograph on the Stomatopoda (1913) for that group of Crustacea, while Borradaile's monograph of the Pontoniinæ (1917) has been followed for that group.

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In the preparation of this report I am greatly indebted to Mr. Patience for kindly allowing me to see the manuscript of his forthcoming paper on the Stomatopods collected by Mr. J. J. Simpson in the Mergui Archipelago, with reference to *Gonodactylus brevisquamatus*, Paulson. The Rev. T. R. R. Stebbing has kindly allowed me to consult and retain for several months his copy of Paulson's rare work on the Crustacea of the Red Sea, and Dr. W. T. Calman has also given me great assistance in the loan of literature. To these gentlemen and to Professor Herdman, I desire to record my grateful thanks.

The types of the new species have been deposited in the British Museum. The remainder of the collection is housed in the Zoological Department of the University of Liverpool.

STOMATOPODA.

Genus Squilla, *J. C. Fabricius.*

Squilla massavensis, *Kossmann*, 1880. *See* Kemp, 1913, p. 76.

Locality. Station I. E, 3 ♀, 216 mm.

Remarks. These specimens are considerably larger than any which have hitherto been recorded. Kossmann's type measured 140 mm., Kemp's largest specimen had a length of 108 mm., Nobili gives the length of one of his specimens as 134 mm., while Balss gives no size for those he examined. They agree very closely with the descriptions given by Balss and Kemp. The latter author, however, states that the anterior bifurcation of the median carina of the carapace was not present in any of the specimens he examined.

This feature can be distinctly traced in the specimens here dealt with, though the actual carinæ are almost obsolete. The three rows of tubercles on the telson are well developed.

Distribution. Red Sea (Kossman, Nobili, Balss); Gulf of Oman and Persian Gulf (Kemp).

Genus Pseudosquilla, *Dana*, 1852.

Pseudosquilla ciliata (*Fabricius*). *See* Kemp, 1913, p. 96.

Locality. Station II, 1 ♂, 50 mm.

Remarks. This specimen is an absolutely typical example of the species, without a spine on the postero-lateral angle of the fourth abdominal segment, and having the inner spine of the bifurcate process of the uropod slightly longer than the outer.

Previously recorded from the Red Sea by Nobili, 1906, and Balss, 1910.

Pseudosquilla megalophthalma, *Bigelow*, 1894. *See* Kemp, 1913, p. 103. (Pl. **27**. figs. 1–3.)

Locality. Station IX. B, 1 ♀, 30 mm.

Remarks. It is with a considerable amount of reserve that I refer this specimen to Bigelow's species. Compared with his description the following differences are to be noted:—

(1) The corneal axis of the eye (Pl. **27**. fig. 2) is only five-sixths of the peduncular axis. In Bigelow's specimen the corneal axis is considerably broader than the peduncular axis (11 to 8).

(2) The length of the rostrum (Pl. **27**. fig. 1) is only four-sevenths of the breadth. It is thus shorter than in Bigelow's specimen (where the proportions are 5 to 7), and, though it covers the ophthalmic segment, it leaves the whole of the eye itself exposed.

(3) The lateral margins of the eighth thoracic segment are provided with a well-marked notch. No mention of such a notch is made by Bigelow.

(4) There are only six spines (Pl. **27**. fig. 3) on the sixth abdominal segment, there being no trace of the small spines on the inner side of the intermediates mentioned by Bigelow.

(5) Only the fourth, fifth, and sixth segments of the abdomen have spines at the postero-lateral corners. In Bigelow's specimen, the second and third segments also had these spines.

There are eight carinæ on the dorsal surface of the telson (Pl. **27**. fig. 3), in addition to the median one. In the nomenclature used by Kemp, these carinæ are the submedian, intermediate, second lateral, and marginal, the first laterals being absent. If my identification of this specimen is correct, it supports Kemp's suggestion that the carinæ next the marginals in this species are homologous with the second laterals of his nomenclature. In the

present specimen they are quite well marked and terminate in the lateral spines of the telson. The submedian carinæ of our specimen are interrupted at about their centre. This may be what Bigelow means in calling it serrated. I may also remark that between the submedian and intermediate spines of the telson there are two lobes on the left side but only one on the right. There are ten spines on the outer margin of the proximal joint of the exopod of the uropods, the last of which reaches the level of the apex of the distal joint. The outer spine of the bifurcate process of the uropods is slightly longer than the inner, the latter reaching the apex of the endopod of the uropods, the former reaching half-way down the distal joint of the exopods. The raptorial claws of this specimen agree with Bigelow's description in having the pectinations on the inner margin of the propodus confined to the proximal half of that margin. There are no traces of eye-spots on the carapace. The most serious differences from Bigelow's description presented by the present specimen are the characters of the eye and the number of spines on the sixth abdominal segment. The notch on the lateral margin of the eighth thoracic segment may have been overlooked, while the spiniform nature of the postero-lateral corners of the abdominal segments is a variable character. Nobili, in recording this species from the Red Sea, notes that in his specimens only the fourth, fifth, and sixth segments of the abdomen had spines at the postero-lateral corners. But in his specimens the inner and outer spines of the bifurcate process of the uropods were subequal. He makes no mention of the size of the eyes, and we must presume that the sixth abdominal segment bore eight spines. The nearest relative of this species is *P. oculata*, from which the present specimen is distinguished by the absence of a spine on the rostrum, and by the presence of second lateral carinæ on the telson instead of first laterals. On the whole, I prefer to leave the present specimen in the species to which I have referred it. More material of both sexes is required before it can be stated whether the differences I have pointed out between my specimen and Bigelow's description are constant enough to be of specific importance.

Since writing the above, I have received a copy of Mr. Kemp's paper "On a collection of Stomatopod Crustacea from the Philippine Islands," in which he gives some notes on a single specimen of *Pseudosquilla megalophthalma* which he examined from that locality. I am now certain that my specimen belongs to that species. Kemp's specimen agrees with the present one in characters 3, 4, and 5 given above as points of difference between my specimen and Bigelow's description. Kemp gives no measurements for the eye, and the rostrum of his specimen is longer in proportion to the breadth than in mine, but these differences are trifling. Unfortunately, the Red Sea specimen shows no traces of the distinctive coloration described by Kemp.

Distribution. Mauritius (Bigelow) ; Obock in the Red Sea, and Djibouti (Nobili) ; Philippine Islands (Kemp).

Genus Lysiosquilla, *Dana*, 1852.

Lysiosquilla multifasciata, *Wood-Mason*, 1895. *See* Kemp, 1913, p. 122. (Pl. 28. fig. 6.)

Locality. Station VIII. B, 1 ♂.

Remarks. The specimen is imperfect, the last two segments of the abdomen, and the telson having been broken off. Identification is, therefore, a matter of some uncertainty. The raptorial claw (Pl. 28. fig. 6), however, has the characteristic form of *L. multifasciata* as described by Kemp. The dactylus bears five teeth, including the terminal one, of which the penultimate is short. The two lobes at the base of its external margin are very unequal, the proximal quite small, the distal very much expanded. The colour of the present specimen in alcohol is distinctive. The carapace shows three bands of dark colour, two anterior paler ones, almost fused, and a posterior one, well marked. The last three thoracic segments each has a single dark band, occupying the posterior half of the segment. The first four abdominal segments possess a single very dark transverse line in the centre third of their posterior border. Above this line and separated from it by a pale line is a rather indistinct broad dark band which does not quite reach the lateral margins. From the postero-lateral corners of this pale transverse band, on each side, there is a much darker band running to the lateral margins. These latter bands have the appearance of being the lateral portions of an interrupted band, the centre part of which is missing. There is a distinct break in contour where these very dark bands meet the centre paler band, suggesting that the latter represents an anterior and separate band of colour.

Previously recorded from the Red Sea by Nobili (1906).

Genus Gonodactylus, *Latreille*.

Gonodactylus chiragra (*Fabricius*). *See* Kemp, 1913, p. 155.

Localities. Station V., 1 ♀, 60 mm. Station VI., 1 ♂, 40 mm.

Remarks. Both these specimens are of the variety represented by *smithii*, except that the median carina of the telson of the male does not end in a spine but is obtusely rounded.

A widely distributed Indo-Pacific species recorded from the Red Sea by Miers, Kossmann, and Nobili.

Gonodactylus demani, *Henderson*, 1893. *See* Kemp, 1913, p. 164, pl. 9. figs. 108–111.

Localities. Station VI., 1 ♀, 22 mm. Station VII. C, 1 ♀, 14 mm., 2 ♂, 14 and 19 mm. Station VIII. C, 2 ♀, 27 and 30 mm.

Remarks. All these specimens agree with Henderson's figure of the type-specimen (1893) in being without setæ on the inner margin of the inner uropod (except for three or four at the extreme proximal part).

In the arrangement and number of tubercles on the telson, they agree generally with that shown in Kemp's figure 109, that is, the tubercles are large and few, but they show evidence that the tubercles increase in number with age and, likewise, become more obtuse, as the following description of the tuberculation of each specimen will show.

♂, 14 mm.

Two median tubercles, one behind the other, on the median carina, one on each submedian carina, one on the carinæ of the submedian teeth, and one on the carinæ of the intermediate teeth. All the tubercles very acutely pointed and spiniform. Carinæ of the sixth abdominal segment likewise ending in sharply pointed spines.

♀, 14 mm.

As above, except that there are two tubercles on the carinæ of the intermediate teeth.

♂, 19 mm.

Three spinous tubercles, forming a well-marked trident at the distal end of the median carina, two tubercles on each submedian carina, two at the base of the submedian teeth, and three on the carinæ of the intermediate teeth. All the tubercles acutely spinous, as are also the carinæ of the sixth abdominal segment.

♀, 22 mm.

Three spinous tubercles, forming a trident, at the distal end of the median carina ; anterior to them a smaller median spinous tubercle flanked by a very small obtuse tubercle on each side ; two tubercles on each submedian carina, three at the base of the submedian teeth, and three on the carinæ of the intermediate teeth. All the tubercles and the carinæ on the sixth abdominal segment, acute but not so sharply pointed as in the smaller specimens.

♀, 27 mm.

Almost exactly the tuberculation of the last specimen but all the tubercles obtusely rounded. This specimen agrees very closely with Kemp's figure 109.

♀, 30 mm.

Like the last, but only two tubercles at the base of each submedian tooth. All the tubercles obtuse.

These six specimens, therefore, form a compact group agreeing in the unarmed inner margin of the inner uropods and having a tuberculation of the telson following a general plan though varying with age. I regard them as referable to the typical form of the species, though Henderson (1893) figures the spinules on the telson of the type as distinctly smaller and

more acute than they are on the specimen of corresponding size in the present collection.

Previously recorded from the Red Sea by Nobili (1906).

GONODACTYLUS DEMANI, *Henderson*, 1893, *var.* SPINOSUS, *Bigelow*, 1893.
See Kemp, 1913, p. 165, pl. 9. fig. 112.

Localities. Station V. D, 1 ♂, 15 mm. Station XI., 2 ♀, 22 and 32 mm.

Remarks. The two specimens from Agig have the entire surface covered with small spinules, densely packed. The small specimen from Khor Dongonab has the telson very much of the form shown in Lenz (1905, fig. 12), except that there is only one row of spinules on the submedian teeth. In all three specimens the intermediate and lateral teeth of the telson appear to me to be as well developed as in the typical form of the species. All three agree in having the inner uropod armed with setæ all round. It is this last character which has led me to refer these specimens to the variety *spinosus* of *G. demani*. Bigelow (1894), when describing this form originally, made no mention of the form of the inner uropod, but Lenz, in the figure already quoted, shows the inner uropod invested with setæ on the entire margin. When Kemp wrote the main part of the text of his valuable monograph, all the specimens, with one exception, of *G. demani* and its varieties to which he had access had the inner uropod setose all round, and it was only later (Addendum, p. 198) after he had examined a number of specimens from the Gulf of Manaar, which all agreed in having the inner margin of the inner uropod unarmed, that he became aware of this character. In Henderson's figure of the type specimen the inner margin of the inner uropod is figured as unarmed, and it seems to me to be just possible that the var. *spinosus* may be constantly differentiated from the typical form by this character. If this is so, then *G. spinosus*, Lenz has been correctly determined and is not a synonym of *G. demani*, Henderson, as given by Kemp. As I have already remarked, the tubercles on the telson of the typical form appear to be fewer, larger, and more obtuse than in the variety, and it may subsequently be discovered that this type of tuberculation goes with the unarmed character of the inner uropod, to emphasise the distinction between the type and its variety. Kemp does not give the character of the inner uropod of the specimen from which his figure 109 was taken. This figure, as I have pointed out, gives the general arrangement of the tubercles on the telson of those specimens which I have referred to the type form, all of which agree in having unarmed inner margins to the inner uropods. In support of the generally accepted opinion that *G. demani* and *G. spinosus* are varieties of one species, I may observe that the copulatory organs on the first pleopod of the male specimen from Khor Dongonab, referred here to the variety

spinosus agree in detail with those from one of the males from Suakin Harbour referred to the typical form.

This variety has been previously recorded from the Red Sea by Nobili (1906).

GONODACTYLUS GLABER, *Brooks*, em. *Henderson*, non *Kemp*, 1913, p. 182.

Localities. Station I. D, 1 ♀, 47 mm.

Station V. E, 20 ♂, 24–54 mm., 15 ♀, 24–58 mm.
Station VII. B, 1 ♀, 68 mm. Station XI., 1 ♀, 35 mm.
Station V. B, 1 ♂, 16 mm. Station V. C, 2 ♀, 9 and 11 mm.
Station V. D, 1 ♀, 30 mm. No locality, 1 ♀, 60 mm.

Remarks. This species is by far the commonest Stomatopod found in the Red Sea. All the specimens, except one listed above, may be referred to the var. *ternatensis*, De Man, and bear traces of the green colour characteristic of the majority of specimens of this species. The one exception, already noted, appears to be referable to the var. *rotundus* of Borradaile. The keels on the telson are broad and swollen so as to touch one another, but there are traces of spines on the three middle keels. This specimen shows no traces of the two black spots on the telson which form so constant a feature of this species, and its colour, as preserved, suggests a mottled or marbled light brown colour in life.

This species has been recorded from the Red Sea previously by Nobili and Balss.

GONODACTYLUS BREVISQUAMATUS, *Paulson*, 1875. (Pl. **27**. figs. 5–6.)

G. brevisquamatus, Nobili, 1906*a*.
G. fimbriatus, Lenz, 1905.
G. fimbriatus, Borradaile, 1907.
G. fimbriatus, Lenz, 1910.
G. brevisquamutus and *G. fimbriatus*, Kemp, 1913.

Locality. Station IX. A, 5 ♂, 4 ♀, 13–28 mm.

Remarks. From Kemp's monograph I learnt that Mr. Patience had found a specimen of this species in a collection of Stomatopods from Mergui and, as a result of his researches, had come to the conclusion that *G. brevisquamatus*, Paulson and *G. fimbriatus*, Lenz are synonymous. On my writing to him, he very kindly allowed me to see the manuscript of his paper and, after comparing my specimens with his description, I can unhesitatingly support his view. There seems to me to be no doubt whatever that the two species are one and the same.

In the largest of my specimens the antennal scale reaches forward to the extremity of the eye, and is therefore relatively longer than shown in Paulson's figure, but in the smaller specimens the scale approaches much

more nearly to the proportions shown by Paulson, and the size of the scale evidently increases with age.

On the sixth abdominal segment (Pl. **27.** fig. 6) the median carinæ are invariably wider than the intermediates. In the male the median carinæ are parallel, but in the female they are slightly divergent. All the carinæ on this segment are smooth and do not terminate in spines, though the lateral carinæ terminate more acutely than shown in Paulson's figure 3 *r*.

The telson (Pl. **27.** fig. 6) bears in the middle of the dorsal surface an oval smooth elevation terminating distally in young specimens in an obtuse slightly transverse tubercle. This tubercle becomes obsolete or almost so with growth ; it is hardly discernible in the largest specimens. On each side of the median elevation there is a prominent submedian carina in close contact with the median one throughout its length. Lateral to the submedian again there is on each side a much fainter carina, distinct in its posterior half but merging into the submedian carina anteriorly. It presents the appearance of a half carina only. Lenz in his figure of the telson of *G. fimbriatus* figures *two* faint carinæ lateral to the submedians, but none of the present specimens show traces of more than one. The carinæ of the intermediate spines are well marked and smooth, while the lateral margin of the telson is thickened to form a ridge. There are two tubercles near the anterior margin of the telson, one on each side of the median elevation and homologous with those found in *G. chiragra*.

There are no lateral spines on the telson. The intermediate spines are about half as long as the submedians. The inner margins of the latter bear a row of from nine to twelve slender spinules. There is in most of the specimens a single similar spinule on the outer margin of the submedian spines and one on the inner margin of the intermediates. In one specimen I found traces of more spinules on the outer margin of the submedians, on one side of the specimen only.

The inner spine of the ventral prolongation of the uropods is longer than figured by Paulson, being at least half the length of the outer. The latter has the very distinct shape shown in Paulson's figure, with the distal extremity rather strongly incurved.

The uropods (Pl. **27.** fig. 6) are very distinctive. The peduncular segment bears a strong spine dorsally on the distal margin. The basal segment of the exopod projects far beyond the articulation of the ultimate segment, and bears on its outer margin, at the distal end, three (in one case two) stout strongly falciform spines, outwardly recurved, and proximally to these, from three to five short straight spines. On the dorsal surface of the basal segment of the uropods, near to the articulation of the distal segment, there is a pad of rather long densely plumose setæ. The dorsal surface of the distal segment of the exopod is beset all over with short plumose setæ and

the margins all round with longer plumose setæ. The ventral surface is smooth.

The dorsal surface of the endopod is smooth but the ventral surface is clothed with short plumose setæ, with a bunch of longer setæ on the proximal part, while the margins are armed all round.

The present specimens show the closest resemblance to Paulson's figures, and the main differences are in minor points which may quite reasonably have been overlooked by Paulson in his specimens. These differences are (1) the presence of spinules on the margins of the teeth of the telson, (2) the presence of a faint carina lateral to the submedian carinæ of the telson, (3) the presence of two tubercles near the anterior margin of the telson, one on each side of the median elevation, and (4) the special and peculiar armature of setæ on the uropods.

With the exception of the last character, which is likewise not noted by Lenz, these differences bring *G. brevisquamatus* into closer agreement with *G. fimbriatus,* Lenz. The most serious differences between my specimens and *G. fimbriatus* are :—

(1) The form and size of the carinæ of the sixth abdominal segment. Lenz figures the submedians and intermediates as more or less equal in size, whereas in my specimens the submedians are distinctly wider than the intermediates.

(2) The presence of *two* carinæ on each side of the submedian carinæ of the telson.

Minor differences may also be noted in the different shape of the outer spine of the ventral prolongation of the uropod, in the larger size of the intermediate teeth of the telson, and in the absence of the short straight spines proximal to the strong recurved spines on the outer margin of the exopod of the uropods.

I do not think that any great weight is to be attached to these differences. Some are no doubt due to age or to individual variation. Borradaile, it is true, identifies specimens from the Seychelles with *G. fimbriatus* without comment, but the examination of these specimens from the Red Sea, undoubtedly *G. brevisquamatus*, Paulson, has served to lessen the gap between this species and *G. fimbriatus*, and I feel no doubt as to the correctness of Mr. Patience's conclusion that they are synonymous.

G. brevisquamatus has been recorded from the Red Sea by Paulson and Nobili, and as *G. fimbriatus* from Zanzibar (Lenz) and the Seychelles (Borradaile).

Gonodactylus pulchellus, *Miers*, 1880. *See* Kemp, 1913, p. 177, pl. 10. figs. 117, 118.

Locality. Station VIII. B, 1 ♂, 39 mm.

Remarks. I have adopted Kemp's opinion in considering this form worthy

to rank as a species distinct from *G. spinosus*. Even after ten years preservation in spirit the dark spots on the sixth, seventh, and eighth thoracic segments, and on the first, fourth, and fifth abdominal segments are distinctly visible, very distinct on the sixth thoracic and first abdominal segments, paler on the seventh thoracic segment, and very faint on the other segments.

Distribution. Not actually recorded from the Red Sea previously though noted from Aden by Nobili; for other records, see Kemp, 1913.

DECAPODA.

Suborder NATANTIA.

Tribe PENÆIDES.

Family PENÆIDÆ.

Subfamily PENÆINÆ, *Alcock*.

Genus PENÆOPSIS, *A. Milne-Edwards*.

PENÆOPSIS STEBBINGI (*Nobili*, 1904). (Pl. 27. figs 7–10; Pl. 28. fig. 13.)

Metapenæus stebbingi, Nobili, 1904, p. 229.
,, ,, ,, 1906 *a*, p. 15, pl. 1. fig. 2.
,, ,, Alcock, 1906, p. 50.
,, ,, De Man, 1911 *a*, pp. 9 & 54.

Localities. Station I. E, 14 ♀ and 15 ♂, 70–90 mm. Station VIII. A, 2 ♂, 50 mm. and 55 mm. Station X., 1 ♀, 60 mm. Station I. B, 1 juv., 27 mm. From Ray's stomach, several juv.

Remarks. Nobili makes no mention of the fact that this species is without exopodites on the last pair of thoracic legs. It, therefore, clearly belongs to the *monoceros* group of species characterized by the absence of exopodites on the last pair of thoracic legs, and by the fact that the merus of the last pair of thoracic legs in the male is notched at its proximal end. It differs from most of the members of this group by having 6–8 small movable spinules on the telson.

I have very little to add to Nobili's description, but his figures are perhaps a little too diagrammatic. I have refigured the carapace, thelycum, and petasma, and added a figure of the notch on the merus of the last thoracic legs of the male. There is a distinct trace of an extra-orbital spine, and the lower anterior corner of the carapace is rounded and not acute as in Nobili's figure.

P. stebbingi is a very distinctive species as far as the thelycum and petasma are concerned, and adult specimens are readily recognizable on these characters.

The last two records given above must be considered as doubtful. The young male, 27 mm. long, from Suez, differs from adult specimens in having a shorter rostrum, which only reaches to the level of the anterior end of the eyes, and in the want of a notch on the merus of the last thoracic legs. The latter are without exopod. The petasma is symmetrical, but the two portions are still free from one another. In its other characters it seems to agree with *P. stebbingi*. The specimens from the stomach of a Ray are all young and not in good preservation, but appear to belong to this species as nearly as it is possible to decide.

P. stebbingi has not been met with outside the Red Sea, from which Nobili records specimens taken at Suez. It would appear to be an abundant species in the neighbourhood of the latter town.

PENÆOPSIS STRIDULANS (*Wood-Mason*).

See Alcock, 1906, p. 27, pl. 5. figs. 14, 14*a–d*; and De Man, 1911*a*, p. 65, pl. 7. figs. 20*a–b*.

Locality. Station VIII. A, 2 ♀, 50 and 55 mm.

Remarks. According to De Man, *P. stridulans* shows a considerable amount of variation in the form of the thelycum, the carinæ on the third abdominal segment, and in the form of the stridulating organ, among other characters. These two specimens agree with the account given by Alcock and would appear to be typical specimens of the species.

Not previously recorded from the Red Sea, though it is quite possible that Paulson's record of *P. velutinus* may refer to this species or the next.

PENÆOPSIS VAILLANTI (*Nobili*). (Pl. **27**. fig. 12.)

Metapenæus vaillanti, Nobili, 1904, p. 229.
„ „ „ 1906*a*, p. 18, pl. 1. fig. 4.
„ „ Alcock, 1906, p. 50.
„ „ De Man, 1911*a*, pp. 9 and 54.

Locality. Station VIII. A, 1 ♂, 52 mm., and 2 ♀, 49 and 55 mm.

Remarks. This species belongs to the *velutinus* group, characterized by the tomentum of the body, the possession of exopods on all the thoracic legs, the absence of a notch on the last pair of legs in the male, the presence of long stout movable spines on the telson, and the asymmetrical form of the petasma.

As in most species it is mainly distinguished by the form of the thelycum and petasma and, as Nobili's figure of the former is somewhat too diagrammatic, I reproduce one here (Pl. **27**. fig. 12).

Recorded from Suez and other places in the Red Sea by Nobili, but not known as yet from waters outside that area.

Genus Trachypenæus, *Alcock.*

Trachypenæus anchoralis (*Spence Bate*, 1888, p. 258, pl. 35. fig. 1).

T. anchoralis, De Man, 1911 *a*, p. 88, pl. 8. fig. 28.
Metapenæus curvirostris, Nobili, 1906 *a*, p. 20.

Locality. Station VIII. A, 1 ♂, 48 mm., and 1 ♀, 67 mm.

Remarks. Trachypenæus curvirostris of Stimpson is the type species of the genus, and *T. anchoralis* (Spence Bate) was regarded by Alcock as a synonym. The researches of Kishinouye and De Man have demonstrated that the two forms are distinct and may be recognized by the form of the petasma and thelycum. My specimens are in substantial agreement with the descriptions and figures of Spence Bate and De Man, of specimens which both authors attribute to *T. anchoralis.*

I think there can be little doubt that the specimens recorded as *Metapenæus curvirostris* by Nobili are to be referred to *T. anchoralis.*

Previously recorded from the Red Sea at Massaouah by Nobili, 1906.

Genus Penæus, *Fabricius.*

Penæus semisulcatus, *De Haan*, 1849, p. 191, pl. 46. fig. 1.

See De Man, 1911 *a*, p. 97, pl. 9. figs. 31 *a–b.*

Locality. Station V. F, 1 ♀, 160 mm.

Remarks. This specimen agrees exactly with De Man's redefinition of this species, and I am in agreement with his suggestion that the *P. monodon* of Alcock is synonymous with this form. Nobili has recorded this species from the Red Sea under the name *P. ashiaka*, Kishinouye, which De Man regards as synonymous with *P. semisulcatus*, De Haan. Other records from the Red Sea include those of Paulson (1875) and De Man (1880). Colosi (1918), however, says that Paulson's records refer to *P. carinatus*, Dana.

Penæus japonicus, *Spence Bate*, 1888, p. 245, pl. 31, pl. 32. fig. 4, and pl. 37. fig. 2.

See De Man, 1911 *a*, p. 107.

Localities. Station I. E, 6 ♀, 160–185 mm. Station VIII. A, 2 ♂, 62 and 72 mm., 1 ♀, 66 mm.

Previously recorded from the Red Sea by Nobili.

Subfamily SICYONINÆ, *Ortmann*.

Genus EUSICYONIA, *Stebbing*, 1914 *b*.

EUSICYONIA CARINATA (*Olivier*, 1811, p. 667).

Sicyonia sculpta, H. Milne-Edwards, 1830, p. 339, pl. 9. figs. 1–8.
,, ,, Spence Bate, 1888, p. 294, pl. 43. fig. 1.

Locality. Station II., 1 ♀, 46 mm.
Not previously recorded from the Red Sea.

Tribe **CARIDES**.

Super-family **Palæmonoida**.

Family ALPHEIDÆ.

Genus ATHANAS, *Leach*.

ATHANAS DJIBOUTENSIS, *Coutière*, 1897 *b*, p. 233. (Pl. 28. fig. 25.)

A. djiboutensis, Coutière, 1905, p. 856, fig. 129.

Localities. Station V. C, 1 ovig. ♀, 8 mm., 3 ♂, 8–9 mm. Station VII. D, 1 ovig. ♀, 8 mm. Station VII. B, 1 ovig. ♀, 7 mm., 2 ♂, 5–7 mm, Station IX. A, 1 ♂, 7 mm.

Remarks. Of the nine specimens which I refer to this species, three are egg-bearing females and six are males. They were collected between the end of January and the end of April, which presumably covers the breeding season of the species in the Red Sea. With the exception of the form of the first pair of legs, there is very little to add to Coutière's description. The rostrum shows some variation in length, but in all the specimens it is longer than the first two segments of the antennular peduncle and never exceeds the whole length of the latter. The supra-, extra- and infra-ocular spines agree very closely in form and relative proportions with Coutière's figures, and the stylocerite in all the specimens reaches as far forward as the distal end of the second joint of the antennular peduncle. One of the female specimens still retains one of the first pair of legs (the left), and this appendage is in close agreement with Coutière's figure 129 *f*. Among the male specimens, imperfect as they are, I have noted some interesting points in the form of the first pair of legs. I should explain that I have relied for the determination of the sex of the specimens on the presence of an appendix masculina on the second pleopods, which is well developed on all the male

specimens. The form of the first pair of legs in these specimens, as far as they are present, may be noted as follows :—

(1) Two specimens have both the first pair of legs missing.

(2) One specimen, 8 mm., lacks the left leg of the first pair. The right one is a regenerated limb, very like the smaller chela of the female as figured by Coutière (fig. 129*f*), but with the carpus relatively much shorter.

(3) One specimen, 5 mm., lacks the right leg of the first pair. The left one is exactly of the same form as the smaller chela of the female, and is in this specimen not a regenerated limb.

(4) One specimen, 9 mm., has both legs of the first pair present and they agree in all particulars with Coutière's descriptions and figures (fig. 129 *c* and *d*).

(5) One specimen, 9 mm., lacks the left leg of the first pair. The right one is of the same form, size, and proportions as shown by Coutière for the larger chela of the male (fig. 129 *c*), but the immovable finger bears a broad high tubercle in the centre of its inner margin, and the movable finger has a prominent smaller tubercle on its inner margin proximal to the tubercle on the fixed finger (Pl. 28. fig. 25).

Kemp (1915, pp. 289–299) has recently described and discussed at length a most remarkable and interesting case of "trimorphism" among the males of a new species of *Athanas*, *A. polymorphus*, Kemp, discovered by him in the Chilka Lake, India. He found three forms of males as follows :—

Form I. Small in size. First pair of legs asymmetric, one enlarged, without tooth on fixed finger, the other slender and of the size and proportions of those of the female.

Form II. Large in size. First pair of legs symmetrical, no tooth on fixed finger.

Form III. Of same size as Form II. First pair of legs asymmetric. One of them with a prominent rounded tooth on the fixed finger, the other without such tooth.

In all three forms the appendix masculina on the second pleopods was well developed, but form I. was met with in the non-breeding season only, and forms II. and III. in the breeding-season only.

After discussing the phenomenon in all its aspects, Kemp inclines to the opinion that forms II. and III. are true dimorphic forms developed simultaneously at the breeding-season from the non-breeding form I.

Regarded in the light of Kemp's observations the males of *A. djiboutensis*

noted above appear to show a close parallel to the case of *A. polymorphus*. The small male (No. 3) probably corresponds to Kemp's form I., and the males 4 and 5 to forms II. and III. The want of the full complement of limbs precludes an absolute comparison.

But the small male, form I., was taken in the company of an ovigerous female and therefore in the breeding-season. It is possible that the capture was made at the very beginning of the breeding-season before this male had moulted into its full adult stage. But another explanation of the facts suggests itself. Kemp notes that in all the forms the appendix masculina on the second pleopods was well developed, and the same observation applies in the present case. I suggest therefore that form I. is a breeding phase and that *Athanas* becomes sexually mature before it is fully grown. This would explain the full development of the appendix masculina and receive support from the capture of a form I. male in the breeding-season. We may turn to the Amphipoda for the necessary analogy.

Walker, in a paper "Notes on *Jassa falcata* (Mont.)" (Proc. Trans. L'pool. Biol. Soc., vol. xxv. pp. 67–72, 1911) calls attention to an interesting series of facts. In a single gathering of Crustacea made from a buoy moored in the harbour of Port Erin, he found an enormous number of specimens of the Amphipod *Jassa falcata* which could be divided up into groups. The circumstances of their capture and the area of their occurrence afford the strongest evidence that all the specimens belong to one species. Walker found two groups of ova-bearing, *i. e.* sexually mature, females differing not only in size but in the form of the gnathopods. In other words, here is evidence that Crustacea may be sexually mature though not structurally fully grown. A similar phenomenon is not so easily demonstrable for males except by sections, but, given its occurrence in females, there seems to me to be no inherent difficulty in accepting its occurrence in males. Walker also found three forms of males which he interprets as a penultimate form and two forms of the fully-grown male, into one or other of which the penultimate form moults.

We have in this case, I think, an interesting parallel to what Kemp has observed in *Athanas polymorphus*, and to what probably occurs in *Athanas djiboutensis* so far as the imperfect specimens at my disposal can be interpreted.

Walker's evidence, coupled with the occurrence of a form I. male of *A. djiboutensis* in the breeding-season and the well-developed appendix masculina present on all three forms of male, has led me to suggest that Kemp's observations may be explained on the following grounds :—that all three forms of male are breeding forms, that form I. is sexually mature but not structurally fully grown and eventually moults into either form II. or III., which are truly dimorphic forms of the fully-grown male. From the

nature of the material at my disposal this can be no more than a mere suggestion. The specimens are too few and too fragmentary for a definite statement, but perhaps Mr. Kemp himself at some future time may be able to clear the matter up by personal observation on living material.

Distribution. Djibouti and Minikoi (Coutière) and Funafuti (Borradaile). Also recorded from an unnamed locality in the Red Sea by Nobili.

ATHANAS DIMORPHUS, *Ortmann*, 1894, p. 12, Taf. I. fig. 1.
(Pl. 28. figs. 23–24.)

Locality. Station I. B, 1 ♂, 15 mm., and 1 ♀, 14 mm.

Remarks. The female has lost both legs of the first pair so that it is not possible to be quite sure of its identity. It agrees, however, very closely with the male caught with it, and I have no doubt belongs to the same species. This male specimen I identify with *Athanas dimorphus*, Ortmann, in spite of some differences, mainly in the form of the first pair of legs. These appendages are both fortunately present in the specimen. They are not equal in size, the right being slightly the larger of the two, and the degree of difference between the right and left being of much the same extent as exists in *A. djiboutensis*. The movable finger of the right leg bears a prominent tubercle on its inner margin near the base, while the fixed finger has a larger and broader tubercle on its inside margin (Pl. 28. fig. 23). The condition of the right chela in this specimen is, in fact, very much as I have noted in *A. djiboutensis*. The smaller left chela is shown in Pl. 28. fig. 24. The fixed finger here bears a smaller and more obscure tubercle in the same position as the prominent one on the right chela. This male specimen therefore corresponds to Kemp's male form III., and as such is evidence that *A. dimorphus* likewise has truly dimorphic forms of the fully-grown male, corresponding with what I have described in *A. djiboutensis* above. It is somewhat extraordinary that Coutière, who has apparently seen numerous specimens of this species from various localities in the Red Sea, did not come across this second form of the male, for I can find no reference to the tubercles on the inner margin of the chela in any of his descriptions.

Distribution. Red Sea at Suez, Perim, and Djibouti (Coutière). Dar-es-Salaam, E. Africa (Ortmann).

There are two further specimens of *Athanas* in the collection which may be provisionally referred to this species with considerable doubt. Both are females, taken on the Suez Mud Flats, and neither of them possesses any of the walking-legs. They differ from *A. dimorphus* in the form of the extra- and infra-corneal spines of the carapace.

The extra-corneal spine is shorter than the infra-corneal spines and does not reach more than half-way across the corneal face of the eye. Both spines are moreover broader and less acute than the same spines in *A. dimorphus*.

Beyond this difference there is no other substantial disagreement with the characters of the latter species which can be noted in the absence of the walking-legs.

ATHANAS PARVUS, *De Man*, 1910, p. 515.

See De Man, 1911 *b*, p. 148, pl. 1. fig. 4.

Locality. Station V. B, 2 ♀, 7 mm., carrying eggs.

Locality uncertain. 1 ♂, 8 mm., labelled as part of the fauna of two dead valves of *M. margaritifera* which were covered by sponges and supported a regular microcosmos of life; 1 ovig. ♀, 7 mm., labelled Crust. fr. 44.

Remarks. It is with some reserve that I refer these specimens to De Man's species. They agree, as far as they go, with his description, except that the rostrum somewhat exceeds and the stylocerite does not quite extend to the distal margin of the second joint of the antennular peduncle. In the form of the extra- and infra-corneal apines, the proportions of the first pair of legs in the female, and the bi-unguiculate character of the dactylus of the three posterior pairs of legs, they agree well with De Man's observations. The male specimen unfortunately is devoid of all the walking-legs.

Distribution. S. coast of Timor (De Man).

New to the fauna of the Red Sea.

ATHANAS CROSSLANDI, n. sp. (Pl. **27**. figs. 13–17.)

Locality. Station V. C, 2 ovig. ♀, 6 and 7 mm.

Description. The rostrum reaches forward to the middle of the third joint of the antennular peduncle. There is no supra-orbital spine. The extra-corneal spine (Pl. **27**. fig. 13) is remarkable for its great length, being almost half as long as the rostrum and extending for half its length beyond the eye. The infra-corneal spine is quite short. The antennular peduncle (Pl. **27**. fig. 14) is somewhat short and robust with the last two joints subequal in length. The stylocerite reaches to the middle of the second joint. The antennal scale (Pl. **27**. fig. 15) is equal in length to the antennular peduncle and is twice as long as broad, with the terminal spine of the outer margin well developed but not projecting beyond the scale itself. The carpocerite reaches the distal end of the second joint of the antennular peduncle.

Legs of the first pair in the female (Pl. **27**. fig. 16) equal and feeble, and of the form characteristic of the *nitescens* group. The merus is one and a half times as long as the carpus and one quarter shorter than the whole chela. The proportions of the limb are, taking the fingers as 1 : merus 2, carpus 1·3, palm 1·6, fingers 1.

The second pair of limbs are long and slender. The proportions of the joints of the carpus are 4 : 1·45 : 1·27 : 1 : 1·72. The whole chela

is about as long as the first joint of the carpus, and the fingers are about equal in length to the palm.

The third pair of legs (Pl. 27. fig. 17) are slender, with the joints in the following proportions, taking the finger as 1 : merus 2, carpus 1·5, propodus 2·5, finger 1.

The dactylus is simple, and there are spines on the inner distal margin of the propodus.

Among described species of the genus, *A. crosslandi* agrees with *A. dimorphus*, *A. minikoensis*, *A. haswelli*, *A. orientalis*, and *A. polymorphus*, to the exclusion of all the other species, by the combination of the two characters, the absence of a supra-orbital spine on the carapace and the simple character of the fingers of the last three pairs of legs. But the five species mentioned all belong to the *dimorphus* group, and though there are no male specimens of *A. crosslandi* available, the form of the first pair of legs of the female point to its affinities with the *nitescens* group, in which its nearest relative is *A. naifaroensis*, Cout. It is, however, distinguished from the latter species by the absence of a supra-orbital spine, and the great length of the extra-corneal spine will serve to distinguish it from most of the species of this group.

Genus Synalpheus, *Sp. Bate*, 1888.

Neomeris group.

Synalpheus gravieri, *Coutière*, 1905, p. 870, pl. 70. fig. 2.

S. gravieri, De Man, 1911 *b*, p. 216, pl. 6. fig. 25.

Locality. Station III., 2 ♀, 10 and 12 mm.

Remarks. The smaller of these specimens has only one spine and the larger two spines, on the merus of the third pair of legs. Otherwise the specimens are in close agreement with Coutière's description.

Distribution. The only previous record for the Red Sea is that of Coutière (1905) from Djibouti. Otherwise known from the Maldives (Coutière, 1905), Ceylon (Pearson, 1905 & 1911), Dutch East Indies (De Man, 1911), Chinese and Japanese waters (Ortmann & Coutière).

Synalpheus streptodactylus, *Coutière*, 1905, p. 870, pl. 70. fig. 1.

S. streptodactylus, De Man, 1911 *b*, p. 226, pl. 7. fig. 29.

Localities. Station IV., 1 ♂, 11 mm., 1 ♀ with eggs, 14 mm.

Uncertain. 1 ♂, 10 mm., 1 ovig. ♀, 14 mm., labelled Crust. fr. 44.

Distribution. Not previously recorded from the Red Sea. Otherwise known from the Maldives (Coutière, 1905), Ceylon (Pearson, 1911), Dutch East Indies (De Man, 1910), Atjeh and Ternate (De Man).

SYNALPHEUS TRIUNGUICULATUS (*Paulson*), 1875, p. 103, pl. 14, figs. 1–1 *g*.

S. triunguiculatus, Nobili, 1906 *a*, p. 31.
S. triungicuulatus, Nobili, 1906 *b*, p. 25.

Localities. Station V. C, 2 ♀, one with eggs, 10 and 12 mm. Station V. D, one juv., 6 mm. Station VII. C, 1 ♂, 14 mm., 1 ♀, with eggs, 15 mm.

Remarks. These specimens agree very closely with Paulson's figures and seem clearly referable to his species.

Distribution. This species has been recorded from various localities in the Red Sea by Paulson, Coutière, and Nobili. So far as I am aware it has not been taken in any other area of the Indo-Pacific Ocean, with the exception of the Persian Gulf (Nobili, 1906 *b*).

SYNALPHEUS FOSSOR (*Paulson*), 1875, p. 103, pl. 13. fig. 5.

S. fossor, Coutière, 1905, p. 872, pl. 70. fig. 6.
See also De Man, 1911 *b*, p. 250, pl. 9. fig. 39.

Localities. Station VIII. C, 3 ♀, 7–11 mm. Station XI., fourteen specimens, 4–10 mm. (in green sponge).

Remarks. These specimens seem to combine the characters of the typeform and the var. *propinqua*, De Man. They agree with the former in having the carpocerite six times as long as broad, and with the latter in having nine spinules on the propodus of the third pair of legs, and in the proportions of the merus of these limbs. The strongly spinous corners of the apex of the telson are always well marked, but they may be longer or shorter than the first of the spines on the apex. This character does not seem to vary with age. Otherwise these specimens are in the closest agreement with Paulson's figures.

Distribution. Recorded previously from the Red Sea by Paulson ; Maldive Archipelago (Coutière) ; the var. *propinqua* is known from various parts of the Dutch East Indies and adjacent waters.

SYNALPHEUS HERONI, *Coutière*, 1909, p. 42, fig. 24.

S. heroni, De Man, 1911 *b*, p. 256, pl. 9. fig. 41.

Locality. Station IX. A, 4 ♀ (one ovig,), 7–10 mm.

Distribution. Red Sea at Djibouti (Coutière) ; Dutch East Indies (De Man).

Paulsoni group.

SYNALPHEUS HULULENSIS, *Coutière*, 1908, p. 12.

S. tumidomanus, Coutière, 1905, p. 876, pl. 63. fig. 14.
S. hululensis, Coutière, 1909, p. 24, fig. 4.

Locality. Station IX. A, 1 ♂, 8 mm., 1 ovig. ♀, 9 mm., 1 juv., 6 mm.

Remarks. Both the carpocerite and the merus of the third legs are four

times as long as wide. The telson is not spinous at the lateral corners of the apex. The species seems to me to be very closely allied to *S. tricuspidatus* of Heller.

Distribution. New to the fauna of the Red Sea. Only recorded by Coutière from the Maldives.

Biunguiculatus group.

SYNALPHEUS BIUNGUICULATUS (*Stimpson*) *Coutière.*

S. biunguiculatus, Coutière, 1905, p. 873, pl. 71. fig. 8.
S. biunguiculatus, De Man, 1911 *b*, p. 273, pl. 11. fig. 51.

Localities. Station V. B, one broken. Station V. A, one, 10 mm. Station V. C, 1 ♂, 12 mm., and 1 ♀, 15 mm. Station X., 1 ♀, 15 mm.

Remarks. All these specimens belong to the typical form of the species as defined by De Man.

Distribution. Previously recorded from the Red Sea by Coutière, from Suez and Djibouti; Maldives and Laccadives (Coutière); Dutch East Indies (De Man).

Nobili has recorded this species from Massaouah in the Red Sea, but De Man states that it is not possible to say what species he had under observation.

SYNALPHEUS SAVIGNYI (*Guérin*), 1856, pp. 47–51, pl. 2. figs. 8–11.

Athanas nitescens, Audouin & Savigny, 1826, p. 90, pl. 9. fig. 4. See also Coutière, 1899, p. 17.

Locality. Station I. F, 1 ♀, 15 mm.

Remarks. I have not been able to consult Guérin's works, and I am indebted for the reference thereto to Coutière. The single specimen at my disposal agrees absolutely with Savigny's figure, and I have little doubt that it belongs to the species which Savigny had under observation and, moreover, it seems to me that Savigny's figure is an extraordinarily faithful reproduction of the species. *S. savignyi* is very nearly allied to *S. biunguiculatus*, and before I was able to consult Savigny's work I had noted it as a variety. The rostrum is exactly as figured by Coutière for *S. biunguiculatus* except that the left tooth of the trident is almost obsolete. The carpocerite is slightly longer than the antennular peduncle, while the scaphocerite is equal in length to the latter. The antennal scale reaches forward to the distal end of the second joint of the antennular peduncle. The inferior spine of the basicerite is equal to the stylocerite, while the superior spine of the basicerite is quite well developed.

The outstanding feature of the species is to be found in the palm of the

large chela (the left one in this case), which ends anteriorly in a sharp spine directed straight forward. In *S. biunguiculatus* the palm ends anteriorly in a bluntly rounded tubercle. The dactylus of the smaller chela is without a dorsal brush of hairs. The merus of the third legs is four times as long as wide, with three or four movable spinules on the distal third of its lower margin. In this character it resembles *S. pachymeris*, Cout. The carpus of these limbs has a single spine on the distal corner of the lower margin and the propodus bears seven or eight spinules.

The species differs from *S. biunguiculatus* in the form of the large chela and in having spinules on the merus of the third legs. In the latter character it agrees with *S. pachymeris*, but differs from this species in the rostrum and large chela.

The specimen was infected by an abdominal Bopyrid.

Distribution. *S. savignyi* does not appear to have been seen since it was originally described and figured by Audouin and Savigny. Its rediscovery is therefore a matter of considerable interest. Savigny's specimen probably came from the Red Sea though no precise locality is given.

Synalpheus quinquedens, n. sp. (Pl. 28. figs. 1–5.)

Localities. Station I. D, 1 ♀, 18 mm. Station V. E, 1 ♀ with eggs, 20 mm. Station VI., 1 ♀, 16 mm. Station VII. F, 1 ♀, 19 mm.

Uncertain. 1 ♂, 13 mm., 1 ♀, ovig., 13 mm., labelled "part of the fauna of two dead valves of *M. margaritifera* which were covered by sponges and supported a regular microcosmos of life."

Description. A new species of the *biunguiculatus* group, belonging to that section of the group characterized by having the posterior margin of the sixth abdominal somite armed with teeth. In *S. quinquedens*, the posterior margin of the sixth abdominal somite is armed with a prominent obtuse spine or tooth at each lateral corner and between them, three other smaller blunt teeth more or less equidistantly placed (Pl. 28 fig. 5).

The general form of the body is robust and tumid, and there are a few very scattered quite short hairs on the carapace and abdomen.

The three prongs or spines of the rostral plate (Pl. 28. fig. 1) are equal in length and extend forward about half-way along the basal joint of the antennular peduncle. The central spine is narrower than the laterals, of more or less equal width throughout. The lateral spines are broad and obtuse. Each of the rostral spines is tipped by a few short setæ.

The antennular peduncle (Pl. 28. fig. 1) has the third joint shorter than the second and the stylocerite slightly longer than the basal joint.

The carpocerite (Pl. 28. fig. 1) is five times as long as wide, and projects beyond the antennular peduncle by about one-sixth of its length. The terminal spine of the scaphocerite is equal to or slightly shorter than the

antennular peduncle, while the antennal scale reaches to the level of the distal end of the second joint of the antennular peduncle. The lateral spine of the basicerite is very acute and as long as the first joint of the antennular peduncle, therefore slightly shorter than the stylocerite. The spine at the upper angle of the basicerite is well developed, acute, about one-third as long as the lateral spine.

The telson (Pl. 28. fig. 5) is two and a third times as long as wide at the posterior margin. Its posterior angles are acute but not spinous, and immediately inside of them the posterior margin bears two spines on each side, the inner of which is slightly the longer. The usual two pairs of dorsal spines are present, rather robust in form, the posterior pair situated about the middle of the telson.

The larger cheliped (Pl. 28. fig. 2) is of the general form found in *S. biunguiculatas*. The merus is triangular in cross-section, each angle of the triangle marking a carina running longitudinally down the joint and ending distally in acute spines. The carpus is acutely spinous at its lower distal corner. The chela is rather more than $2\frac{1}{2}$ times as long as broad, quite smooth and oval in form. The anterior margin of the palm ends in an acute but not spinous tubercle. The fingers are about one quarter of the length of the whole chela.

The merus of the smaller cheliped is three times as long as wide, unarmed at the apex, with numerous long setæ on the inner margin. The whole chela is three times as long as broad, the palm being two-thirds of the total length and the fingers one-third. The movable finger is tapering and furnished with stiff setæ at its tip.

The merus of the second pair of legs (Pl. 28. fig. 3) is very nearly five times as long as wide. The carpus is about equal in length to the merus, the first joint equal in length to the succeeding four, the last joint longer than the combined length of the third and fourth. The chela is very slightly shorter than the first joint of the carpus, with the fingers one and a half times as long as the palm and fringed with long tufts of setæ.

The third pair of legs (Pl. 28. fig. 4) are of relatively stout form. The merus is rather more than three times as long as broad and unarmed. The carpus is four-ninths and the propodus two-thirds as long as the merus, the carpus being unarmed and the propodus bearing seven short spines on its inner margin. The dactylus is very short with the secondary nail well developed. Length of the only male 13 mm., of the female 13–20 mm., the smallest as well as the largest of which are ovigerous.

This species falls within that group of forms belonging to the *biunguiculatus* division of the genus, in which the posterior margin of the sixth abdominal somite is armed with teeth. De Man has described six species in the Siboga Report, belonging to this group: *S. bispinosus*, *S. triacanthus*,

S. quadridens, *S. quadrispinosus*, *S. trispinosus*, and *S. septemspinosus*, the specific names of which refer to the number of teeth on the posterior margin of the sixth abdominal somite. Following this nomenclature, the specific name of the new species here described indicates at once the main point of difference from the species described by De Man. Among De Man's species, *S. quinquedens* is at once distinguished from *S. triacanthus*, *S. trispinosus*, and *S. septemspinosus* by the character of the rostral plate. In the first two species the central spine is exceedingly long, much longer than the lateral teeth and as long as or longer than the first joint of the antennular peduncle. In *S. septemspinosus* the central prong of the rostral trident is longer than the laterals, whereas in *S. quinquedens* all three are equal. *S. trispinosus* and *S. septemspinosus* are further distinguished from *S. quinquedens* by having the merus of the third legs armed with seven or eight spinules. Of the other three species, *S. quinquedens* approaches most closely to *S. quadrispinosus*, differing only in the extra spine on the sixth abdominal segment.

This group of species is most nearly related to the type-form of the division of the genus to which they belong, *S. biunguiculatus*, and in fact, but for the armature of the sixth abdominal somite, would be difficult to separate from that species.

Genus Alpheus, *Fabricius*.

Macrochirus group.

Alpheus gracilis, *Heller*, 1861, p. 271, Taf. 3. figs. 19, 20.

See De Man, 1911 *b*, p. 337, pl. 14. fig. 60.

Localities. Station VII. B, 1 ♂, 16 mm., 1 ♀ with eggs, 17 mm. Station IX. A, 4 ♂, 9–17 mm., 4 ♀, 9–16 mm., three of which, 12–16 mm. in length, were carrying eggs.

Distribution. The type-form has so far not been met with outside the Red Sea, from which both Heller and Coutière have recorded the species. The var. *alluaudi*, Coutière, is known from Mahé and the var. *luciparensis*, De Man, from Lucipara Island in the Dutch East Indies.

Alpheus ventrosus *, *H. M.-Ed.*, 1837, p. 352.

A. ventrosus, Coutière, 1905, p. 882.

A. ventrosus, De Man, 1911 *b*, p. 339.

Localities. Station VII. B, six specimens. Station V. E, several.

Distribution. Recorded previously from the Red Sea by Heller, Paulson, Kossmann, De Man, Miers, Nobili, and Coutière; widely distributed throughout the Indian and Pacific Oceans.

* Stebbing (1915) identifies this species with the earlier described *Alpheus lottini*, Guérin, which name it should accordingly bear.

Crinitus-obeso-manus group.

ALPHEUS MICROSTYLUS, *Sp. Bate*, 1888, p. 566, pl. 101. fig. 6.

A. microstylus, Coutière, 1905, p. 884, pl. 76. fig. 23.
A. microstylus, De Man, 1911 *b*, p. 344.

Locality. Section V. E, 2 ♂, 20 and 22 mm.
Distribution. Previously recorded from the Red Sea by Coutière from Djibouti and Mascat ; widely distributed in the Pacific Ocean.

Crinitus-crinitus group.

ALPHEUS ALCYONE, *De Man*, 1902, p. 870, Taf. 27. fig. 61.

A. alcyone, Nobili, 1906 *b*, p. 32.
A. aculeipes. Coutière, 1905, p. 892, pl. 79. fig. 31.
A. alcyone, De Man, 1911 *b*, p. 351.

Locality. Station V. C, one specimen, 10 mm.
Distribution. Previously recorded from the Red Sea by Coutière from Djibouti ; widely distributed in the Indian Ocean.

ALPHEUS sp. ?

Locality. Station V. A, 1 ♂, 10 mm.
Remarks. This specimen approaches *A. alcyone* very closely, but differs from it mainly in the fact that the median rostral process is absent or obsolete so that the rostrum presents the form of an emarginate plate.

The dactylus of the last three pairs of legs has a very small accessory tooth so that it is obscurely bi-unguiculate, There is no prominent spine on the distal corner of the lower margin of the carpus of the third legs, but there are two spines on the median portion of this margin. The second joint of the carpus of the second pair of legs is about three times as long as the first. The other characters are exactly as in *A. alcyone*.

ALPHEUS BUCEPHALOIDES, *Nobili*, 1905 *b*, p. 238.

A. bucephaloides, Nobili, 1906 *b*, p. 29.

Localities. Station V. E, 1 ♂, 9 mm. Station IX. A, 1 ♂, 10 mm.
Remarks. It is with a considerable amount of reserve that I refer these specimens to Nobili's species. They differ from the latter in not having the movable finger of the small cheliped broadened and fringed with setæ, and in having the second joint of the carpus of the second legs 1·3 times as long as the first, instead of 1·6 as in *A. bucephaloides*.

The carpus of the third legs has only three spinules on the lower border in addition to the terminal one and has no spines on the upper border. There

is only one spine on the outer uropod at the suture. These small differences may be due to immaturity, as the specimens are in otherwise close agreement with *A. bucephaloides*.

Distribution. This species is new to the fauna of the Red Sea and is otherwise only known from Nobili's record from the Persian Gulf.

Alpheus consobrinus, *De Man*, 1908, p. 101.

A. consobrinus, De Man, 1911 *b*, p. 360, pl. 16. fig. 75.

Localities. Station V. A, 1 ♂, 1 ♀, 14 mm. Station V. D, 1 ♂, 9 mm. Station V. E, 2 ♀, 14 mm. Station VII. C, 1 ♂, 1 ♀, 10 mm. Station IX. A, 1 ♂, 2 ♀, 9 mm.

Remarks. This species is very closely allied to *A. bucephalus*, Coutière, but differs in having the fingers of the small chela of the male expanded and hairy. The differences between the two species do not seem to me to be clearly established, but by reason of the above character I refer my specimens to De Man's species.

Distribution. New to the fauna of the Red Sea; otherwise only known from the waters round the Dutch East Indies.

Alpheus pachychirus, *Stimpson*, 1860, p. 30.

A. pachychirus, De Man, 1911 *b*, p. 366, pl. 16. fig. 77.

Locality. Station IX. A, 1 ♂, 15 mm.

Distribution. Recorded once previously from the Red Sea by Coutière from Djibouti; widely distributed throughout the Indian and Pacific Oceans.

Crinitus-insignis group.

Alpheus insignis, *Heller*, 1861, p. 269, Taf. 3. figs. 17–18.

A. insignis, Coutière, 1905, p. 899.

Locality. Station IX. A, 1 ♀.

Remarks. This specimen agrees very well with the descriptions of *A. insignis* except that the lateral lobes of the rostrum are not setiferous.

Distribution. Recorded previously from the Red Sea by Heller, Paulson, De Man, Nobili, and Coutière; otherwise widely distributed in the Indo-Pacific Ocean.

Alpheus paracrinitus, *Miers*, 1881, p. 365, pl. 16. fig. 6.

Locality. Station VII. C, four specimens, 11–12 mm.

Distribution. Recorded by Coutière from the Red Sea at Djibouti; other-

wise known from the original record of Miers from Goree Island, Senegambia. A variety of this species, *bengalensis*, Coutière, is known from Minikoi.

Edwardsi group.

ALPHEUS AUDOUINII, *Coutière*, 1905, p. 911, pl. 87. fig. 52.

A. audouinii, De Man, 1911 *b*, p. 414, pl. 23. fig. 100.

Locality. Station V. E, 1 ♂, 21 mm., 1 ♀, 19 mm.

Distribution. This species has hitherto been confused with *A. edwardsii*, Audouin, so that the previous records for the Red Sea are not easy to determine. It has, however, been certainly recorded by Nobili and Coutière from this area.

ALPHEUS STRENUUS, *Dana*, 1852, p. 543, pl. 34. fig. 4.

A. strenuus, Coutière, 1905, p. 913, pl. 87. fig. 53.
A. strenuus, De Man, 1911 *b*, p. 423.

Localities. Station I. A, one specimen, 28 mm. Station V. E, two specimens, 17 and 24 mm. Station VII. C, one specimen, 22 mm.

Distribution. Previously recorded from the Red Sea by De Man, Nobili, and Coutière ; a widely distributed Indo-Pacific species.

ALPHEUS BOUVIERI, *A. M.-Ed.*, var. HULULENSIS, *Coutière*, 1905, p. 908, pl. 85. fig. 46.

Locality. Station V. C, 1 ♀, 10 mm.

Distribution. Recorded from the Red Sea by Coutière from Djibouti ; otherwise only known from the Maldives.

ALPHEUS PARVIROSTRIS, *Dana*, 1852, p. 551, pl. 35. fig. 3.

A. parvirostris, Coutière, 1905, p. 906.
A. parvirostris, De Man, 1911 *b*, p. 432, pl. 22. fig. 106.

Localities. Station V. A, 2 ♂, 12 and 13 mm., 5 ♀, 9–14 mm. Station V. B, 14 specimens. Station V. C, 2 ♂, 8 and 10 mm. Station V. E, 2 ♂, 13 and 14 mm., 2 ovig. ♀, 12 and 14 mm. Station VII. C, 2 ♂, 12 and 13 mm., 2 ovig. ♀, 12 and 13 mm. Station IX. A, 3 (including 1 ovig. ♀), 5–9 mm.

Distribution. Recorded from the Red Sea by Heller and Coutière ; otherwise widely distributed in the Indian and Pacific Oceans.

In addition to the above-named species the collection contained two ovigerous female Alpheids, from among coral in one fathom of water at Mersa Ar-rakiya, which were too much damaged to identify with certainty.

Family HIPPOLYTIDÆ.

Genus Saron, *Thallwitz*.

Saron neglectus, *De Man*, 1902, p. 854, pl. 26. fig. 58.

S. neglectus, Coutière, 1910, p. 71, figs. pp. 73, 78.
S. neglectus, Kemp, 1914, p. 87.

Locality. Section IX. A, two specimens, 25 mm.
Previously recorded from the Red Sea by Coutière.

Genus Thor, *Kingsley*, 1878.

Thor paschalis (*Heller*, 1861, p. 276, pl. 3. fig. 24).

Paschocaris paschalis, Nobili, 1906 *a*, p. 38, pl. 3. fig. 1.
Thor paschalis, Kemp, 1914, p. 94, pl. 1. figs. 6–10.

Locality. Station V. C, two specimens, 9 mm.

Remarks. The carpus of the second peræpods is six-jointed and the telson bears four pairs of spinules.

Distribution. Previously recorded from the Red Sea by Heller and Nobili. For further distribution see Kemp (*loc. cit.*).

Genus Hippolyte, *Leach*.

Hippolyte proteus, *Paulson* (1875, p. 109). (Pl. 28. figs. 10–12.)

See Nobili, 1906 *a*, p. 33.

Locality. Exact locality uncertain. The label bears the number W. 12, and I think refers to specimens captured in Suakin Harbour.

Remarks. Two small specimens of *Hippolyte*, 9 and 11 mm. in length, I refer to Paulson's species, with some doubt. Nobili (1906 *a*) has published a translation of Paulson's original description, and to it I am indebted for information on this form. My specimens belong to category A of Paulson and to the first group of that category. The rostrum (Pl. 28. fig. 10) is equal in length to the antennular peduncle and much shorter than the antennal scale. The upper edge bears three teeth, the first two placed at one-third and two-thirds of the way along the rostrum and the third and smallest tooth near the tip. The larger specimen has two small teeth on the lower edge in the anterior (distal) third, the smaller specimen only one small tooth. The antennal scale (Pl. 28. fig. 11) is about three and a quarter times as long as broad. The carpus of the second pair of legs (Pl. 28. fig. 12) has the first joint twice as long and the third joint one and a third times as long as the second. The latter is one and a half times as long as broad.

Nobili regards the category B specimens of Paulson as synonymous with *H. orientalis*, Heller, which Kemp (1914) suggests is possibly a synonym of *H. ventricosus*, M.-Ed. From the latter as redescribed by Kemp, my specimens differ in having a much shorter rostrum. In *H. ventricosus* the rostrum is equal in length to the antennal scale and much longer than the antennular peduncle. In my specimens the rostrum is only as long as the antennular peduncle and much shorter than the scale. There are also differences in the proportions of the joints of the carpus and in the antennal scale, and it seems useful to indicate these by the following table, in which I have incorporated measurements made from Kemp's figures.

	H. ventricosus.	*H. varians.*	*H. proteus.*
Antennal Scale—			
L : B	3·0	3·5	3·25
Joints of Carpus 1	3·0	2·6	2·0
„ „ 2	1·0	1·0	1·0
„ „ 3	1·7	1·4	1·3
2nd joint of Carpus L : B ..	1·0	2·0	1·5

At the same time it is only just to point out that my specimens are not fully grown, and the proportions of the joints of the carpus may change with age. The rostrum is well known to be of very variable form in species of this genus. I record my specimens under the name *H. proteus*, rather with the idea of indicating their structure, than from any conviction that the species is really distinct from *H. orientalis*, Heller, or *H. ventricosus*, M.-Ed.

Family PALÆMONIDÆ.

Subfamily PONTONIINÆ, *Kingsley*, 1878.

Genus PALÆMONELLA, *Dana*, 1852.

PALÆMONELLA TENUIPES, *Dana*, 1852, p. 582, pl. 38. fig. 3.

P. tenuipes, Nobili, 1906 *a*, p. 70.
P. tenuipes, Borradaile, 1917, p. 358.

Localities. Station V. P, one specimen, 10 mm. Station VII. C, three specimens, 10–17 mm.

Remarks. I think this is certainly the species recorded by Nobili as *P. tenuipes*, Dana. The main points of difference from Dana's description and figures are:—(1) The relatively longer palm to the chelæ of the second pair of legs; (2) the merus is armed with a spine at the distal extremity of the lower border *only*; (3) Dana makes no mention of the minute teeth on the fingers of the chelæ noted by Nobili and present in these specimens.

The four specimens in the present collection have the rostrum armed with seven or eight teeth above, two of which are on the carapace, and two below.

Two of the specimens still retain the second pair of legs, and these, measured, give the following proportions, taking the carpus as unity. These measurements are compared with those given by Nobili in his description of this species and with similar measurements taken from Dana's figure and from Borradaile's figure of *P. tridentata* (1898 *a*, p. 1007, pl. 64. fig. 8). I have added the proportions of the joints of the first legs, derived from the same sources.

	Crossland Red Sea specimens.			Nobili.	Dana.		Borradaile. *P. tridentata*.	
	1st leg.	2nd leg.		2nd leg.	1st leg.	2nd leg.	1st leg.	2nd leg.
Merus	1·0	1·4	1·2	1·1	1·5	1·2	·9	·7
Carpus	1·0	1·0	1·0	1·0	1·0	1·0	1·0	1·0
Palm	·4	1·7	1·6	1·5	·625	1·2	·5	1·5
Fingers	·35	1·0	1·0	·8	·625	·8	·4	·75

From this table of measurements it will be noted (1) that in Dana's specimens the palm of the second leg is relatively shorter than in either Nobili's specimens or mine, and (2) that my specimens have relatively longer fingers than either Dana's or Nobili's, though Nobili gives the measurements of the palm and fingers of another specimen in which the fingers are relatively longer than in the other limb measured and approach more closely to the present specimens.

As regards the first pair of legs, Dana's specimens have the arm and hand both longer than the wrist, while in mine the arm is equal to the wrist and the hand shorter.

Palæmonella tridentata, Borradaile, is very closely allied to *P. tenuipes*. Borradaile gives the following points of difference:—

(1) There are three teeth on the underside of the rostrum, instead of two.

(2) The inner edges of the fingers of the second pair of chelæ are armed with teeth.

(3) The distal end of the merus is rounded in profile, but provided with a large spine below at a short distance from the end. In *P. tenuipes* it is acute in profile and without the tooth.

(4) The arrangement of teeth on the inner ramus of the mandible is different in the two species.

Of these differences, number one is merely an individual variation, and numbers two, three, and four apply also to the present specimens and to

Nobili's as distinct from Dana's. The most important difference between the present specimens and *P. tridentata* is brought out in the table of measurements of the second pair of legs given above. In my specimens, and also in those examined by Dana and Nobili, the merus is longer than the carpus. In Borradaile's figure of *P. tridentata* it is shown as considerably *shorter* than the carpus. On the other hand, the proportions of the joints of the first legs in *P. tridentata* agree closely with the present specimens.

As a result of the above considerations, it follows that the present specimens belong to the same species as those examined by Nobili and referred by him to *P. tenuipes*, Dana. I accept Nobili's identification. *P. tridentata*, Borradaile, is closely allied to *P. tenuipes* and doubtfully distinct.

Distribution. Previously recorded from the Red Sea by Nobili ; Sulu Sea (Dana) ; Japan (Ortmann) ; Maldives (Ortmann) ; Amboina (De Man).

Genus Periclimenes, *Costa*.

Periclimenes petitthouarsii (*Audouin*, 1826).

Palæmon petitthouarsii, Audouin, 1826, Descr. Egypte, Hist. Nat. I. iv. p. 91 ; Savigny, Atlas, Crust., pl. 10. fig. 3.

Periclimenes petitthouarsii, Borradaile, 1898 *b*, p. 381 ; and 1917, p. 369.

Localities. Station V. A, one, 16 mm. Station V. C, two, 13 and 15 mm. Station VII. E, one, 11 mm. Station VII. C, four, 10–15 mm.

Sudan Coast, no definite locality, forty, 7–18 mm.

Distribution. Previously recorded from the Red Sea by Audouin, Paulson, Kossmann, and Nobili, and by the latter from the Persian Gulf.

Periclimenes calmani, n. sp. (Pl. 27. fig. 11 ; Pl. 28. figs. 14–15.)

Locality. Sudan Coast, four specimens, 13–17 mm.

Description. The carapace is smooth, without supra-orbital spines. Antennal and hepatic spines are present, the latter a little below the level of the former.

The rostrum (Pl. 27. fig. 11) reaches almost or quite to the apex of the antennal scale and considerably beyond the apex of the antennular peduncle. It is concave from the base and bears dorsally 8–9 teeth, the proximal tooth well behind the orbit, the second tooth placed over the orbit, and the remainder more or less regularly spaced with a longer interval between the 5th and 6th tooth. The lower edge bears 4–5 teeth, the proximal one below the 5th tooth of the upper edge.

The third maxillipeds reach to the end of the antennal peduncle. The exopod is longer than the antepenultimate joint. The latter bears six spinules and a few setæ on its outer margin. The first legs (Pl. 28. fig. 14) extend

forwards to the apex of the antennal scale. The carpus is about one-sixth longer than the merus and one and a half times the length of the hand. The palm is equal in length to the fingers. There are no ischial, meral, or carpal spines. The fingers are without teeth on their cutting-edges. The second legs (Pl. 28. fig. 15) extend beyond the antennal scale by one-half of the carpus plus the whole of the hand. The proportions of the joints are as follows :—Ischium 2·0 mm., merus 2·3 mm., carpus 2·55 mm., palm 1·8 mm., finger 1·6 mm. There are no ischial, meral, or carpal spines. Both the fixed and immovable fingers have on their inside margins a shallow oval pit bounded by small teeth proximally and distally.

This species clearly belongs to the subgenus *Falciger*, and if we attempt to run it down with the aid of Borradaile's key to the species of the subgenus we find that it would fall in Section I. by reason of the oval pits in the fingers of the large chela, a peculiarity only noted in two of the species, *P. spiniferus*, De Man and *P. petitthouarsi* (Audouin). From the former species, *P. calmani* is distinguished by the absence of supra-orbital spines and from the latter by the long and slender form of the great chela, the much greater length of the carpus of these limbs, and the absence of spines on the first and second legs.

It is possible, however, that the oval pits have been overlooked in other species of the genus. If, therefore, we ignore Section I. of Borradaile's key and proceed to Section II., we find the nearest ally of *P. calmani* in *P. seychellensis*, Borradaile, from which it is distinguished by the shorter rostrum and the longer pair of second legs.

P. calmani is very closely similar to *P. demani*, Kemp, 1915 *a*. The general form of the body and the proportions of its various parts are very much alike. But *P. demani* has a supra-orbital spine and has meral and carpal spines on the second legs. Judging from Kemp's figure, *P. demani* also has oval pits on the fingers of the chelæ of the second pair of legs.

Periclimenes sp.?

Localities. Station V. C, two, 7–10 mm. Station VII. A, one, 7 mm. Uncertain, one, 13 mm.

These specimens belong to the subgenus *Falciger* and to that group of the species having a supra-orbital spine. The rostrum is longer than the antennular peduncle and subequal to the antennal scale. The formula is $\frac{7-8}{2}$, and the rostrum is concave from the base. Unfortunately the second legs are missing in all the specimens. I think they are almost certainly the form recorded from the Red Sea by Nobili under the name of *P. ensifrons*, Dana, but as the second legs provide the characters for specific determination it is not advisable to name these specimens.

PERICLIMENES sp. ?

Locality. Uncertain, one specimen, broken, labelled "Commensal, P.O.13."

Remarks. I cannot identify the single mutilated specimen with any described species and I think that it represents a new form. As the second pair of legs and the posterior half of the abdomen are missing, I refrain from giving it a name. Among described forms it appears to be most closely allied to *P. borradailei*, Rathbun = *P. tenuipes*, Borradaile, nec Holmes, and to *P. kolumadulensis*, Borradaile, 1915.

The rostrum, which is slender and slightly recurved at the tip, extends beyond both the antennular peduncle and the antennal scale, and is one and a quarter times as long as the carapace measured dorsally. The rostral formula is $\frac{1+7}{2}$. The carapace bears supra-orbital, antennal, and hepatic spines. Such of the legs as remain still attached to the specimen are exceedingly long and slender. The first pair extend beyond the apex of the rostrum by the whole of the chela. The carpus is one and a quarter times as long as the chela. The fifth leg reaches forward as far as the apex of the antennal scale. This specimen differs from both *P. borradailei* and *P. kolumadulensis* in the shorter rostrum and different rostral formula and in the presence of a supra-orbital spine, but resembles both in the slender form of the legs.

PERICLIMENES sp. ?

Locality. Station VII. C, one specimen, 9 mm.

Remarks. This specimen cannot be identified with certainty as the second pair of legs is missing. It belongs to the subgenus *Falciger* and to that group of species having antennal and hepatic, but no supra-orbital, spines on the carapace. The suborbital angle of the antero-lateral border of the carapace is acute but not spiniform, and the lower angle sub-rectangular. The rostrum is long, equal in length to the dorsal line of the carapace from the border of the orbit, and extends forward to the same level as the tip of the antennal scale and far beyond the antennular peduncle. It bears seven teeth (including the terminal one) on the upper margin and two teeth on the lower. All the upper teeth are situated on the rostrum itself, the first one immediately above the orbital border, and there are none on the carapace. The antennal scale is about three and a half times as long as broad at its widest part, and the external margin ends in a strong spine which extends beyond the apex of the scale. The antennular peduncle reaches forward to the level of the fifth tooth of the rostrum. It has one spine only on the external distal corner of the basal joint and a prominent spine on the ventral surface of this joint near the middle of the outer margin. The last three thoracic legs seem unusually stout.

The species of this genus are difficult to determine in the absence of the second pair of legs, and I have not attempted a specific identification in this case.

PERICLIMENES sp.?

Locality. Station VII. A, one, 5 mm.

Remarks. This small specimen belongs to the subgenus *Cristiger* and is most closely allied to *P. potina*, Nobili. The rostral formula is $\frac{4}{1}$ and all the teeth are on the rostrum, none on the carapace behind the orbit. There is no supra-orbital spine.

Genus HARPILIUS, *Dana*, 1852.

The type species of the genus is *Harpilius lutescens*, Dana, and Borradaile, on the evidence of Sollaud (1910) that the third maxilliped in this genus has no arthrobranch (although Sollaud does not say what species he has examined), coupled with the remarkable form of the second maxilliped figured for the type species by Dana, has instituted a new genus *Harpiliopsis* to include two species, *H. beaupresi* and *H. depressus*, which have the second maxillipeds of normal form and arthrobranchs on the third maxillipeds. The validity of the genus *Harpiliopsis* seems to me to be questionable. The addition of a single line to Dana's figure (the line showing the contour of the antepenultimate joint) will give a form of second maxilliped not unlike that depicted by Borradaile for *H. depressus*. It is more reasonable to imagine that this line has been accidentally omitted from Dana's figure than to suppose that *H. lutescens* really has the remarkable form of second maxilliped actually figured. *H. lutescens* is otherwise so closely similar to *H. depressus* as to be doubtfully distinct. The latter species has normal second maxillipeds, and on Borradaile's evidence as well as my own, has an arthrobranch on the third maxilliped. So that if my suggestion as to Dana's figure be accepted, *Harpiliopsis* at once becomes a synonym of *Harpilius*.

On the other hand, specimens which I have referred to *H. gerlachei*, Nobili, do not appear to possess an arthrobranch on the third maxillipeds, and they further differ from all the other species of the genus in the absence of a hepatic spine. It would appear therefore that if a new genus is required, it must be instituted to receive *H. gerlachei*. Until more evidence is forthcoming as to what species of *Harpilius* Sollaud has examined with reference to the presence or absence of arthrobranchs on the third maxillipeds, it would be premature to define a new genus for *H. gerlachei* and I prefer, at present, to include all the species in one genus.

HARPILIUS BEAUPRESI (*Audouin*, 1826, Descr. Egypte, Hist. Nat. I, 4, p. 91, pl. 10. fig. 4). (Pl. 28. fig. 8.)

H. beaupresi, Borradaile, 1898 *b*, p. 386; and 1917, p. 379.
H. beaupresi, Nobili, 1906 *a*, p. 63.

Locality. Suakin, Station VII. A, five specimens, 10–16 mm.

Remarks. The rostral formulæ of the specimens are $\frac{7}{4}$, $\frac{5}{3}$, $\frac{5}{3}$, $\frac{5}{2}$, and $\frac{5}{2}$. All these specimens have a spine on the lower surface of the basal joint of the antennular peduncle. Nobili was unable to find a similar spine in the specimens he examined. *H. beaupresi* is at once distinguished from the other species of the genus by the extreme length of the spine on the outer corner of the joint from which the antennal scale springs. The form of the dactylus (Pl. 28. fig. 8) of the last three pairs of legs is characteristic. It is stout, slightly curved, swollen at the base, and equal in breadth at its base to the propodus to which it is attached.

Savigny's original figure shows the form of the dactylus very well, but I refigure it here to compare with other species of the genus.

Distribution. Previously recorded from the Red Sea by Audouin, Heller, Paulson, and Nobili; Persian Gulf (Nobili); East Indies (De Man).

HARPILIUS DEPRESSUS (*Stimpson*). (Pl. 28. fig, 7.)

Harpiliopsis depressus, Borradaile, 1917, p. 380.

Locality. Station VII. C, 1 ♀, 18 mm.

Remarks. The identification of this specimen is based on Borradaile's monograph (1917), but I am doubtful of the distinctness of this species from *H. lutescens*, Dana. Except for the fact that this specimen has two teeth on the lower margin of the rostrum, I can find no marked character in which it differs from Dana's species. The discrepancy in the form of the second maxilliped I have already attempted to explain. The present specimen has an arthrobranch on the third maxillipeds. It is to be noted in this connection that Nobili records Dana's species from the Red Sea, without comment.

The species differs from *H. beaupresi* in its more robust form, in the shorter spine on the outer corner of the joint bearing the antennal scale, in the shape of the antepenultimate joint of the third maxilliped, and in the stouter form of the last three pairs of thoracic legs and their dactyli. The latter are short, stout, and curved, and apparently capable of being almost retracted into a socket at the base of the propodus (Pl. 28. fig. 7). The whole arrangement recalls the claws of the carnivora and is found in *H. lutescens*, *H. depressus*, *H. gerlachei*, and *H. consobrinus*. In *H. beaupresi* the last thoracic legs are much more slender, and there does not appear to be a socket at the apex of the propodus for the retraction of the claws.

On the ventral surface of the thorax, between the bases of the first pair of

legs there is a strong median forwardly directed spine, and in front of the bases of the third pair of legs are two transverse chitinous ridges or plates, one on each side, meeting in the centre and separated by a notch. These latter are exactly in the situation occupied by the thelycum of the Penæidæ, but I have no idea whether they function as such in this species or are even homologous. I have noticed similar structures in *H. gerlachei*.

Distribution. Indo-Pacific, in corals. New to the fauna of the Red Sea.

H. lutescens is known from Tongatabu (Dana) and the Red Sea (Nobili).

HARPILIUS GERLACHEI, *Nobili*, 1905 *a*, p. 160. (Pl. 28. fig. 9.)

H. gerlachei, Nobili, 1906 *b*, p. 45, pl. 6. figs. 10, 10 *a* ; Borradaile, 1917, p. 381.

Locality. Station V. E, 3 ♀ with eggs, 14–18 mm.

Remarks. These specimens are in substantial agreement with Nobili's description and figures. The rostrum reaches to about the level of the apex of the antennal scale and has the formula $\frac{4-5}{1}$, all the teeth being on the rostrum and none on the carapace. This species is characterized by the absence of a hepatic spine, which together with its tumid form and the shape of the dactyli of the last three pairs of legs serve to render it easily recognizable. The dactylus of the last three pairs of legs (Pl. 28. fig. 9) is short, stout, strongly curved, and much narrower at its base than the distal extremity of the propodus, which is swollen slightly and appears to have a socket at its apex into which the dactylus can be retracted.

Distribution. New to the fauna of the Red Sea. Otherwise only known from the Persian Gulf (Nobili).

Genus CORALLIOCARIS, *Stimpson*, 1860.

CORALLIOCARIS SUPERBA (*Dana*, 1852, p. 573, pl. 37. figs. 2 *a–f*).

See Borradaile, 1898 *b*, p. 385, and 1917, p. 383.

Locality. Station V. E, 2 ♀ with eggs, 18 and 23 mm.

Remarks. This species has no hepatic spine on the carapace.

Distribution. Previously recorded from the Red Sea by Paulson and Nobili ; East Indies ; Tongatabu ; Tahiti.

CORALLIOCARIS LUCINA, *Nobili*, 1901, p. 5.

C. lamellirostris, De Man, 1902, p. 842, pl. 26. fig. 55.
C. lucina, Nobili, 1906 *a*, p. 57 ; Borradaile, 1917, p. 384.

Locality. Station V. E, two specimens, 17 and 18 mm.

Remarks. These specimens agree closely with the descriptions given by De Man and Nobili. The only difference I can find from De Man's figures is that there is a greater interval between the fifth (penultimate) tooth of the

rostrum and the small sixth (last) tooth, which is much nearer the apex of the rostrum in my specimens. The rostrum extends forward to the apex of the antennal scale and has the formula $\frac{6}{4}$. All the teeth are situated on the rostrum and none on the carapace. This species possesses both antennal and hepatic spines on the carapace.

Distribution. Only known from the Red Sea (Nobili) and Ternate (De Man).

Genus Anchistus, *Borradaile*, 1898 *b*.

Anchistus miersi (*De Man*, 1888, p. 274, pl. 22. figs. 6–10).

See Borradaile, 1917, p. 388.

Locality. Station VII. G, 16 specimens, ♂, 15–21 mm., ♀, 21–30 mm.

Distribution. Previously recorded from the Red Sea by Nobili; Persian Gulf (Nobili); coasts of India (Henderson), and the Mergui Archipelago (De Man).

Anchistus inermis (*Miers*), 1884, p. 291, pl. 32. fig. B. (Pl. **27**. fig. 4.)

A. inermis, Borradaile, 1898 *b*, p. 387; and 1917, p. 388.

Locality. Station VII. G, 1 ♂, 24 mm.

Remarks. The first legs present a feature not hitherto noticed in this species. The chela has the appearance of a somewhat deep spoon or scoop, the edge of which is fringed with somewhat long setæ (Pl. **27**. fig. 4). This appearance is brought about by the expansion of the propodus and the folding inward of its margin. This character is possibly sexual.

Nobili (1906 *a*) in recording *Pontonia pinnæ*, Ortmann, from the Persian Gulf, ascribes to his specimens two characters which do not agree with Ortmann's original description. He says that the rostrum extends almost to the end of the antennular peduncle, and that the fingers of the great chela are a little longer than the half of the palm, rather more than one-third of the total length of the hand. Ortmann shows the rostrum to be considerably shorter than the antennular peduncle and, while giving no proportions in his short description, figures the fingers of the great chela of the second pair of legs as scarcely more than one-third of the length of the palm. It is precisely in these two characters that *Anchistus inermis*, Miers, differs from *Pontonia pinnæ*, Ortmann. I think it is very probable that Nobili's specimens from the Persian Gulf, recorded as *Pontonia pinnæ*, Ortmann, should be referred to *Anchistus inermis*, Miers. There remains the question as to whether *Pontonia pinnæ*, Ortmann, is really distinct from *Anchistus inermis*, Miers. The differences between the genera lie entirely in the characters of the third maxilliped. In *Anchistus*, the last

two joints are narrow, while in *Pontonia* they are broad. Ortmann makes no mention of the form of the maxillipeds in his specimens. No one except Nobili has recorded his species since. I have given reasons above for supposing that Nobili's specimens were really referable to *A. inermis*, Miers. The two characters of the rostrum and large chela I have already mentioned provide the only points of difference between the two species. Are these sufficient for specific differentiation? An examination of Ortmann's type is necessary to clear up this point.

Distribution. New to the fauna of the Red Sea; hitherto known from the Indian Ocean.

Genus Conchodytes, *Peters*, 1851.

Conchodytes meleagrinæ, *Peters*, 1851.

C. meleagrinæ, Borradaile, 1917, p. 393.

Locality. Uncertain. 40 specimens, 12–30 mm., labelled "Commensal P. O. 13."

Distribution. Previously recorded from the Red Sea by Nobili; Indo-Pacific in *Meleagrina* and occasionally in *Tridacna*.

Subfamily Palæmoninæ.

Genus Leander, *Desmarest*.

Leander tenuicornis, *Say*, 1818, p. 249.

Leander natator, Nobili, 1906 *a*, p. 74.
Leander tenuicornis, Stebbing, 1914 *a*, p. 288.

Locality. Station II, 1 ♀, 37 mm.

Remarks. My specimen agrees very closely with figure 6, pl. 128, of the 'Challenger' Report except that the rostral formula is $\frac{9}{7}$, two of the dorsal teeth being situated behind the orbit. The rostrum extends just beyond the apex of the antennal scale and is of the deep "latirostris" form. The confusion which at present exists among the species of this family is well exemplified in the species here in question. Stebbing (*loc. cit.*) has identified the *Leander natator* of Milne-Edwards and subsequent authors with the earlier described *Palæmon tenuicornis* of Say. At the same time Stebbing points out that this species agrees with *Leander squilla* in having the palp of the mandible two-jointed. His description runs as follows: "the mandibles have a very slender two-jointed palp, the second joint much the longer." My specimen agrees exactly with this description. It should, however, be pointed out that specimens in the British Museum labelled *Leander natator* have, according to Calman (Kemp, 1910, p. 130, footnote),

a three-jointed mandibular palp. Spence Bate (1888, p. 784) makes no mention of the number of joints in the palp but merely remarks on its "extreme tenuity." The question is of great importance in connection with the characters of the genus *Leander*. The type of the latter genus is *L. erraticus*, Desmarest, identified by Spence Bate and later authors with *L. natator*, M.-Ed., which, as mentioned above, Stebbing has shown to be identical with *L. tenuicornis* of Say. Stimpson also gives *L. natator* as the type species. It follows, therefore, that the type species of the genus *Leander* has a two-jointed palp, and if the number of joints in the mandibular palp be considered of generic importance, it is the three-jointed palp species which must be transferred to a new genus.

Palæmon torensis, Paulson, cannot be identical with *L. natator*, M.-Ed., as surmised by Nobili, since Paulson distinctly figures the mandibular palp as three-jointed. On the other hand, *Palæmonella gracilis*, Paulson, is a species of *Leander* with a two-jointed mandibular palp.

These remarks will serve to show the pressing need for a revision of the genera and species of this family.

Distribution. Widely distributed in the Atlantic, Mediterranean, Indian, and Pacific Oceans.

LEANDER CONCINNUS (*Dana*, 1852, p. 587, pl. 38. fig. 10).

Leander longicarpus, Ortmann, 1891, p. 516.
Leander concinnus, De Man, 1897, p. 765.
Leander concinnus, De Man, 1902, p. 807.

Locality. Station I. A, 23 specimens, the largest 38 mm. in length.

Remarks. The rostrum in the majority of the specimens has the form shown in Dana's figure 10 *b*. There is in all the specimens but a single tooth behind the orbit. This is followed by from 4–6 teeth more or less equidistantly placed on the proximal part of the rostrum. The distal part is upcurved slightly, and usually devoid of teeth with the exception of a small one almost at the extreme apex, giving the latter a bifid appearance. In two specimens the apex is trifid, and in one of the remaining specimens there is a single tooth on the distal part of the rostrum half-way between the proximal teeth and the apex. Below, the rostrum bears from 3–5 teeth. The rostral formula may therefore be represented as follows :—

$$\frac{1 + (4\text{–}6) + (0\text{–}1) + \text{bifid (trifid) apex}}{3\text{–}5}.$$

This species, like the preceding one, has the palp of the mandible two-jointed.

Distribution. New to the fauna of the Red Sea. Fiji (Dana) ; East Indian Archipelago (De Man).

Super-family Crangonoida.

Family PROCESSIDÆ.

Genus NIKOIDES, *Paulson*, 1875, p. 98.

NIKOIDES sp.?

Locality. Station VIII. C, one specimen, 8 mm.

Remarks. I am unable to determine this specimen with any degree of certainty, and as the left leg of the first pair and both legs of the second pair are broken it is not possible to give an adequate description. It differs from the description of *N. danæ*, Paulson, as given by Nobili in the following particulars :—

(1) The rostrum is very much shorter, hardly extending as far forward as the proximal margin of the cornea of the eye ; it is acute with a single small acute dorsal tooth quite near the apex ; on each side of the base of this tooth there springs a single strong seta which extends forward to the apex of the rostrum.

(2) The exopod of the first pair of walking legs is very much shorter and barely extends beyond the ischiopodite.

(3) There are no spines on the ischius and merus of the last three pairs of legs, which are otherwise in close agreement with Nobili's description.

In the last two characters my specimen approaches *N. maldivensis*, Borradaile, 1915, p. 209, but I am unable to institute a comparison with that species in the characters of the first legs, and Borradaile's description of the rostrum of *N. maldivensis* does not agree with what I have observed in the present specimen.

The chelate leg of the first pair, which is present in my specimen on the right side, agrees closely with Nobili's description of that appendage in *N. danæ*.

Suborder REPTANTIA.

Tribe ANOMURA.

Super-family Thalassinidea.

Family AXIIDÆ, *Bate*, 1888.

Genus AXIOPSIS, *Borradaile*, 1903, p. 538.

AXIOPSIS ÆTHIOPICA, *Nobili*, 1904, p. 235.

A. æthiopica Nobili, 1906 *a*, p. 93, pl. 6. fig. 1.

Locality. Station V. E, one specimen, 19 mm.

Remarks. This specimen agrees completely with Nobili's careful description, and I have nothing further to add to his account.

Distribution. At present only known from the Red Sea (Nobili).

Family CALLIANASSIDÆ, *Bate*, 1888.

Subfamily UPOGEBIINÆ, *Borradaile*, 1903, p. 542.

Genus UPOGEBIA, *Leach*.

UPOGEBIA (CALLIADNE) SAVIGNYI, *Strahl*, 1862, p. 1064.

U. savignyi, Nobili, 1906*a*, p. 98.

Localities. Station VII. D, 29 specimens, 5–27 mm. Station I. C, always in pairs, a large ♀ and small ♂ in yellow sponge, 14 specimens. Station V. G, one specimen, 9 mm.

Uncertain. 1 juv., 5 mm., labelled "Crust. fr. 44."

Remarks. This species seems to be usually, if not always, associated with sponges. Two specimens were infected by a Rhizocephalan parasite on the under side of the abdomen.

UPOGEBIA (UPOGEBIA) PSEUDOCHELATA, n. sp. (Pl. 28. figs. 16–22.)

Locality. Station VII. C, 1 ♂, 6 mm., 1 ♀, ovigerous, 12 mm.

Description. The rostrum is quite short and does not extend beyond the eyes. In dorsal view it is triangular in shape with an obtusely rounded apex, and its margins are not provided with teeth or spines. The lateral tooth on each side is almost obsolete, but it marks the anterior termination of a strong lateral tuberculated ridge which runs backward on each side to the well-marked cervical groove. This ridge bears about a dozen small tubercles. The central portion of the dorsal surface of the rostrum and carapace is provided with numerous small obscure tubercles arranged irregularly in six rows, more numerous and prominent nearer the rostrum, becoming obsolete or absent towards the cervical groove. Between the tuberculated portion of the carapace and the lateral ridge on each side, and running parallel to the latter, is a linear groove or impression, devoid of tubercles and likewise becoming obsolete as it nears the cervical groove. The rostrum itself is provided with a dense tuft or mass of short setæ, and the remaining part of the carapace and the body is adorned with scattered hairs of varying lengths. The antennular peduncle (Pl. 28. fig. 17) is shorter than the antennal peduncle, equal in length to the first three joints of the latter, and extending beyond the eye by the whole of the last two joints and the narrow distal portion of the basal joint. The third segment is three times the length of the second. One flagellum is thirteen-jointed and the other ten. The longer flagellum is about one-fifth longer than the peduncle, the shorter flagellum equal to the peduncle in length.

The antennal peduncle (Pl. 28. fig. 16) is composed of four segments with no prominent spines on any of them. Between the second and third segments there is the articulated remnant of the antennal scale, consisting of a small triangular plate with two small apical teeth. The second joint is furnished with a row of very long setæ on the whole of its lower margin. This row of setæ is continued across the outer face of the third joint and terminates in a dense brush on the upper distal corner of the joint.

The first pair of legs (Pl. 28. fig. 18) are equal in size and subchelate in both sexes. The merus is equal in length to the propodus and double the length of the carpus. The propodus or palm is three times as long as wide, oblong in shape with parallel sides. The movable finger is about half as long as the palm, and the fixed finger rather less than half the length of the movable one. The fixed finger bears five small tubercles on its proximal half and impinges on a prominent tooth on the movable finger so that a false chela is thereby formed. There are no prominent spines on any of the joints but the limb is richly provided with setæ. The merus has a row of very long setæ on its inner and lower margin, while the carpus has a dense fringe of small hairs on its upper margin. The palm has its lower margin fringed with long setæ, and there is a dense row of shorter hairs on its outer face besides other scattered hairs. The movable finger is well provided with setæ.

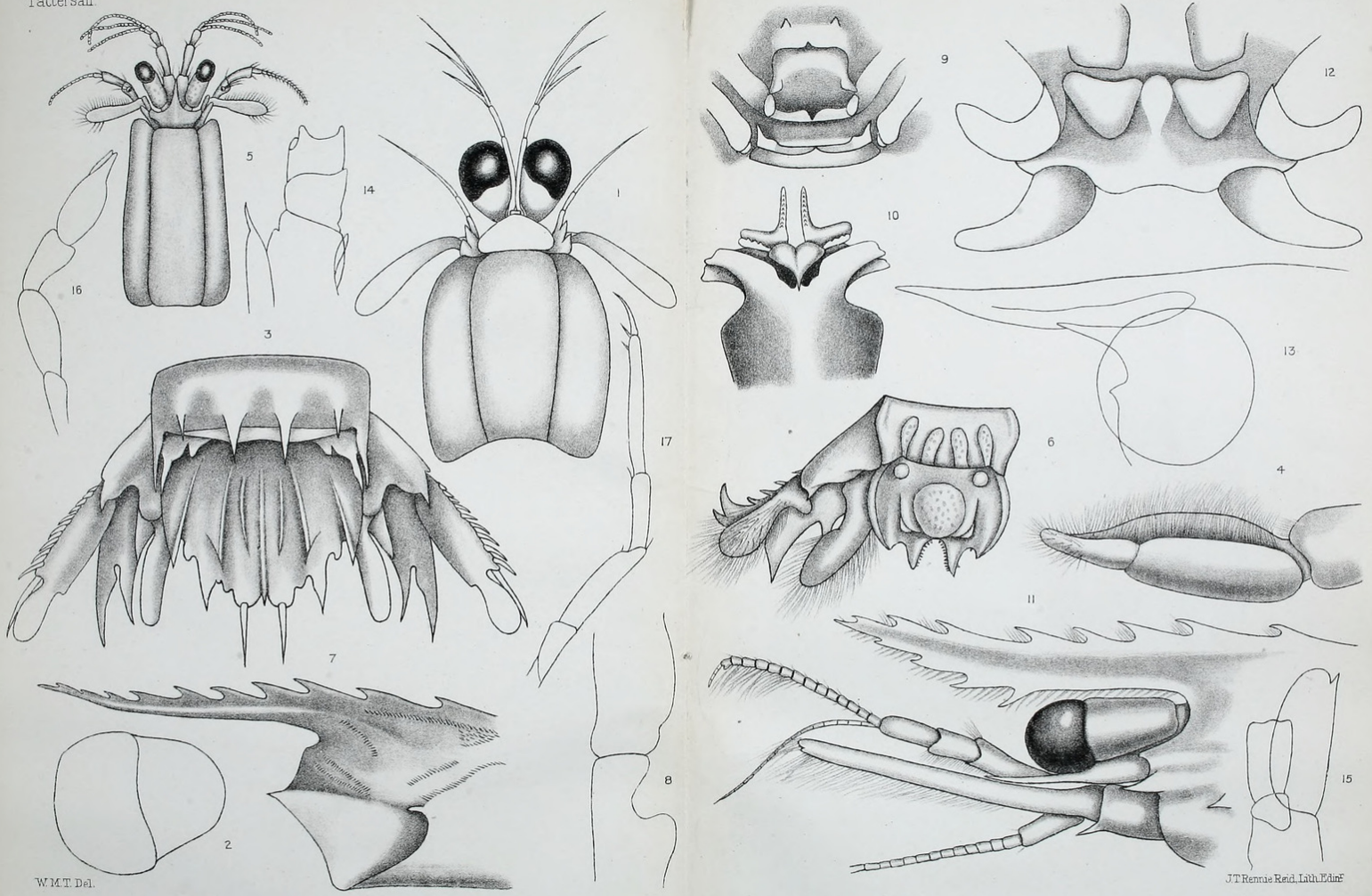
The second leg (Pl. 28. fig. 19) has the merus about equal to the propodus and carpus combined, the proportions of the joints being merus 3·75, carpus 1·75, propodus 2, dactylus 1. The propodus is two and a half times as long as broad. There are no specially prominent spines on these legs, but the merus, carpus, and propodus are well provided with long setæ.

The third and fourth legs (Pl. 28. fig. 20) are specially noticeable for the form of the dactylus. Its outer margin bears five to seven tubercles and the inner margin a dense saw of about 14–16 finely pointed teeth on the distal part.

The fifth legs (Pl. 28. figs. 21–22) have the usual subchelate arrangement due to a prolongation forward of the lower edge of the propodus. This prolongation is about half as long as the dactylus and terminates in a prominent tooth. The dactylus bears a saw of fine teeth on its inner margin. The telson is broader than long, its lateral margins parallel, the lateral corners evenly rounded and the posterior margin straight. It is of the same length as the uropods.

Length of an ovigerous female, 12 mm., of the only male, 6 mm. The male specimen agrees fully with the female, but I am unable to say whether there is the marked sexual dimorphism in size which the two specimens suggest.

Among described species, *U. pseudochelata* approaches most nearly to *U. heterocheir*, Kemp, 1915 *a*. The latter has the same pseudochelate form



W.M.T. Del.

J.T. Rennie Reid, Lith. Edinr.

STOMATOPODA AND MACRUROUS DECAPODA FROM RED SEA.

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STOMATOPODA AND MACRUROUS DECAPODA FROM RED SEA.

of the first pair of legs in the male only, the female having the first pair of legs simple. In this character the species are distinct. These two species also agree in the character of the dactyli of the third and fourth pairs of legs. *U. pseudochelata* differs from *U. heterocheir* in the following points :— (i.) the much shorter rostrum and the almost complete absence of lateral teeth ; (ii.) the presence of tubercles on the rostrum ; (iii.) the relatively longer flagella to the antennule ; (iv.) the absence of spines and teeth on the limbs and other appendages ; (v.) the different form of the pseudochelate limb and the fact that it is common to both sexes ; (vi.) size.

In general facies and structure the two species are closely allied, but the differences already mentioned may be considered of specific value.

EXPLANATION OF THE PLATES.

Plate 27.

Fig.	1.	*Pseudosquilla megalophthalma*, Bigelow.	Dorsal view of anterior region.
	2.	,, ,,	Lateral view of eye to show the real proportion between cornea and peduncle.
	3.	,, ,,	Dorsal view of sixth abdominal segment and telson.
	4.	*Anchistus inermis* (Miers).	Chela of leg of the first pair of the male.
	5.	*Gonodactylus brevisquamatus*, Paulson.	Dorsal view of anterior region of specimen 28 mm.
	6.	,, ,,	Dorsal view of sixth abdominal segment and telson of the same specimen.
	7.	*Penæopsis stebbingi* (Nobili).	Carapace and rostrum.
	8.	,, ,,	Merus of last thoracic leg of a male to show notch.
	9.	,, ,,	Thelycum.
	10.	,, ,,	Petasma.
	11.	*Periclimenes calmani*, n. sp.	Lateral view of anterior end.
	12.	*Penæopsis vaillanti* (Nobili).	Thelycum.
	13.	*Athanas crosslandi*, n. sp.	Lateral view of anterior end to show the relations of the rostrum, extra- and infra-corneal spines, and eyes.
	14.	,, ,,	Antennular peduncle.
	15.	,, ,,	Antennal peduncle and scale.
	16.	,, ,,	Leg of the first pair.
	17.	,, ,,	Leg of the third pair.

Plate 28.

Fig.	1.	*Synalpheus quinquedens*, n. sp.	Dorsal view of anterior end.
	2.	,, ,,	Large chela.
	3.	,, ,,	Leg of the second pair.
	4.	,, ,,	Leg of third pair.

Fig. 5.	*Synalpheus quinquedens*, n. sp.	Dorsal view of sixth abdominal segment and telson.
6.	*Lysiosquilla multifasciata*, W.-M.	Raptorial claw.
7.	*Harpilius depressus* (Stimpson).	Third leg (distal joints) to show the form of the dactylus.
8.	„ *beaupresi* (Aud.).	Distal joints of third leg to show form of dactylus.
9.	„ *gerlachei.*	Distal joints of third leg to show form of dactylus.
10.	*Hippolyte proteus* (Paulson).	Rostrum.
11.	„ „	Antennal scale.
12.	„ „	Carpus and chela of the second pair of legs.
13.	*Penæopsis stebbingi* (Nobili).	Lateral view of petasma to show teeth.
14.	„ „	First leg.
15.	„ „	Second leg.
16.	*Upogebia pseudochelata*, n. sp.	Antennal peduncle.
17.	„ „	Antennular peduncle and flagella.
18.	„ „	Leg of the first pair.
19.	„ „	Leg of the second pair.
20.	„ „	Leg of the third pair.
21.	„ „	Leg of the fifth pair.
22.	„ „	Distal end of leg of the fifth pair.
23.	*Athanas dimorphus*, Ortmann.	Chela of the right leg of the first pair in the male.
24.	„ „	Chela of the left leg of the first pair in the male.
25.	*Athanas djiloutensis*, Coutière.	Chela of the right leg of the first pair in the male.