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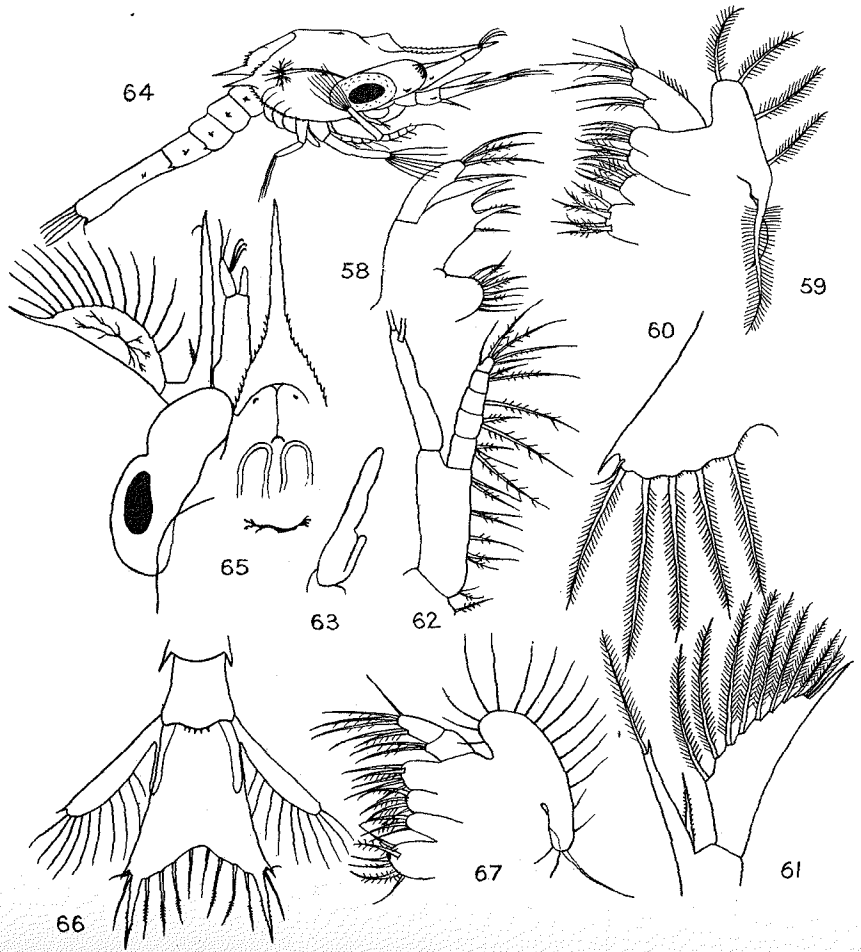

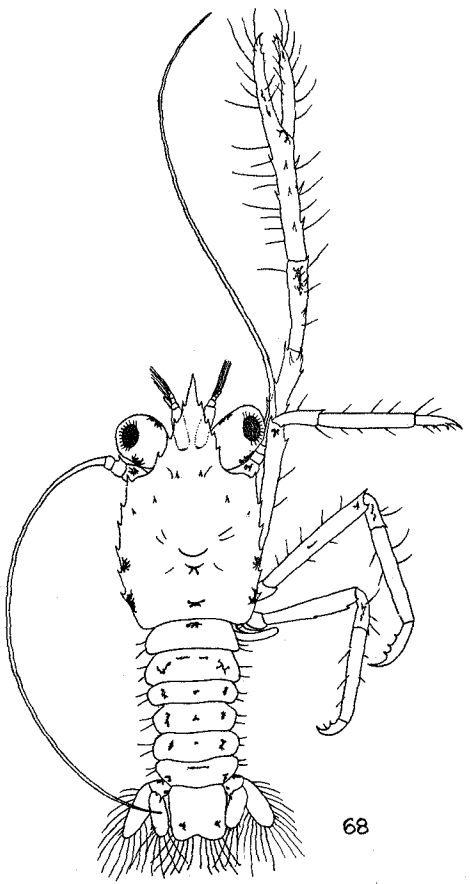

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FIGS. 58–68. *GALATHEA LONGIMANA.*

7. Notes on some Decapod Crustacea from the Red Sea.—VI.–VIII.

By Robert Gurney, D.Sc., F.Z.S.

[Received July 15, 1937 : Read March 15, 1938]

(Plates I.–VI.)

With the publication of this account of the larvæ of certain Brachyura and Anomura I have completed the description of the material collected at the Biological Station at Ghardaqa. The larvæ of some Hippolytidæ have been included in a report published by the ' Discovery ' Committee (vol. xii. pp. 377–440), and those of the Palæmonidæ obtained will be described in a report dealing with material from the Great Barrier Reef Expedition*.

My thanks are due to Dr. I. Gordon and to Dr. Ramadan for the identification of the parent species.

VI. Some Brachyuran Larvæ.

Xanthidæ.

The family includes a very large number of genera, mainly littoral, and the following subfamilies are recognized by Balss (1927).

	Genera of which the zoea is known.
Menippinæ Ortm.	7
Xanthinæ Ortm.	3
Carpilinæ Ortm.	–
Etisinæ Ortm	1
Oziinæ Alcock	–
Eriphiinæ Alcock	1
Trapeziinæ Miers	2
Polydectinæ Dana	–

Rathbun (1930), on the other hand, rejects these subfamilies, "as no satisfactory arrangement to include all genera has yet been made." As larvæ of genera representing four of these groups are known it should be possible to derive from them some evidence as to the validity of the subfamilies.

The uniformity of structure among the zoeas of the Brachyrhyncha and Oxyrhyncha is such that sharp systematic cleavages cannot be made. Miss Lebour, whose work of 1928 gives a survey of the British genera and a discussion of the bearing of the zoea upon the classification of the Brachyura, summarized the characters of the main groups ; but though she was able to show that every species has recognizable features, generic and family characters were very difficult to establish. No definition will, for example, cover the normal Brachyrhynch zoea and also that of *Pinnotheres*, and comparison of her definition for the normal Brachyrhynch with that of the Oxyrhyncha shows that there is no distinction apart from the difference in the number of stages and, consequently, the degree of development of the first zoea.

* Now published. Great Barrier Reef Exp. Rep. vol. vi. no. 1.

Aikawa (1929–1933), who has given special attention to small details of structure in the antenna, telson, etc., has attempted to divide all Brachyuran zoeas into nine groups ; but these groups do not, as he himself pointed out, correspond, even approximately, to any possible phylogenetic grouping of the adults. For instance, his Inachozoea group not only includes Inachidæ, but also some Xanthid genera, while the Grapsizoea group contains genera of Cancridæ, Grapsidæ, Xanthidæ, and even some Oxyrhyncha. Such a method of grouping by selected characters may have some convenience in sorting unidentified zoeas from the plankton, but it is of no help in throwing light upon systematics.

So far as concerns those Xanthid larvæ which are known, the following are the general characters (see Lebour, 1928, p. 529) :—

Prezoea with four setæ on antennal exopod.

Stages generally four.

Telson with three lateral spines, of which the middle one is more or less reduced, or even lost.

Abdomen with lateral papillæ on somites 2 and 3 ; somites 3–5 with lateral spines.

Carapace with dorsal and rostral spines long, lateral spine small. Only the dorsal spine present in *Heteropanope glabra*.

Antenna : basipodal spine generally as long as rostrum ; exopod rarely equal to spine, generally reduced or vestigial.

The following table gives the characters of the genera known. In the table the length of the antennal exopod is given as a fraction of the length of the spine.

XANTHIDÆ.

Characters of First Zoea.

	Exopod of antenna.	Lateral spines on telson.	Spines on carapace.	Author.
MENIPPINÆ.				
Menippe	1·6. 2 setæ ?	2	3	Hyman.
Neopanope	Vestigial.	3 very small.	3	Hyman.
Eurypanopæus	Vestigial.	3 very small.	3	Hyman.
Panopæus	9. 1 seta.	3 very small.	3	Hyman.
Heteropanope glabra	1.	1	D	Aikawa.
Pilumnus	1.	2	3	Aikawa.
Lophopanopæus	Vestigial.	1	3	Hart.
Heteropanope tridentata	Vestigial ?	0	3	Tesch.
XANTHINÆ.				
Xantho	Vestigial.	3	3	Lebour.
Heteractæa	8·2. 2 setæ.	3	3	Gurney.
Cymo	5·3. 3 setæ.	3	3	Gurney.
Chlorodiella	12·5. 2 setæ.	3	3	Gurney.
ETISINÆ.				
Chlorodopsis	13. 2 setæ.	3		Gurney.
ERIPHIINÆ.				
Eriphia	1·7. 2 setæ.	2	3	Hyman.
TRAPEZIINÆ				
Trapezia	3·7. 3 setæ.	3	3	Gurney.
Tetralia	2 ? 3 setæ.	3	4	Gurney.

It will be seen from this table that, so far as concerns these particular characters, there is no means whatever of grouping the zoeas to correspond with the arrangement of the adults. The most striking point which arises is the difference between the two species of *Heteropanope*. If the parentage of these two zoeas and their description are correct, it is useless to regard any of the characters used to be of any more than specific value. The position is not improved by referring *H. tridentata* to *Pilumnus*, in which it has been placed by some.

Apart from this depressing difficulty the table shows very well the tendency to reduction of the antennal exopod, and of the outer spines of the telson.

As Aikawa has shown, there may be small differences in the number of setæ on the maxillule and maxilla or in the form of the endopod and endites in the latter—compare, for example, the endopod of the maxilla in *Cymo andreossyi* and *Trapezia guttata*; but the information available is not sufficient to be of any use at present.

The zoeas of six species of Xanthidæ from Ghardaqa are described below. Two others were obtained, but the adults have not been identified. The only striking feature is the presence of an additional lateral spine in *Tetralia*, which is otherwise a normal Xanthid.

Subfamily *Carpilinæ*.

CHLORODIELLA NIGER (Forskal). (Pl. I. figs. 1–4.)

Prezoea : the prezoeal cuticle appears to be thrown off in the act of hatching, and was not seen.

Stage I.—Length of body 1·2 mm. Tip of dorsal spine to tip of rostrum 1·45 mm.

Rostrum strongly spined ; lateral spine very small. Abdomen with lateral papillæ on somites 2 and 3 ; lateral spines on somites 3–5 closely pressed to sides of somites. Fork of telson narrow ; three inner spines about equal, the innermost with a few conspicuous hairs ; middle spine of the outer three minute.

Antennal spine longer than rostrum ; exopod very small, about one-thirteenth length of spine, with two very small apical setæ.

Endopod of maxillule of two segments, with one seta on segment 1 and six on segment 2.

Colour.—Chromatophores red.

Subfamily *Etisinæ*.

CHLORODOPSIS SPINIPES (Heller). (Pl. I. figs. 5–10.)

Stage I.—Length of body 1·5 mm. Tip of dorsal to tip of rostral spine 1·35 mm.

Rostrum and dorsal spine with a few denticles ; lateral spine small. Abdomen with lateral papillæ on somites 2 and 3 ; somites 3–5 with small lateral spines. Branches of telson straight and stout, with three outer spines, the middle one small ; innermost spine with hairs at base in addition to minute spicules.

Spine of antenna slightly longer than rostrum ; exopod minute, about one-thirteenth length of spine, with two small apical setæ.

Maxillule, endopod of two segments ; segment 1 with one seta, segment 2 with six setæ ; no outer seta on basis. Maxilla, endopod with two inner

prominences, with 3 . 2 . 2 setæ. Endopod of maxillipede 2 of three segments, segment 3 with five setæ.

Colour.—General colour very red. Rostrum, dorsal spine, and antennal spine pink.

Subfamily *Xanthinæ*.

Cymo andreossyi var. melanodactyla (De Haan). (Pl. I. figs. 11–13; Pl. II. figs. 14–18.)

The prezoea moults immediately after hatching. Antennule with two embryonic setæ, the outer one small and not plumose. Exopod of antenna with four large plumose setæ corresponding to three of the setæ of the zoea. Telson with 7+7 embryonic spines, the outermost and the fourth not plumose. Second and third in two specimens examined quite small (fig. 11). These two are usually long, and it is probable that the condition figured is abnormal.

Stage I.—Length of body 1·42 mm. Tip of dorsal spine to tip of rostrum 1·55 mm.

Rostrum denticulate at end; lateral spine small. Abdomen with lateral papillæ on somites 2 and 3; somites 3–5 with short lateral spines. Telson with three outer spines, the middle one minute; innermost spine with hairs at base in addition to small spinules.

Spine of antenna as long as rostrum; exopod about one-fifth length of spine, with three unequal apical setæ. Maxillule without outer seta on basis; endopod of two segments; segment 1 with one seta, segment 2 with six, in three pairs. Maxilla, endopod with large basal lobe and 3 . 2 . 3 setæ (fig. 17)*.

Maxillipede 2 endopod of three segments; segment 3 with six setæ (fig. 18).

Colour.—Almost colourless; very small reddish chromatophores as shown in fig. 14.

Subfamily *Trapeziinæ*.

Trapezia cymodoce (Herbst). (Pl. II. figs. 23–28.)

Prezoea: antenna with four large embryonic spines. Telson with 7+7 spines, nos. 1 and 4 not plumose.

Stage I.—Length of body 1·4 mm. Tip of dorsal to tip of rostral spine 1·65 mm.

Rostrum and lateral spines with a few small spinules; lateral spine long. Abdomen with lateral papillæ on somites 2 and 3; somites 3–5 with large lateral spines. Telson with three lateral spines, the outer one very large, middle one very small. Innermost spine without hairs.

Spine of antenna shorter than rostrum; exopod more than one quarter length of spine, with three apical setæ, one of which is very long and reaches end of spine.

Maxillule, endopod of two segments; segment 1 with one seta, segment 2 with five setæ. Endopod of maxilla with large basal lobe bearing three setæ, and two apical setæ, without intermediate seta-bearing prominence.

Endopod of maxillipede 2 of three segments, segment 3 with four setæ.

Colour.—Almost colourless. Light orange at end of each abdominal somite; lateral spines orange at tip.

Trapezia guttata Rüpp. (Pl. II. figs. 19–22.)

Stage I.—Length of body 1·1 mm. Tip of dorsal to tip of rostral spine 1·28 mm.

* One seta is hidden in the position in which the figure is drawn.

Rostrum with small spinules ; lateral spine long, with spinules. Abdomen with lateral papillæ on somites 2 and 3 ; lateral spines on somites 3–5.

Fork of telson rather narrow ; three outer spines, of which the outermost is very large ; innermost spine without hairs at base.

Antennal spine as long as rostrum ; exopod more than one-third length of spine, with three apical setæ, the longest reaching end of spine.

Endopod of maxillule of two segments, one seta on segment 1.

Colour.—Nearly colourless. Diffuse pink in posterior part of thorax. Chromatophores of abdomen red.

TETRALIA GLABERRIMA (Herbst). (Pl. III. figs. 29–33.)

Stage I.—Length of body 1·47 mm. Tip of rostrum to tip of dorsal spine 1·8 mm.

Rostrum very stout, with numerous spinules ; carapace with two pairs of large lateral spines. Abdominal somite 2 with lateral process, somite 3 without one ; somites 3–5 with small lateral spines. Telson with arms of fork long, slender, and parallel, with two outer spines. A specimen from the plankton had also a minute third spinule. As the specimens hatched have been lost I am unable to find if this third spine was actually present in some of them.

Antenna with basipodal spine nearly twice as long as the exopod, which bears three setæ.

A few specimens were taken in plankton, and one in stage II is shown in figs. 30–33. It differs from stage I in having six setæ on the exopods and small rudiments of the legs.

Colour.—Reddish brown in thorax in front and with large reddish-brown chromatophore in abdominal somite 1 extending forwards into the body and backwards into somite 2.

This zoea is very remarkable for having two pairs of large lateral spines. So far as I am aware there is only one previous record of such an additional spine, namely a zoea figured by Dohrn (1871) with the spines expanded at the ends. I have seen a similar zoea from the Great Barrier Reef.

In the form of telson and the presence in some, if not all, specimens of three outer spines, one of which is vestigial, it agrees with other Xanthidæ, but the relatively large exopod of the antenna is a feature wherein it differs from most other genera.

There seems to be no great uniformity among Xanthid zoeas, since the exopod of the antenna, though generally reduced or vestigial, is nearly as long as the spine in several genera, e. g., *Menippe*. The lateral spine seems to be in all cases except *Tetralia* relatively small, but never absent. There are generally, but not always, lateral processes on abdominal somite 3, and usually three lateral spines on the telson.

HYMENOSOMATIDÆ.

ELAMENA MATHAEI (Desmarest). (Pl. IV. figs. 34–37.)

Stage I.—Length of body 1·5 mm.

Carapace with short rostral process but no trace of dorsal or lateral spines. Abdomen without lateral papillæ on somites 2 and 3 ; somites 2–4 with lateral ridges, somite 5 with lateral ridge very broad and produced backwards as a rounded lobe. Telson fused with somite 5, parallel-sided, with six terminal

spines on the straight margin between the arms of the narrow fork ; outer spines absent.

Antenna reduced to a minute knob. Palp of maxillule of two segments, segment 1 with one seta, segment 2 with six. Maxilla, proximal lacinia reduced and bearing one seta ; lacinia 2 undivided, with two groups of four setæ (only three shown in fig. 37) ; endopod without proximal lobe, with four or five distal setæ ; exopod with three setæ on distal end ; proximal lobe long and narrow, without setæ, but ending in a feathered point which represents the normal large terminal seta.

Maxillipede 2, endopod of two segments.

Rudiments of maxillipede 3 and legs present.

Colour.—Richly coloured with olive-brown, and appearing nearly black. The lateral and dorsal chromatophores of the thorax pink.

Remarks.—The position of the Hymenosomatidæ has been a matter of some uncertainty. Milne-Edwards, Dana, and Alcock placed the family among the Catometopa, assuming some relationship to the Pinnotheridæ, but De Haan in 1839 recognized affinity with the Oxyrhyncha, and his view now prevails. Tesch (1918) states that the only character which justifies placing the genera among the Catometopa is the sternal opening of the male gonads, and that this character " is counterbalanced by a whole series of features showing a close relationship to the Oxyrhyncha and especially to the Maiidæ."

Aikawa (1929) has described the zoea of *Rhynchoplax messor* Stimps., *Trigonoplax unguiformis* De Haan, and *Halicarcinus septentrionalis* Yokoya, so that representatives of four out of the six genera recognized by Kemp (1917) are known. The zoea described by me in 1924 (1924, p. 196) no doubt belonged to *Elamena*.

Aikawa notes that the larva has no resemblance at all to that of the Cancroid crabs, but seems to be most closely related to the Leucosiidæ. With the larva of the Oxyrhyncha it has nothing in common.

While there is great similarity with the Leucosiidæ in the globular form, absence of carapace spine, and reduction of the antenna, these characters are also those of certain Pinnotheridæ, and it is to that family that the Hymenosomatidæ are, in my opinion, most nearly related. It is true that the zoeas of *Pinnotheres* and *Ebalia*, for example, are remarkably alike (Lebour, 1928), but the form of the telson is very different, and there are small differences in the maxillule and maxilla. In *Elamena* the telson is almost exactly the same as in the Pinnotherid *Pinnixa* (Faxon, 1878), which has the same expansion of somite 5. Such an expanded somite 5 is not known in any other genus. In all genera of the Hymenosomatidæ the endopod of the maxillule has two segments, with a seta on segment 1, whereas it is unsegmented in *Ebalia*. The genera of the Hymenosomatidæ differ from all others in the great reduction of lacinia 1 of the maxilla.

There can be no doubt that, if it were possible to construct a system for the Brachyura upon the zoea alone, then the three families Leucosiidæ, Pinnotheridæ, and Hymenosomatidæ would have to be placed together.

Pinnotheridæ.

Ostracotheres tridacnae (Rüppell). (Pl. IV. figs. 38–41.)

Prezoea, removed from egg, apparently without embryonic spines on telson.

Stage I.—Length of body 1·77 mm. Tip of dorsal to tip of rostral spine 1·9 mm.

Carapace with very large dorsal, rostral, and lateral spines; dorsal spine straight, smooth, sloping slightly forwards. Abdomen with lateral papillæ on somites 2 and 3; somites 4 and 5 with lateral ridges. Telson with large median triangular process and three spines on either side, the inner pair much the longest; outer angle with two small spines confluent with telson.

Antenna vestigial. Maxillule, endopod of two segments; segment 1 without a seta, segment 2 with four setæ; no outer seta on basis. Maxilla, inner laciniæ undivided; endopod with two very small inner lobes and 1.1.1 or 2.1.1 setæ; exopod with five setæ. In the example figured there are two very large setæ on the proximal lobe, but usually the distal of these two is very small and seated farther forward.

Endopod of maxillipede 2 unsegmented, with five setæ.

Colour.—Rostrum and lateral spines rich purple; dorsal spine and body yellowish.

Remarks.—Hyman (1924) has given a summary of knowledge of the Pinnotheridæ to which but little has been added since. Aikawa (1937) divided the larvæ into two groups which he called Pinnozoea and Dissodactylozoea, the former having a telson with a median process, and the latter with a forked telson without lateral spines; but these groups do not at all correspond with the grouping of the adults since, for instance, *Pinnixa chætopterana* falls into group 1 and *P. sayana* into group 2. The two species of *Pinnixa* agree, however, in having somite 5 expanded as it is in *Elamena*, and the general form of the telson is the same, although *P. chætopterana* has a small median process.

The remaining species, including *Pinnotheres* and *Dissodactylus*, agree in having the antenna vestigial, but differ in form of telson and number of carapace spines as follows:—

	Telson with median process.	Telson a simple fork without lateral spines.	Carapace spines. {O.=None. D.=Dorsal. L.=Lateral. R.=Rostrum.
Pinnotheres pisum (Linn.)	+	−	L. R.
P. veterum Bosc.	+	−	D. L. R.
P. holothuriæ Semper	+	−	O.
P. ostreum Say	+	−	O.
P. maculatus Say	−	+	D. L. R.
P. taylori Rathbun	−	+	D. R.
Pinnixa sayana Stimps.	−	+	D. L. R.
P. chætopterana Stimps.	+	−	D. L. R.
Dissodactylus mellitæ Rathb.	−	+	D. L. R.
Ostracotheres tridaenæ (Rüppell)	+	−	D. L. R.

VII. The Larvæ of *Porcellana inæqualis* Heller.

Although the larva of "*Porcellana*" has been described and figured repeatedly from the time of J. V. Thompson (1835) onwards, the only descriptions of definitely identified species which have present value are those of Faxon (1879–1882, *Polyonyx macrocheles* (Gibbes)) * and Sars (1889, *Porcellana longicornis* Linn.). These two larvæ are very much alike, but differ in the number of pleopods, *P. longicornis* having none on somite 5. Claus (1876) and Cano (1893) have described larvæ of the normal Porcellanid form, having four pairs of pleopods, but with a median spine on the telson.

Miss Webb (1921, p. 412) states that the two British species *P. longicornis* and *P. platycheles* are "very similar," but the latter is slightly the larger. The number of stages passed through is not definitely known, but Claus (1867) distinguished three.

The following account of the development of *Porcellana inæqualis* proves that the presence or absence of a pleopod on somite 5 is not a generic character; but it is not possible at present to say whether the median spine on the telson is a character of generic value.

The Red Sea is rich in species of Porcellanidæ, mostly of the genus *Petrolisthes*; but my own collections from the reef flat and harbour reefs at Ghardaqa included very few of them, and only one of these has been named. This species, *Porcellana inaequalis*, for the naming of which I am indebted to Dr. Ramadan, is abundant in dead coral on the reefs; but a remarkably large proportion of those taken were parasitized by a Sacculinid, and it was found very difficult to examine these very small animals closely enough to determine, without damaging them, whether the yellow sphere under the tail was a parasite or an egg-mass. Numbers of them were kept alive during my stay, but only one hatched its eggs, and from these eggs only one living larva was obtained. Other species from the reef flat were kept, but none of them hatched out. Larvæ were absent from the plankton on my arrival, but began to appear in very small numbers early in March. Even at the end of March they were not numerous.

Porcellana inæqualis Heller. (Pl. V. figs. 42–53.)

Prezoea: telson with 6+6 spines, the outermost, enclosing the outer spine of stage I, small and smooth; spines 2–6 with large lateral spinules. No trace of a spine corresponding to reduced spine 2 of stage I could be seen. The antennule was not satisfactorily seen. Antennal exopod with five large feathered spines; endopod with a single small apical spine.

Stage I.—Length: Rostrum 2·61 mm. Posterior spine 0·61 mm. Body 1·77 mm.

Rostrum with minute spinules. Posterior spines with two small spinules at base, not reaching quite to end of telson. Abdominal somite 5 with large lateral spines. Telson one and half times as long as wide, with outer spine and five pairs of long setæ of about equal length, the outer seta without spinules at the end. Anal spine absent.

Mandible without palp. Palp of maxillule unsegmented, with three setæ. Exopod of maxilla with five setæ on anterior part; posterior lobe narrow, with one large apical seta; endopod unsegmented.

* Faxon's larvæ were all taken in plankton. No evidence is given for the identification of the present species.

Maxillipedes 1 and 2, endopod of four segments, without outer setæ on segments 1–3 ; exopods with four setæ. Rudiments of maxillipede 3 and legs very small.

Colour.—Rostrum with yellow bands. Intestine blue. Orange chromatophores in abdominal somites.

Stage II.—Rostrum 3·6 mm. Posterior spine 1·0 mm. Body 2·32 mm.

Telson slightly broader in proportion than in stage I, and with an additional pair of setæ on the median prominence.

Antennule with small inner branch. Antenna, endopod longer than antennule, and a little longer than exopod.

Exopods of maxillipedes 1 and 2 with ten setæ ; endopods with outer setæ on segments 2 and 3, not very long and either bare or very minutely feathered.

Maxillipede 3 a large rudiment with a very small rudiment of the exopod. Legs large, with gill rudiments. Pleopods present on somites 2–5. Uropods traceable under skin of telson.

Remarks.—Having only two specimens of each of these two stages it is impossible to determine the number of stages with certainty, but it is unlikely, in view of the measurements, that there is an intermediate stage. The oldest larva appears to be in the last stage, since the uropods are traceable, and, if this is so, there are only two stages in all.

PETROLISTHES ? sp. (Pl. V. figs. 54–57.)

Stage I.—Rostrum 5·2 mm. Posterior spine 2·63 mm. Body 2·6 mm.

Rostrum with numerous spinules. Posterior spine with a series of 3–6 rather large spinules at base. Abdominal somite 4 with a pair of very small lateral spines ; somite 5 with slender lateral spines. Telson nearly as broad as long, with anal spine and 5+5 long setæ, seta 5 seated on median prominence. Seta 1 strongly serrated at end, the others very minutely serrated at end.

Endopod of antenna about half as long as exopod. Maxillipedes 1 and 2, endopods of four segments, without outer setæ on segments 1–3 ; exopods with four setæ. Rudiments of maxillipede 3 and the legs very small.

Stage II.—Rostrum 12 mm. Posterior spine 4·55 mm. Body 3·5 mm.

Telson of same shape, and with the same number of setæ, but with a large median spine at end.

Antennule with small inner branch. Antenna, endopod longer than antennule, and about twice as long as exopod. Maxillipedes 1 and 2 with very long, richly feathered, outer setæ on segments 1–3 ; exopod with twelve setæ symmetrically arranged. Maxillipede 3 with exopod rudimentary. Leg rudiments large, with gills. Pleopods present on somites 2–5.

Colour.—Spines chrome yellow. Blue in mouth region. Otherwise colourless, except for a small patch of red at base of posterior spines.

Remarks.—This species is of interest as having a median spine on the telson as figured by Claus and Cano, but absent from typical *Porcellana*. The proof that this median spine appears in stage II is afforded by a specimen which died in the moult, showing the telson of the moulted skin without the spine.

In this case also there appear to be only two stages. The larva is referred provisionally to *Petrolisthes*, since that is the common genus of the locality. It probably belongs to one of the rather large species which was common on the reef flat, the hatching period of which was very near.

VIII. The Larvæ of *Galathea longimana* Paulson.
(Pl. VI. figs. 58–68.)

Galatheidæ are not common at Ghardaqa, and only one species was found on the reefs, which was probably *G. ægyptiaca* Paulson. Larvæ of this species were hatched in the laboratory, but are so like those of the European species that description is unnecessary. A few larvæ were taken in plankton which differ very much from those already described. From them two post-larval specimens were obtained by moult which may be identified with sufficient certainty as *G. longimana*.

Stage I.—Length 2·54 mm. (one specimen only). (Pl. VI. figs. 58–63.)

Rostrum broad, deeply hollowed at base, with denticles on margin in proximal half. Carapace with small posterior spine and serrated margins behind; a conspicuous lateral ridge runs from the posterior spine nearly to the orbit. Abdominal somites with minute spicules in transverse rows on somites 2–6; somites 4 and 5 with lateral spines, those of somite 4 very small. Telson deeply hollowed, and of usual Galatheid form.

Antennule unsegmented, slender, with inner feathered seta in position of endopod. Antennal scale with long apical spine and ten setæ; endopod a slender rod with long apical seta and small apical spine; basis with long ventral spine.

Endopod of maxillule unsegmented, with four setæ; lacinia 2 with two very large spines and three small ones. Endopod of maxilla large, unsegmented, with two inner groups of two spines; exopod with five setæ, the proximal one very long.

Maxillipede 1, endopod of five segments, without outer seta on segments 1–4; exopod with four setæ. Maxillipede 2, endopod of four segments, without outer setæ on segments 1–3. Maxillipede 3 rudimentary, with large exopod and very small endopod at base of basis. Rudiments of legs 1–3 present.

Colour.—Olive-brown chromatophores in antennal scale and sides of thorax; red at posterior end of carapace, and in abdomen.

Stage II.—Length 2·92 mm. (Pl. VI. fig. 64.)

General form as in stage I. Telson with 8+8 setæ. Eyes movable, very large, and of peculiar form (fig. 65). Antennule with small bud representing endopod. Antennal scale with twelve setæ; endopod without seta, about two-thirds length of scale.

Exopods of maxillipedes 1 and 2 with seven setæ, that of maxillipede 3 with six setæ. Rudiments of all legs present, with small knobs at base representing gills. Pleopods absent.

Stage III.—Length 4·0 mm. (Pl. VI. figs. 65–68.)

Telson much narrower, its greatest width about equal to its length; spine formula 8+8, spine 4 now very large and confluent with telson.

Peduncle of antennule unsegmented, but swollen at base; exopod with lateral group of æsthetes; endopod small and slender, without setæ; one inner seta at base of endopod. Antennal scale with fifteen setæ; endopod a straight rod about as long as scale.

Mandible with small palp. Maxilla, exopod large with eighteen setæ in all, proximal seta very large, no part of margin bare. Maxillipede 2 with outer setæ on segments 3 and 4; maxillipede 3, exopod with seven setæ.

Leg rudiments very large, leg 1 chelate. Epipods absent, but small rudiments of gills present. Only one gill rudiment on maxillipede 3 and two on leg 1. Pleopods large, with very small endopod. Uropods with endopod

not jointed to basis, and without setæ; exopod with ten setæ and with or without outer apical spine.

Remarks.—This is the oldest stage seen, and it was from this stage that the post-larval stage was obtained. Development is therefore shortened as compared with European species in which there is a fourth stage with the endopod of the uropod setose. The larva also differs from those previously described in having the endopod of the maxillule unsegmented. This endopod is unsegmented in *Munida*, and this is the only real difference between the genera.

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EXPLANATION OF THE PLATES.

Plate I.

Fig. 1. *Chlorodiella niger*. Stage I.
2. ,, ,, Antenna.
3. ,, ,, Telson.
4. ,, ,, Palp of maxillule.
5. *Chlorodopsis spinipes*. Stage I.
6. ,, ,, Antenna.
7. ,, ,, Abdomen and telson.
8. ,, ,, Maxillule.
9. ,, ,, Maxilla.
10. ,, ,, Endopod of maxillipede 2.
11. ,, ,, Prezoeal telson.
12. ,, ,, Prezoeal antenna.
13. ,, ,, Prezoeal antennule.

PLATE II.

Fig. 14. *Cymo andreossyi*. Stage I.
15. ,, ,, Abdomen and telson.
16. ,, ,, Antenna.
17. ,, ,, Palp of maxilla.
18. ,, ,, Endopod of maxillipede 2.
19. *Trapezia guttata*. Stage I.
20. ,, ,, Telson.
21. ,, ,, Antenna.
22. ,, ,, Palp of maxilla.
23. *Trapezia cymodoce*. Stage I.
24. ,, ,, Prezoeal telson.
25. ,, ,, Prezoeal antenna.
26. ,, ,, Antenna.
27. ,, ,, Endopod of maxillipede 2.
28. ,, ,, Telson.

PLATE III.

Fig. 29. *Tetralia glaberrima*. Stage I.
30. ,, ,, Stage II.
31. ,, ,, Telson.
32. ,, ,, Antenna.
33. ,, ,, Palp of maxillule.

PLATE IV.

Fig. 34. *Elamena mathaei*. Stage I.
35. ,, ,, Telson.
36. ,, ,, Maxillule.
37. ,, ,, Maxilla.
38. *Ostracotheres tridacnæ*. Stage I.
39. ,, ,, Telson.
40. ,, ,, Maxillule.
41. ,, ,, Maxilla.

PLATE V.

Fig. 42. *Porcellana inæqualis*. Prezoeal antenna.
43. ,, ,, Stage I.
44. ,, ,, Antenna.
45. ,, ,, Maxillule.
46. ,, ,, Maxilla.
47. ,, ,, Maxillipede 2.
48. ,, ,, Mandible.
49. ,, ,, Telson.
50. ,, ,, Stage II.
51. ,, ,, Telson.
52. ,, ,, Maxillipede 2, endopod.
53. ,, ,, Maxillipede 1, endopod.
54. *Petrolisthes* sp. ? Stage II.
55. ,, Stage I. Telson.
56. ,, Stage II. Telson.
57. ,, ,, Maxillipede 1, endopod.

PLATE VI.

Fig. 58. *Galathea longimana*. Stage I. Maxillule.
59. ,, ,, ,, Maxilla.
60. ,, ,, ,, Telson.
61. ,, ,, ,, Antenna.
62 ,, ,, ,, Maxillipede 1.
63. ,, ,, ,, Maxillipede 3.
64. ,, ,, Stage II.
65. ,, ,, Stage III. Head, dorsal.
66. ,, ,, ,, Telson and uropods.
67. ,, ,, ,, Maxilla.
68. ,, ,, Post-larval. Stage I.

8. An Account of Surface Ciliation in some Polychæte Worms.

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(Text-figures 1–5.)

CONTENTS.

INTRODUCTION.

It is well recognized that cilia are important organs of Polychæte larvæ, and their employment in locomotion is a characteristic feature. In the adult Polychæte, with but few possible exceptions, epidermal cilia have no locomotor significance, but are responsible for the production of currents or the movement of material over the surface of the animal. In a number of cases it has been shown that these cilia are of the greatest importance in feeding. The ciliary feeding mechanism of *Chætopterus* has been described by Joyeux-Laffuie (1890) and Potts (1932), Sabellidæ, Serpulidæ, and Sabellariidæ by Johansson (1927), and Sabellidæ by Nicol (1930). In other cases, described in the course of this work, the cilia create currents which, in my opinion, are respiratory in nature.

Scattered references to the presence of epidermal cilia in a number of tubicolous and burrowing forms are found throughout the literature, but the accounts of their distribution are incomplete and there is no description of the currents they produce. The only work bearing directly on this question is due to Coonfield (1931). In a short paper this author describes the presence

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