# REPORTS

OF THE

# PERCY SLADEN TRUST EXPEDITION

TO

# THE INDIAN OCEAN IN 1905,

UNDER THE LEADERSHIP OF

MR J. STANLEY GARDINER, M.A.

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## VOLUME THE EIGHTH

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# No. VI.—ANOMURA COLLECTED BY Mr J. STANLEY GARDINER IN THE WESTERN INDIAN OCEAN IN H.M.S. "SEALARK."

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(Communicated by Professor J. Stanley Gardiner, M.A., F.R.S., F.L.S.)

(Plates 8 and 9.)

Read 3rd December, 1925.

The collection of Anomura with which this paper deals was made during Prof. Stanley Gardiner's "Sealark" Expedition to the Western Indian Ocean in 1905. The various localities from which specimens are recorded lie between 3° and 21° S. lat. and between 51° and 73° E. long.

The collection comprises 47 species which belong to 18 genera and are distributed among the Anomuran tribes as follows: Hippidea 1, Galatheidea 24, Thalassinidea 0, Paguridea 22.

Four of the species are described as new to science; one of them is a Porcellanid, *Petrolisthes alobatus*, and three are Galatheids, *Galathea providentia*, *G. submagnifica* and *G. gardineri*. It is possible that with further data the distinctness of *G. submagnifica* from *G. magnifica*, Hasw., may not be upheld.

The collection presents a typical Indo-Pacific facies. A fair proportion of the species are, however, now recorded for the first time from localities so far west in the Indo-Pacific Ocean, particularly of the hitherto poorly represented tribe Galatheidea. Some are new to the Mascarene Area. One, *Galathea integra*, Benedict, is new to the Indo-Pacific region. The material shows, moreover, a strong affinity with the fauna of the Japanese Area as defined by the Challenger Society, whose chart of the world showing areas of marine distribution is reproduced by Calman and Farran (**1912**); twelve of the present species have been also recorded from that area. Indeed, the south-eastern portion of the Challenger Society's Japanese Area should be considered a part of the Indo-Pacific Area for purposes of distribution, the Challenger definition having been influenced by bibliographical considerations.

On the other hand, there is a marked dissimilarity from the fauna of the tropical West Coast of America and from that of the Western African Coast. The forms which reach to the Western Coast of America are *Petrolisthes lamarcki* (Leach), *Parapagurus pilosimanus*, Smith, and *Coenobita rugosus*, H. M.-Edw. *Remipes testudinarius*, Latr., is recorded from the Galapagos Islands by Miers **1878**, p. 319. The forms which occur in the Atlantic are again *Petrolisthes lamarcki*, *Parapagurus pilosimanus*, and *Coenobita rugosus*. Also *Munidopsis tridentata* (Esmark). *Munida comorina*, Alc. and And., though recorded so far from the Mascarene Area only, is said by Alcock **1901**, p. 239, "hardly to differ from the Caribbean *Munida caribaea*, A. M.-Edw."

Each of the three forms named above as extending both to West American and to Atlantic fauna has a very wide distribution. It will be noted that one of them, *Para-*

*pagurus pilosimanus*, is a deep sea form and that another, *Coenobita rugosus*, is a land form. *Petrolisthes lamarcki*, accepting Borradaile's synonymy, **1898**, p. 464, occurs through the Indo-Pacific Region, Japan, from Lower California to Peru, from Florida to Brazil, and off Bermudas. *Parapagurus pilosimanus* has a distribution summarised by Balss **1913 (2)**, p. 50, as "Atlantik: Irland, Golf von Gascogne, Spanien, Marokko, Senegal, Sierra Leone, Tristan d'Acunha, Kap, Sargasso-See, Bermudas, Azoren, Neu-Schottland, Antillen. Pazifik: Port Otway, Valparaiso, Golf von Kalifornien, Papua, Philippinen, Yokohama, Banda, Indischer Ozean. Tiefe: 350–400 m." The distribution of *Coenobita rugosus* is summarised by the same author, p. 69, as "Westküste Afrikas, Rotes Meer, Ostküste Afrikas bis Japan (Nagasaki), den Polynesischen Inseln, dem Südlichen Kalifornien, Chile und der Magellanstrasse."

Authors' descriptions of some of the Porcellanids and Galatheids are slender, and species of both families frequently show a good deal of variation. Points of difficulty thus often arise, and I have felt it desirable in many instances to indicate and discuss comparatively small points of difference between the present specimens and other specimens of the same species recorded in the literature.

Miers **1884**, p. 513, mentions the principal memoirs then published which deal with the Crustacean Fauna of the East African coast and adjacent islands, and so including most of the area under present consideration. Miers's own paper deals with Crustacea collected from Seychelles, Amirante and Providence. Nobili **1905**, p. 1, and Lenz **1905**, give some later references to Zanzibar. Of papers of about the same or more recent date one may refer to Borradaile **1901**, Borradaile **1904**, Lenz **1910**, Balss **1912**, Bouvier **1915** and Gravier **1920** as recording Anomura from districts close to those from which the present collection was made. Also Nobili **1906**, Riddell **1911**, Balss **1915**, and Nobili **1907**, may be mentioned as useful papers of comparatively recent date, dealing, the three former with the Red Sea and the latter with the Persian Gulf. The similarity of the Anomuran forms throughout the Indo-Pacific Region is such that the various recent works on the Eastern Asiatic fauna must be consulted. The study of Indian Paguridea may be usefully based upon Alcock **1905**; and Balss in his various papers brings literature, synonymy and distribution to a later date. The Galatheidea have not been so recently revised as a whole, but a list of species of Galatheidae, provided with keys, is given by Benedict **1902**, and a later list of species of the same group and their distribution is given by Doflein and Balss **1913**. Balss **1913 (2)** gives keys and distribution for the Japanese species of both Galatheidea and Paguridea and again in **1924** brings their distribution to date; I have found these papers very valuable.

Some of the work in the preparation of this paper was carried out at the British Museum of Natural History, and I thank Dr Calman for his courtesy in providing me with facilities for working in his laboratory and for access to the Museum collections and literature.

The following contractions are used: C. carapace; Ch. cheliped; W.L. walking leg; l. length; b. breadth.

## TRIBE HIPPIDEA.

### Family Hippidae.

#### Genus *Remipes*, Latreille, 1806.

1. *Remipes testudinarius*, Latreille, 1806.

*Remipes testudinarius*, Latreille **1806**, p. 45; Miers **1878**, p. 318, pl. 5, fig. 2 (var. *denticulatifrons*); Richters **1880**, p. 159 (Seychelles); de Man **1896(2)**, pp. 461 and 463, and **1898**, pl. 33, fig. 50; Lenz **1905**, p. 374 (Zanzibar); Balss **1914**, p. 92 (var. *denticulatifrons*); Bouvier **1915**, p. 214 (var. *denticulatifrons*); Balss **1915**, p. 2.

**Loc.** Chagos: Salomon, 1 ♂.

C. l. 29 mm. De Man, after re-examining an original example of *R. testudinarius*, Latreille, states that he considers Miers's var. *denticulatifrons* (but not Miers's *R. testudinarius*) to be synonymous therewith. Miers's variety is White's original *R. denticulatifrons*, a *nomen nudum*.

## TRIBE GALATHEIDEA.

### Family Chirostylidae.

#### Genus *Uroptychus*, Henderson, 1888.

2. *Uroptychus nigricapillis*, Alcock, 1901.

*Uroptychus nigricapillis*, Alcock **1901**, p. 283, pl. 3, fig. 3; Doflein and Balss **1913**, p. 167 (distribution).

**Loc.** Saya de Malha: C 6, 145 fms., 1 ♂.

C. l. (rostrum included) 5·5 mm., Ch. l. 16 mm. This example agrees with Alcock's description and figure of the type specimen except in the following particulars. (1) There are 5 additional spines on the carapace, namely, a median gastric spine, a small one behind and just to the outer side of each member of the pair of gastric spines, and one just internal to the 1st post-cervical spine of each side. (2) There is a spine, smaller than the antero-lateral one, between the latter, which is more pronounced than in Alcock's figure, and the still larger 1st post-cervical spine. (3) The lateral borders of the carapace behind the cervical groove are armed with spines, not merely serrated. (4) The rostrum is somewhat broader at the base and narrower distally than in Alcock's figure. (5) The antennal acicle is longer, reaching to the tip of the antennal peduncle. (6) The merus of the 3rd maxillipede has a small spine distally on the outer border, and there is a minute spine on the proximal portion of the outer border of the carpus. (7) The posterior border of the dactylus of each of the three anterior pairs of walking legs bears definite horny spinelets instead of being merely serrated.

The above particulars may be summarised by saying that the present example shows a general tendency to a greater development of spines than Alcock's type specimen. It is only one-half the size of the latter and of different sex.

### Family Galatheidae. Subfamily Galatheinae.

#### Genus *Galathea*, Fabricius, 1793.

3. *Galathea australiensis*, Stimpson, 1858.

*Galathea australiensis*, Stimpson **1858**, p. 251, and **1907**, p. 230; Miers **1884**, p. 277, pl. 31, fig. A (mislettered B); Ortmann **1892**, p. 251, pl. 11, fig. 8; Grant and McCulloch **1906**, p. 44; Balss **1913(2)**, p. 13 (distribution); Doflein and Balss **1913**, p. 169; Balss **1915**, p. 2 (synonymy); Balss **1924**, p. 42 (distribution).
*Galathea corallicola*, Haswell **1882 (1)**, p. 761, and **1882(2)**, p. 162; Doflein and Balss **1913**, p. 169.

**Loc.** Amirante: E 11, 25–80 fms., 18 ♂ (including *a*), 1 non-ovig. ♀, and 9 ovig. ♀

(including *b*); E 13, 20–25 fms., 1 ♂ and 1 ovig. ♀ (*c*); E 21, 30 fms., 5 ♂ and 2 ovig. ♀. Saya de Malha: C 19, 29 fms., 1 ♀ (*d*) and 1 ovig. ♀ (*e*). Cargados Carajos: B 13, 30 fms., 1 ♂.

I have examined the specimens in the British Museum from Port Molle and from the Arafura Sea identified by Miers, in my view correctly, as *australiensis* and described and figured by him in **1884**, and find that my examples agreed with them. My specimens therefore differ from those of Balss **1913**(2), p. 14. Failure to include Balss's specimens as *G. australiensis* would mean the elimination of Japan from the distribution as given by Doflein and Balss **1913**, p. 169. It may be, however, that this species is a highly variable one, for Balss **1915**, p. 2, after examination of material from the Red Sea and Japan, concludes that *aegyptiaca*, Paulson, 1875, *brevimanus*, Paulson, 1875, and *longimanus*, Paulson, 1875, are all synonyms of *australiensis*.

From Miers's figure the present examples differ (i) in possessing only one of the two ciliated lines shown just behind the level of the gastric spines with an anteriorly directed salient in the middle of their length; (ii) in the possession of two (or three), instead of only one, post-cervical marginal spines, of which additionals one is at the level of the 3rd and the other, when present, at the level of the 1st post-cervical line; (iii) the sides of the carapace diverge posteriorly so that the greatest breadth is well behind the middle, and this applies to both sexes.

When all three post-cervical marginal spines are present the total number of lateral marginals including the one below the insertion of the antenna is eight, as in Stimpson's description. This occurs in two only of the specimens (male *d* and ovig. female *b*); a third example (ovig. female *e*), though having only the two pairs of post-cervical marginals, has a total of eight owing to an additional small one just behind the most anterior (supra-antennal) of the series.

In the last-named specimen, but not in the others, there are a few long coarse setae on the dorsal surface of the rostrum, of the kind shown in Ortmann's figure 8 *a* but not so numerous.

The specimens come under de Man's more detailed description, though as just said only one of them has the strongly developed rostral setae. Ortmann's figure 8 *i* represents quite fairly the 3rd maxillipede of my examples. Grant and McCulloch, after re-examination of the type specimens of *G. corallicola*, confirm the suggestion of Miers that the latter is a synonym of *G. australiensis*.

4. *Galathea spinosorostris*, Dana, 1852.

*Galathea spinosorostris*, Dana **1852**(2), p. 480, and **1855**, pl. 30, fig. 9; Lenz **1910**, p. 566 (Madagaskar); Doflein and Balss **1913**, p. 170 (distribution).
*Galathea spinulifera*, Southwell **1909**, fig. 12.

Loc. Providence: D 1, 39 fms., 1 ♂. Amirante: E 1, 29 fms., 2 ♂ and 1 ovig. ♀; E 2, 29 fms., 1 ♂; E 3, 25 fms., 1 ovig. ♀; E 6, 28 fms., 2 ovig. ♀; E 9, 34 fms., 1 ♂ and 2 ♀ (one of them ovig.); E 12, 32 fms., 1 ♂; E 25, 20–44 fms., 1 ovig. ♀. Seychelles: F 4, 30 fms., 1 ♂ (*a*). Coetivy: 2 ♂ (*b*, *c*). Saya de Malha: C 19, 29 fms., 1 ♂ and 1 ovig. ♀. Cargados Carajos: B 19, 28 fms., 1 ♂ and 1 ♀; B 20, 28 fms., 1 ♂. Chagos: Egmont, lagoon, 6–7 fms., 1 ♂ (*d*); Egmont, reef, 1 ♀; Salomon, 10–14 fms., 1 ♂.

Southwell's figure is an excellent representation of the present specimens, but the 1st lateral marginal tooth of the carapace appears in dorsal view not as the actual outer

orbital angle but as being immediately behind this, and there is a minute additional tooth between the 2nd and 3rd lateral marginals.

I find that in the 3rd maxillipede the distal tooth of the inner border of the merus is smaller than in Dana's figure and in some it is very much reduced. In some examples there is between the two inner meral teeth another quite minute one. In some there is a third minute tooth on the outer border of the merus proximal to the others. On the outer border of the carpus are 3 low rounded elevations.

The specimens which I here place under *spinosorostris* are very easily distinguishable from those I place under *australiensis*. In the present comparatively large series the variation in line pattern is quite small, and the same is true in my series of *australiensis*.

In male *d* (C. l. 4·75 mm., left Ch. missing) the fingers gape considerably; this is due to their curved form which is more marked in the fixed finger. The mobile finger has on its biting margin a flat-topped stump-like tooth, at about one-third of its length from the articulation, and a smaller tooth proximal to this. Though the palm is broader than in the female, the cheliped still remains of a comparatively slender build. In the smaller male *b* (C. l. 4 mm., right Ch. missing) and male *a* (C. l. 4·25 mm.) the fingers also gape.

5. *Galathea mauritiana*, Bouvier, 1915.

*Galathea mauritiana*, Bouvier 1915, p. 200, figs. 10 and 11.

Loc. Farquhar: from Black Lipped Oyster, 1 ovig. ♀. Coetivy: 3 ♂ and 5 ♀ (4 of them ovig., the non-ovig. one is *b*). Saya de Malha: C 16, 26 fms., 1 ovig. ♀. Chagos: Salomon, 2 ♂ (includes *a*) and 2 ovig. ♀.

A pair of gastric spines are present in my specimens as in *G. australiensis*, etc. Also they possess on the lateral margin of the carapace a minute tooth between the 1st and 2nd teeth of the lateral series. The apical portion of the rostrum attracts particular notice upon a close examination; in addition to its "longuement acuminée" character it is seen, under a strong hand lens, to have some fine serration laterally on its wider, proximal part. This species appears to be very closely related to *G. affinis*, Ortmann 1892, p. 252, pl. 11, fig. 9.

6. *Galathea providentia*, n. sp. Pl. 8, figs. 1–4.

Loc. Providence: D 11, 50 fms., 2 ♂ (*e*, *f*), 2 ovig. ♀ (*a*, *b*), 1 non-ovig. ♀ (*c*); D 4, 50–78 fms., 1 ovig. ♀ (*d*).

The ovigerous female specimen *a* is taken as the holotype.

*Description.* Carapace broad (breadth is ·62 of the length including rostrum in female *a* where length is 6·5 mm., and ·64 in male *e* where length is 5·5 mm.). The striations are weak and tend to be broken and all have a thin fringe of fine setae which are mostly short, but a few longer. The external orbital angle forms a well marked tooth best seen in a lateral view of the animal, and behind this the carapace is armed with 3 marginal spines of which the 1st is the largest, the last is small (absent in two examples), and the 2nd is very small; below the 2nd is a well-developed spine which is not seen from a dorsal view. The lower orbital margin is drawn forward to form an acutely pointed triangular projection. There are no spines on the gastric region. There is a small dorsal spine to the inner side of the 1st marginal spine and behind this dorsal spine there is, in

female *a*, another very minute one situated on the 2nd transverse striation. (This minute one is generally absent in the other specimens, and in one of them the larger dorsal spine is also absent.)

The striations of the carapace will be best understood by reference to the figure. The 1st line is broken slightly in the middle; the 2nd is broken in the middle and extends laterally to behind the base of the larger dorsal spine; behind the break in the 2nd line are a couple of anteriorly convex scales; a 3rd short line is continuous and occupies about the middle third of the carapace, but in some it is broken in the middle and (or) the ends; the 4th line is of about the same length as the 3rd and is broken in the middle; behind the median break in the 4th line is an anteriorly convex scale and behind this and just in front of the middle part of the strong 5th line is the backwardly curved median portion of the incomplete cervical line; the anterior portion of the incomplete cervical line appears on each side as a short line running obliquely backwards and inwards from the 3rd marginal spine, and between its inner end and the outer end of the 3rd line is a gap, in front of and again behind which is a small and anteriorly convex scale; in a line obliquely backwards and inwards from the 4th marginal spine are 2 minute scales; the 5th line is the most strongly marked, being fairly straight with a slight backward curve in the middle and running across the region of the 5th marginal spines dividing the carapace into two approximately equal halves; a 6th line faintly indicated and very much broken crosses the carapace at the level of the 6th marginal spines; a 7th line has its middle third continuous but separated from the outer third, which latter tends to be broken and runs to the space between the 6th and 7th marginal spines; behind this follow 3 lines which are broken, the 1st and 3rd of them particularly so; finally, there is the usual well-marked posterior sub-marginal line. In some examples these lines of the carapace are very obscure except the 5th, and it is difficult to follow them unless the specimen is dry.

The rostrum is rather long; it is in female *a*, for example, 3 mm., i.e. ·46 the length of the carapace including the rostrum. Its tip forms a strong median spine, and it has 4 spines on each side which are so formed that lying forward almost against the rostrum they do not, with the exception of the 1st, much interrupt its even contour. The rostrum is medially grooved.

The basal joint of the 1st antenna bears on its distal margin 3 large forwardly directed spines of subequal length. Two of these are on either side of the articulation with the 2nd joint and of these two the outer is the more massive; the 3rd, to the outer side again, on the outer part of the margin, is still more massive. The last joint of the peduncle is fringed on the upper half of its distal margin by a few (8) fairly long setae, of approximately the same length as the last joint itself (but not the close fringe described and figured by Milne-Edwards and Bouvier **1894**, p. 200); the setae bear a few secondary lateral setae on their distal halves.

The antepenultimate joint of the 2nd antenna has an outer and an inner distal spine.

The ischium of the external maxillipede has a somewhat inwardly directed spine at its inner distal angle; the outer distal angle is considerably produced; the anterior toothed ridge has about 21 closely placed denticles. The merus has on its inner margin 3 spines of which the most distal is minute but the other two prominent (see also

under *Remarks*); its outer margin has 2 small scaliform (spinuliform in some) spines. The carpus, while having its outer margin almost smooth, bears there 3 spine eminences.

The chelipeds are not very robust, twice as long as the carapace including the rostrum (in female *a* with C. l. 6·5 mm. and male *e* with C. l. 5·5 mm.). They are scantily clothed with long hairs. Viewed from the outer (upper) surface the proximal half of the merus is seen to be covered with setose scales; the distal half of the merus, and the carpus, are spinose; the hand, of generally smooth appearance, bears some obscure setose scales which become more marked and spiniform towards the margins; the fingers are smooth. The dactylus is about the same length as the palm.

The spines of the merus referred to above increase in size distally. Those of the carpus include a row of 5 running from the meral to the propal articulation; to the anterior (upper) side of this row are 3 spines, of which the distal one is the largest on the carpus; on the posterior (outer) side of the row of 5 is a row of 4; and along the posterior (outer) margin are 2 spiniform scales.

The inner (under) surface of the cheliped is covered with scattered setose scales and is for the greater part devoid of spines; but there is 1 spine on the distal margin of the ischium, a few on the distal part of the merus, and on the carpus 2 or 3 of which one, considerably larger than the others, is on the posterior part of the distal margin.

The fingers are incurved at the tips, overlapping when closed, so that the tip of the dactylus is to the outer side; the tip of the dactylus bites against a surface of the fixed finger which is bounded on the inner side by the curved tip of the fixed finger and on the outer side by a subterminal tooth.

In the male *e* the fingers of the right cheliped gape slightly; their facing margins are serrate distally, and proximally the dactylus has two obtusely triangular teeth between which fits a similar tooth on the margin of the fixed finger; the left fingers do not gape but the teeth are present though less marked. In the female *a* the fingers do not gape; the two most distal of the teeth are present, but obscurely developed, on the right fingers (also the proximal one in the larger female *b*, which has only the right cheliped preserved) which are finely serrate throughout their length, while on the left all three teeth are absent and the margins are hardly serrate.

The 1st pair of walking legs have the upper margin of the merus spinulate (9 spinules) and the lower margin terminating on its outer side in a distal spinule; the upper margin of the carpus of the 1st walking leg is also spinulate (5 spinules and 3 on the upper-outer surface); the 2nd walking leg is very similar to the 1st, the inner margin not so spiniform but terminating distally in a spinule; the merus and carpus of the 3rd walking leg are comparatively smooth, having only reduced spinules; the dactylus is in each case spinulate on its lower margin.

Epipodites are present on the chelipeds but not on any of the walking legs.

*Remarks.* The inner meral spines of the external maxillipedes are subject to a good deal of variation. The ovigerous female *a* described above (C. l. 6·5 mm.) has, as stated, 3 on each maxillipede, of which the most distal is minute; ovigerous female *b* (C. l. 6·5 mm.) has 3 well-developed spines on each maxillipede; male *e* (C. l. 5·5 mm.) has on the right

maxillipede 3, of which the middle one is small, while it has only 2 on the left, the middle one being here absent; non-ovigerous female *c* (C. l. 4·5 mm.) has 3 on the right, of which the two most distal are much reduced, while it has 2 only, both well-developed, on the left; male *f* (C. l. 5 mm.) and ovigerous female *d* (C. l. 4·25 mm.) have each of them 2 only on each maxillipede.

Two examples show asymmetrical development of the marginal spines of the carapace. In ovigerous female *a* there is an additional spine on the right side, the extra one being apparently the next one posterior to the 5th transverse line. In male *f* there are 7 post-orbital spines on the right side but only 6 on the left, where it is the last that is absent.

In recognising this species useful characters are: the comparatively smooth appearance of the carapace, which is contributed to by the weakness of the transverse lines and by the absence of the gastric spines; the general disposition of the lines on the carapace and their relation to the marginal spines; the general appearance of the rostrum; the comparative smoothness of the hand.

This species appears to have affinities with *G. formosa* and *G. consobrina*, both of de Man 1902 (Pl. 23, figs. 40 and 41 respectively). From *formosa* it can be easily distinguished by the form of the rostrum and by the outer surface of the hand, in both of which features there is a closer resemblance to *consobrina*. From *G. mauritiana*, Bouvier 1915, p. 200, it differs in the form of the rostrum, the detailed arrangement of the lines of the carapace, and the more numerous spines on the inner margin of the merus of the external maxillipede.

7. *Galathea submagnifica*, n. sp. Pl. 8, figs. 5–10.

Loc. Providence: D 4, 50–78 fms., 4 ♀ (*a–d*, *a* and *d* being ovig., and *b* and *c* each having a parasitic Rhizocephalan). The ovigerous ♀ *a* is selected as the holotype.

*Description.* Carapace-breadth is about two-thirds its length, rostrum included (C. l. 4·0 mm., C. b. 2·5 mm.).

The rostrum occupies more than one-third the length of the carapace (its length in this specimen is about 1·6 mm.). It is medially grooved. It bears on each lateral margin 4 teeth, of which the 3rd from the tip is less prominent than the 1st and 2nd, and the 4th is quite small. It measures 1 mm. across the level of the angles between the 3rd and 4th pairs of lateral teeth.

The outer orbital angle forms an inconspicuous tooth, seen in a lateral view of the animal; the lower orbital margin is drawn forward into a broad triangular pointed projection. Behind the outer orbital angle the carapace is armed with 6 marginal spines of which the 1st is the most conspicuous. Between the 1st and 2nd marginal spines, at a lower level, is a well-marked spine flanking the base of the 2nd antenna on its outer side.

There are on the dorsal surface of the carapace 4 gastric spines and also on each hepatic region there is one to the inner side of the large 1st lateral marginal spine, behind the middle portion of the curved upper orbital margin.

There are no spines on the terga of the abdominal segments.

The striations of the dorsal surface of the carapace, which are almost devoid of setae, are much reduced and broken; two are pronounced, of which the one, the transverse

cervical crossing at level of 4th pair of lateral teeth, divides the carapace, excluding the rostrum, into approximately equal anterior and posterior portions, and the other, crossing between the level of the 5th and 6th pairs of lateral teeth, subdivides the posterior portion again into an anterior third and a posterior two-thirds.

(In detail: the 1st line, at the base of the rostrum, curving anteriorly, is marked out by the 4 gastric spines; a 2nd line crosses between the 1st pair of marginal spines, it is broken into five well separated parts of which one is median and each of the outer lateral parts bears the hepatic spine already named; between the 2nd lateral teeth are obscure scaliform fragments suggesting a 3rd line; behind these again on each side of the middle line is a more clearly marked but short fragment, to the outer side of which are some minute scattered scales; the next line is the transverse cervical one, at the level of the 4th pair of marginal spines, its middle two-thirds is pronounced but the lateral portions break down; the next line has a pronounced median portion, and lateral portions which fall short of the margin of the carapace; behind this are faint indications of another line broken into numerous obscure fragments and in its neighbourhood laterally are some additional obscure scales. There is the usual well-marked submarginal line bordering the posterior margin.)

The basal joint of the 1st antenna bears on its distal margin 3 large forwardly directed spines. There are 2, one on each side of the articulation with the 2nd joint, and of these two the outer is the larger; the 3rd, to the outer side again, on the outer part of the margin, is still larger. The last joint of the peduncle is fringed on the upper half of its distal margin by a few (11) fairly long setae of approximately the same length as the last joint itself (but not the close fringe described and figured by Milne-Edwards and Bouvier 1894, p. 200); the setae bear a few secondary lateral setae on their distal halves.

The antepenultimate joint of the peduncle of the 2nd antenna has an outer distal and an inner distal spine.

The ischium of the external maxillipede has its outer, but not its inner, distal angle spiniform; the anterior toothed ridge has about 21 closely placed denticles. The merus has on its inner margin 2 spines, of which one about the middle is well-developed, and the other, distal to this, is smaller; its outer margin has in addition to one or two obscure scales a distal terminal spinule. The carpus has on its outer margin 3 squamiform eminences.

The chelipeds are subequal in length and very similar except that the propus is a little broader in the right one. They are rather less than twice as long as the carapace including the rostrum (in this specimen Ch. l. is 7 mm., which is 1·75 the C. l.). There are a few setae on the fingers; otherwise the chelipeds are almost devoid of them. The distal half of the outer (upper) surface of the merus and the outer surface of the carpus and of the propus are well armed with spines which are arranged with fair regularity in four rows; two of these rows are strictly on the outer surface while the other two are one on the anterior (inner) and one on the posterior (outer) margin. The inner (under) surface of the cheliped is but little armed. The anterior margins of the dactylus and of the hand are of almost equal length. The fingers meet throughout their length; their curved tips cross, that of the dactylus lying to the outer side.

(Detail: in the ischium there is a spine on the inner (under) surface just proximal to

its distal apex. In the merus the distal margin bears 5 enlarged spines, 3 of them on the portion bordering the outer surface and 2 on the inner portion; the 3 outer spines lie out of the even course of the rows already named; in addition to these distal spines the outer surface of the merus bears 1 spine to represent the anterior marginal row, 2 for the antero-outer, and 3 for the postero-outer row; the 2 inner distal marginal spines lie one anteriorly and one posteriorly; proximal to the anterior one are 2 smaller spines and there is a small submarginal one at its posterior base; proximal to the posterior distal spine are a few scales. The carpus rows comprise respectively, counting from anterior to posterior, 2 (or 3), 6, 6, 5 spines; on the inner surface are some scales and in addition there are on its anterior part 2 smallish spines and a third distally at the point of articulation with the propus. The hand rows comprise respectively, counting from anterior to posterior, 4, 5, 6, 6 spines, and there is a spine on the distal margin between the two middle rows at the point of articulation with the dactylus; on its inner surface are a few scales, at the articulation with the dactylus is a spine, and some of the scales on the posterior margin close to the spines (counted as marginal in describing the outer surface) tend to be spinuliform. The fingers meet throughout their length; the immobile finger has 3 small spines on its posterior margin. To the inner base of the tip of the dactylus lies a tooth, between which and the tip itself the tip of the fixed finger locks, and which itself locks between the tip of the fixed finger and a tooth to the inner side of the latter.)

On the inner surface of the larger propus the 2 distal members of the posterior submarginal row of scales are enlarged and lie close up to the row of spines considered marginal in describing the outer surface of the smaller propus.

The walking legs have very few setae. The 1st and 2nd are armed with a row of spines along the upper margin of the merus, carpus, and proximal half of the propus, and a second row of spines lies to the outer side of the marginal carpal row; there are spines also on the lower margins of propus and dactylus, elongated, slender and anteriorly directed in the former, and at right angles to the margin in the latter. In the 3rd walking leg the armature is not so much emphasised, but is still clearly in evidence on the dactylus.

*Remarks.* In specimen female *b* setae are a little more in evidence on the chelipeds and walking legs; also the carapace-line next to the posterior submarginal one is, though faint and broken, not so broken as in ovigerous female *a*.

In considering the affinities of the new species, the general arrangement of the carapace-lines, the setae on the upper distal margin of the terminal joint of the base of the 1st antenna, the armature of the external maxillipede, and the general form and armature of the chelipeds (much as in *G. magnifica*) should be noted.

It resembles *G. magnifica*, Haswell **1882(2)**, p. 162, in many respects; it has for example the much broken condition of the lines of the anterior half of the carapace. A fuller description of *G. magnifica* is given by Grant and McCulloch **1906**, p. 47, pl. 4, figs. 3, 3*a*, who re-examined the types in addition to examining new material. From these authors' description and from Balss's account of its synonym *setosa* **1915**, p. 267, pl. 35, figs. 2, 2*a*, 2*b*, the present species differs in the following particulars: the carapace-lines are weaker, notably the next to the posterior submarginal one, and there is a smaller number of scales on the anterior half of the carapace; there is less development of setae; the form of the 3rd lateral tooth of the rostrum is different; the ischium of the external

maxillipede bears a spine on its outer distal angle, but not on its inner; the merus of the external maxillipede has one large and one small spine on its inner margin and one at the distal angle of the outer margin.

I would like to examine considerable material of both *G. magnifica* and of this species for the purpose of seeing whether perchance the two merge into one another. It is not known whether or not setae are present in *magnifica* on the distal margin of the terminal joint of the base of the 1st antenna.

8. *Galathea gardineri*, n. sp. Pl. 9, figs. 1–5.

Loc. Providence: D 11, 58 fms., 1 ♂ (*c*), 1 ovig. ♀ (*b*). Seychelles: F 8, 34 fms., 1 ♂ (*a*). The male specimen *a* is selected as the holotype.

*Description.* The carapace is broad and depressed, its breadth is two-thirds its length, rostrum included (C. l. 3·9 mm., C. b. 2·6 mm. without the spines). The gastric area is defined by a shallow groove, as also is the cervical triangle on each side; the median curved strip of the cervical groove is very distinct. The cardiac area is also delimited by a shallow groove but not in ovigerous female *b* or male *c*.

The rostrum is short and broadly triangular (its length to the level of the angle between the 3rd and 4th lateral teeth is 1·2 mm., which is one-third the length of the carapace, and its breadth across the region of the angles named is 1·1 mm.). It is a little concave from side to side and a little deflexed. It bears on each lateral margin 4 teeth of which the 1st and 4th are of approximately equal size; the 2nd is a little larger and the 3rd a little larger again.

The outer orbital margin is without a tooth but immediately behind it is a minute spinule and behind this are 6 marginal spines, of which one is in front of the cervical triangle, two on the margin of the triangle and three behind it. Of the last named the most posterior one is really dorsal in position; a further one behind this again, and still more dorsally placed, is suggested only.

None of the carapace-lines are continuous but are broken into numerous squamiform fragments from which arise fairly long coarse setae. The latter occur also on the chelipeds, walking legs, and terga of abdominal segments. The scales of the anterior region, as also of the lateral regions, and also those bordering the transverse cervical groove, tend to bear spinules (in ovig. female *b* there are also 4 spinules on the raised posterior margin). A feature of the line pattern of this specimen is the almost continuous middle portion of a line running across the breadth of the cardiac area, but in ovigerous female *b* this is very distinctly broken. There are no spines on the terga of the abdominal segments.

(Detail: on the anterior part of the gastric region are a pair of scales each with a spinule; between the 1st large lateral marginal spines a backwardly curved line is represented by 5 scales of which the outermost on each side, on the hepatic region, carries a spinule (each lateral of the remaining 3 scales of the row bears an almost negligible spinule, the middle scale having a pair of such); behind this line of scales there is on the gastric area a transverse series of 7 scales, behind these is a pair and behind these again in the middle line just in front of the cervical groove a single one; in the cervical triangle are 4 minute scales, three of them, of which the most anterior bears a spinule, bordering the anterior limb of the cervical fork; bordering the transverse cervical groove posteriorly

is a broken line of 8 scales, each of the outer three of which on each side bears a minute spinule; behind the broken line last named there are scattered over the posterior portion of the carapace a number of transverse scales; these are more numerous on the branchial areas, while across the cardiac area are 3 transverse lines, the middle one of which is rather conspicuous and the anterior one merely a scale. A scale behind the level of the last marginal spine, and to its inner side, bears a minute spinule which though dorsal might be considered an additional member of the marginal series. The posterior submarginal line is continuous and bears some rudiments of spinules, but 4 definite spinules are present in ovigerous female *b*.)

The basal joint of the 1st antenna bears on its distal margin 3 forwardly directed spines. There are 2, one on each side of the articulation with the 2nd joint, and of these two the inner is the more dorsal and is relatively small and the outer, ventrally placed, is large; the 3rd, to the outer side again, on the outer part of the margin, is still larger. The last joint of the peduncle is fringed on the upper half of its distal margin by a few (say 10) fairly long setae exceeding in length the last joint itself (but there is not the close fringe described and figured by Milne-Edwards and Bouvier **1894**, p. 200); the setae bear a few secondary lateral setae on their distal halves.

The antepenultimate joint of the 2nd antenna has a distal terminal outer spine, a distal terminal inner spine, and another spine proximal to the latter on the inner margin.

The external maxillipede has no spines on its outer margin. The basipodite has an anterior ridge bearing half a dozen closely placed denticles; the ischium has a spinule on its inner distal angle; its anterior toothed ridge has about 27 closely placed denticles; the merus has 2 spines on its inner margin of which one is at about the middle of its length and the other at its distal angle; the carpus has a spinule at its inner distal angle.

The chelipeds are equal and similar; they are robust with distal halves moderately flattened; they are a little more than twice the length of the carapace including the rostrum (Ch. l. 8·4 mm.). They carry a number of long coarse setae which are particularly developed on the anterior (inner) margin. The outer (upper) surface of the merus is spinose; there are a few reduced spines on the outer surface of the carpus contrasting markedly with certain strongly developed spines along the anterior margin, which latter curves into continuity with the distal margin producing a somewhat characteristic appearance; the outer surface of the hand and fingers is free from spines which are however present on the margins of the propus, more strongly developed on the posterior margin. The apposed margins of the fingers are denticulate and meet throughout their length; their curved pointed tips cross each other so that the tip of the dactylus is to the outside. The inner surface of the cheliped is almost free from setae and spines.

(Detail: on the distal margin of the merus are 5 well-marked spines. The 1st of these is on the inner side of the anterior (inner) margin, and proximal to it is a well-marked spine; the 2nd distal marginal is on the outer side of the anterior margin, and proximal to it also is a well-marked spine; proximal to the space between the 2nd and 3rd distal marginals are 2 smaller spines; proximal to the space between the 3rd and 4th distal marginals there runs proximally a line of 8 spines; the 5th distal marginal lies on the posterior (outer) distal angle and becomes visible on turning the cheliped over somewhat: on the inner surface of the merus is a series of scales. The carpus has on its

anterior margin 5 spines of which counting from the proximal end the 1st is small (a granule only in the right cheliped), the 2nd small, and the 3rd, 4th and 5th well-developed, particularly the 3rd; there is also a small marginal spine at the point of articulation with the propus; on the distal margin is a spine of fair size; these spines form together a continuous curved series: on the outer surface of the carpus the spines are reduced, 5 being present, of which two are in a line running proximally from the distal marginal spine, and three are in a line parallel to the anterior margin and proximal to the articulation with the propus: 2 small spines are present on the inner side of the anterior margin of the carpus. The hand has 4 small spines just to the outer side of the anterior margin, and 5 larger ones on the posterior (outer) margin, these being continued by 4 more on the posterior margin of the fixed finger. The anterior margin of the dactylus is free from spines.)

The exposed surface and the margins of the walking legs bear long coarse setae. The exposed surface bears also scales which tend to be spiniform on the distal part of the merus. The upper margin of the merus bears spines as also does that of the carpus and of the proximal portion of the propus; on the carpus is a second row to the outer side of the upper margin. The lower margin of the merus bears spines throughout its length in the 1st walking leg but only on the distal portion in the 2nd and 3rd; the lower margin of the carpus is tipped distally by a spinule; there are 2 or 3 slender spinules on the lower margin of the propus of each of the first two walking legs; the dactylus terminates in a strong curved spine proximal to which on the lower margin is a pronounced spine about two-thirds the length of the terminal one.

In ovig. female *b* the chelipeds are essentially the same as in male *a*, but they are somewhat shorter (Ch. l. 7·5 mm., C. l. 4 mm.).

*Remarks.* In the small specimen (C. l. 3·2 mm., Ch. missing) the scales of the carapace are finely denticulate, a condition which is somewhat obscured in the other two examples, and on some scales one of the denticles is enlarged to form a spinule; the arrangement of such spinules corresponds closely to that described for male *a*.

The new species resembles *G. aculeata*, Haswell, 1882 (re-described from type by Grant and McCulloch **1906**, p. 49, pl. 4, figs. 4, 4*a*) in the broken character of the lines on the anterior half of the carapace and the tendency of many of the scales of this region to bear spines; the external maxillipede also resembles that of *aculeata* in a general way. It may, however, be readily distinguished from that species by the extension of the broken character of the lines to the posterior half of the carapace and by the broader, differently armed, chelipeds, of which one noticeable feature is the ornamentation of the carpus.

9. *Galathea elegans*, Adams and White, 1848.

*Galathea elegans*, Adams and White **1848**, pl. 12, fig. 7; Miers **1884**, p. 278; Henderson **1893**, p. 421; Ortmann 1894, p. 23; de Man **1902**, p. 709; Grant and McCulloch **1906**, p. 50; Southwell **1909**, p. 120, fig. 11; Lenz 1910, p. 566 (O. Madagaskar); Balss **1913** (2), p. 4, figs. 2 and 3 (description, synonymy, literature); Doflein and Balss **1913**, p. 169 (distribution); Potts **1915**, p. 83, pl. 1, fig. 5 and text-fig; Balss **1921**, p. 22 (distribution, synonymy, literature); Balss **1924**, p. 42 (distribution carried on from **1913**(2), p. 4).

*Galathea longirostris*, Dana **1852** (2), p. 482, and **1855**, pl. 30, fig. 11; Southwell **1906**, p. 220.

*Galathea grandirostris*, Stimpson **1858**, p. 252, and **1907**, p. 234.

*Galathea deflexifrons*, Haswell **1882**(2), p. 163.

**Loc.** Seychelles: F. 7, 34 fms., 1 ♂ (*a*); F. 8, 34 fms., 3 (*b* ♂, *c* ♀, *d* ♀). Cargados Carajos: B. 3, 30 fms., 1 ♀ (*g*); B. 14, 30 fms., 1 ♂ (*f*); B. 15, 30–33 fms., 1 ♂ (*e*).

| | Male *a* | Male *f* | Female *g* | Female *d* |
|---|---|---|---|---|
| C. l., including rostrum | 6·0 mm. | 7·75 mm. | 6·0 mm. | 6·75 mm. |
| Ch. l. | 10·5 mm. | 12·5 mm. | 10·25 mm. | 11·0 mm. |
| Ch. l. ÷ C. l. | 1·75 | 1·61 | 1·71 | 1·63 |

The present examples come under Miers's description. There are 9 spiniform teeth on the lateral border of the carapace without counting the outer orbital angle or the inferior antennal spine; the 2nd spine is quite small and is in one example doubled. The rostrum has 7 teeth on each side in *a*, *c* and *f*; 8 on each side in *b*; in *d* there are 8 on the left and 7 on the right side; and in *g* there are 8 on the left and 9 on the right side. The figure of the 3rd maxillipede given by Balss **1913(2)** shows the inner margin of the merus provided with 3 spines; 2 only are present in my specimens as in Grant and McCulloch's figure. I treat this as a matter of individual variation.

The rostrum is distinctly deflexed in three of the examples (*a*, *b* and *c*) as Haswell describes for *G. deflexifrons*, but the lateral denticles of the rostrum are not less developed in these than in the remaining specimens. *Deflexifrons* may well be a variety of *elegans*, as mooted by Miers and by Henderson and supported by Grant and McCulloch.

I take the little-known *G. longirostris*, Dana, 1852, to be a synonym, though Dana's figure has a narrower rostrum and its external orbital angles carried further forward than in my examples of *elegans*. De Man does not admit this synonymy.

I have before me two of the Ceylon specimens which Southwell placed under *longirostris* (in one of them the rostrum is somewhat deflexed) and feel I must place them in the same species with the present specimens; they do not show the characters named above as figured by Dana and differ very little from Southwell's examples of *elegans* in the same collection, and which I also have before me, except in having the two well-marked light bands on a dark background as shown in Dana's figure of *longirostris*. One of my examples (*a*, with deflexed rostrum) also has this type of marking while another (*e*, rostrum not deflexed) is marked as in Southwell's Okhamandal figure of *elegans*; in the others the colour has faded. Miers has called attention to the variable colouration of *G. elegans*.

Ortmann **1894** and de Man **1902**, followed by Balss **1913(2)**, consider *grandirostris*, Stimpson, to be a synonym of *elegans*, a possibility suggested by Henderson but rejected by Grant and McCulloch.

There does not appear to me to be any distinction of specific value between *elegans*, *grandirostris*, *longirostris* and *deflexifrons*. The most marked contrast among described examples of these species appears to be between those with the long slender cylindrical chelipeds of *deflexifrons*, described and figured by Grant and McCulloch and described by Balss, and those with the shorter more massive flattened type of cheliped which occurs in the other three; but such a difference may be found later to be due to growth change. The present examples come into the latter group, the flattening being not very marked however in the female.

The above notes were written before I had read the publications of Potts **1915**, p. 84, and Balss **1921**, p. 22; my conclusions regarding synonymy in the last paragraph support the views of these authors. (Potts does not refer to *grandirostris*.)

10. *Galathea laevirostris*, Balss, 1913.

*Galathea laevirostris*, Balss 1913(1), p. 221; Doflein and Balss 1913, p. 140, pl. 12, fig. 1; and p. 169.

Loc. Amirante: E. 18, 280 fms., 1 ♂. C. l. 5 mm. The original specimens of this species are recorded from the Sombrero Straits, Nicobar, at a depth of 805 m. The present is the first subsequent record.

11. *Galathea integra*, Benedict, 1902.

*Galathea integra*, Benedict 1902, p. 248; Balss 1913(2), p. 7, figs. 4 and 5; Doflein and Balss 1913, p. 169 (distribution).

Loc. Providence: D. 11, 58 fms., 1 example. A small specimen, C. l. 3 mm., which differs from Benedict's description of type, and from the figure of Balss, in having only a pair of gastric spines instead of a row of four. The form of the inner orbital tooth and the lateral form of the rostrum differ from Dana's figure, 1855, pl. 30, fig. 12, of the closely allied *G. integrirostris*, in the direction of *integra*, though the distinction does not appear to be as marked as in Benedict's type specimen, nor is it so marked as in Balss's figure. The 3rd transverse line of the carapace is broken into four portions. Of the 7 spines of the lateral margin of the carapace the 2nd and 7th are very small.

This species has hitherto been recorded only from Japan.

## Genus *Munida*, Leach, 1820.

12. *Munida comorina*, Alcock and Anderson, 1899.

*Munida comorina*, Alcock and Anderson 1899, p. 18; Illust. Invest. 1899, pl. 43, fig. 3; Alcock 1901, p. 239.

Loc. Providence: D. 11, 58 fms., 1 ♂. Body l. 6 mm., C. l. 3 mm., Ch. l. 10 mm., 1st W.L. 8 mm. In this small male the chelipeds are, as one would expect, shorter in proportion to the body length than in Alcock and Anderson's larger specimens. The 1st pair of walking legs reaches the base of the fingers. Also there is no gape at the base of the fingers nor are there enlarged teeth in this region on their apposed margins. The specimen is dry and the carapace is a good deal wrinkled, ecdysis having evidently occurred recently, but I feel that it may be safely placed in the present species. Alcock and Anderson do not describe the armature of the lateral border of the carapace, but the whole of this border has a denticulated appearance in the "Investigator" figure. In the present example there are 6 spinules on each side. Of these the antero-lateral spine is the largest and is well-developed; behind this, but in front of the anterior limb of the cervical fork, a very small one follows; between the two limbs of the cervical fork are two others: and there are two more, behind its posterior limb, the more posterior of the two being small. The walking legs have the dactylus ending in a curved claw and possessing 5 teeth on its posterior border which increase in size distally, the proximal one being inconspicuous and the distal one a well-developed spine.

This is the only record other than that of the original specimens.

13. *Munida japonica*, Stimpson, 1858.

*Munida japonica*, Stimpson 1858, p. 252, and 1907, p. 235; Ortmann 1892, p. 254, pl. 11, fig. 11; de Man 1902, p. 724; Southwell 1906, p. 221; Balss 1913(2), p. 15, fig. 14 (description of typical form and var. *heteracantha*: distribution); Doflein and Balss 1913, p. 172 (distribution); Balss 1915, p. 3 (distribution); Parisi 1917, p. 1.

*Munida heteracantha*, Ortmann 1892, p. 255, pl. 11, fig. 12.

*Munida sagamiensis*, Doflein 1902, p. 623.

*Munida hanshuensis*, Benedict 1902, p. 261, text-fig. 11.

Loc. Providence: D. 4, 50–78 fms., 1 ♂ (*g*). Mauritius: A. 2, >100 fms., 6 ♂ (*a–f*).

| | *a* | *c* | *b* | *g* | *d* | *e* | *f* |
|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| C. l. | 9·0 | 7·5 | 6·5 | 6·5 | 4·0 | 3·5 | 3·0 |
| Ch. l., right | 16·0 | 14·5 | 13·7 | – | 7·5 | – | – |
| Ch. l., left | 17·2 | 13·5 | 14·0 | – | 7·5 | – | – |
| Prop. l. (upper bord.) of larger Ch. | 3·5 | 2·5 | 3·0 | – | 1·2 | – | – |
| Dact. l. of larger Ch. | 4·0 | 3·5 | 3·0 | – | 1·7 | – | – |

The present specimens differ from Ortmann's description of *M. japonica* in certain particulars. Thus in my largest example the following points may be noted: (1) The eyes are not fringed. (2) The merus of the 3rd maxillipede has only 2 spines on its inner border instead of 3; the spine on the outer distal border is very small. (3) The form of the anterior and antero-lateral borders of the carapace anterior to the cervical groove differs from Ortmann's figure; they form together a continuous backwardly sloping curved line. (4) The greater number and the disposition of the spines of the dorsal surface of the carapace. They are more or less scattered over the anterior and antero-lateral regions; their detailed arrangement is as follows: (i) an anterior gastric row of 8, of which the 2nd pair from the middle line is the largest; (ii) one on each side behind the gap between the 2nd and 3rd of the anterior gastric row and between that row and the broken ciliated line behind it; they may be considered as equivalent to the 3rd pair of Ortmann's figure placed further back; (iii) a median spine in the broken ciliated line behind the anterior gastric row; (iv) 2 small spines on the left and 3 on the right outer part of the above named broken ciliated line and behind the region of the 2 outer spines of the anterior gastric row; they are not in Ortmann's description or figure; (v) a small spine on each side in a line with those just named and to the inner side of the 2nd of the marginal antero-lateral series; this is not in Ortmann's description or figure; (vi) behind the broken ciliated line referred to is a stronger unbroken ciliated line at each end of which there are 3 spines, the innermost of which is the largest, being doubtless the one described by Ortmann, but the other 2 are not described by him; the outermost of the 3 is almost on the antero-lateral margin; (vii) at the outer end of the next ciliated line behind this again is a spinule on each side, not described by Ortmann; (viii) on each side there is a spine in the triangular area formed by the forking of the cervical groove, as in Ortmann's description; (ix) there is finally, as in Ortmann's description, a single spine on each side behind the cervical groove, just behind the fork. Thus the differences from Ortmann's *japonica* are the backward position of the 2nd pair of the anterior gastric row, so that the impression of a conspicuously straight row of spines is lacking; the further reduction of this row by the absence of one of its outer pairs; and the presence of certain additional spines, which it may be noted are the smallest of the series.

In *b*, *c* and *g* there are, under the heading (iv) above, 2 spines only on each side; the outermost of the 3 spines named under (vi) above is absent, which is a difference in the direction of Ortmann's description; and there is an additional spine in the cervical triangle, anterior to the other, which is a point of difference from Ortmann's description. In *c* both the outermost and the middle of the 3 spines referred to under (vi) above are absent, so that there is only one spine in this position, as in Ortmann's description. In the small examples *d*, *e* and *f*, the additional spines tend to be obscure or absent.

Herdman's Ceylon specimens are recorded by Southwell as differing in various

respects from Ortmann's description. I have had access to his material and find that the general outline of the carapace in front of the cervical groove agrees with mine and further that while in some examples the inner margin of the merus of the 3rd maxillipede has 3 spines as in Ortmann's figure, in others, which are otherwise very similar, only 2 spines are present as in my examples. De Man also describes points of difference from Ortmann's account.

Balss **1913(2)**, with considerable Japanese material before him, discusses variation in this very variable species, contrasting the typical form and var. *heteracantha*.

The preceding specimens tend to fall under the *heteracantha* form in having the less regular arrangement of the gastric row of spinules and in having only 2 inner meral spines on the 3rd maxillipede, but on the other hand they have the dorsal spinule in the cervical triangle and the smooth (non-spinulate) dorsal surface of the 2nd abdominal segment of the more typical *japonica*.

*Note on the Chelipeds.* It is noted that though one of the present examples, namely male *b*, has fingers showing a large proximal gape, this example is by no means the largest. In male *a*, the largest example, the left cheliped is the larger and in both right and left chelipeds the fingers gape a little throughout their length, meeting only at their tips, but the gape, which is a little wider in the larger chela, is not emphasised proximally in either; the dactylus has a large tooth proximally and the fixed finger has one just distal to this. In male *c* the right cheliped is a little the larger, and, while in it the fingers are separated in their proximal halves by narrow slits, they meet in the left throughout their length; enlarged proximal teeth are present as in male *a*. In male *b* the right and left chelipeds are of similar size and appearance, the left a trifle the longer; in each the fingers gape widely proximally but hardly at all in their distal 3rd; the dactylus has near its proximal end a large stump-like tooth of characteristic appearance, flattened at its free end but not reaching across the gape, and the fixed finger has a somewhat enlarged tooth of ordinary appearance limiting the wider part of the gape distally. In male *d* the chelipeds are of equal length and in each the fingers meet throughout their length. In all these examples the tip of each finger is produced into a long curved spiniform tooth, which crosses over the corresponding tip of the apposed finger when closed; in all the apposed margins of the fingers bear numerous small teeth throughout their length.

Two other specimens (female *h* and male *i*) from depths similar to the others approach the more typical *japonica* in having a straighter arrangement of the gastric row as in the figures of Ortmann and of Balss. In male *i* are 3 spines on the inner margin of the merus of the 3rd maxillipede; in female *h* there are 2 spines only. Female *h* has its 2nd abdominal segment armed with 4 spines, in male *i* this region is unarmed. Female *h* (Amirante: E. 10, 22–85 fms.) has C. l. 6·75 mm., Ch. l. 12 mm. Male *i* (Mauritius: V. 1, 100–200 fms.) has C. l. 7 mm., Ch. l. 12·25 mm.

It may be further noted in regard to these two specimens: that the number of gastric spines is 12 only, of which 10 form the gastric row and the other 2 are placed one at each end of the first unbroken ciliated line (in female *h* the left member of the outermost pair of the row is abortive, in male *i* the 3rd pair stand somewhat behind the level of the others); that in female *h* the carapace has only 6 marginal spines, there not being any

small 2nd one anterior to the cervical groove and only 2 between the limbs of the cervical fork; that of the 2 inner meral spines of the 3rd maxillipede of female *h* the basal one is large and the distal one small.

Balss has already pointed out that *M. houshuensis*, Benedict, is a synonym of *M. heteracantha*, Ortmann. He also considers *M. sagamiensis*, Doflein, a synonym of *M. heteracantha*. The present examples go far towards breaking down the specific distinction between *heteracantha* and *japonica* and so towards confirming Balss's conclusion based upon Japanese material.

14. *Munida elegantissima*, de Man, 1902.

*Munida elegantissima*, de Man **1902**, p. 726, pl. 24, fig. 42; Doflein and Balss **1913**, p. 173 (distribution).
*Munida alcocki*, Southwell **1906**, p. 222, and text-fig. 2.

Loc. Providence: D. 4, 50–78 fms., 1 ovig. ♀ (*a*). Amirante: E. 16, 39 fms., 1 ♀ (*b*); E. 25, 20–44 fms., 1 ♀ (*c*).

| | Body l. mm. | C. l. mm. | C. b. mm. | Ch. l. mm. |
|---|---|---|---|---|
| Ovig. female *a* | 19·5 | 11·5 | 7·0 | 25·0 |
| Female *c* | 12·0 | 7·0 | 4·2 | 14·0 |
| Female *b* | 10·0 | 5·7 | 3·5 | 12·5 |

These female examples differ from de Man's description of his male specimen in the following particulars. (1) The antero-lateral spines do not present the marked inward curve as in de Man's figure; they are almost straight. (2) The supra-antennal spine of the anterior border of the carapace is of the same size in *b*, a little smaller in *c* and a good deal larger in *a*, though still distinctly smaller than the antero-lateral spine. (3) In all three the supra-ocular spine is a little shorter, the free portion being one-half the length of the free portion of the median rostral spine. (4) The triangular cervical area, which in *b* is as in de Man's account, and is very similar in *c*, contains in *a* an additional spine on the right side between the other spine and the 3rd of the antero-lateral spines. The presence of an additional pair of spines is noted by Southwell in his *M. alcocki*; on examining his types, I find that it is present in the larger but absent in the smaller specimen.

De Man's single male was small (C. l. 6·4 mm.), and it will be noted that it is in my largest specimen that the above named minor points of difference between my specimens and his are most apparent. The chelipeds are in the present female examples just a little more than twice the carapace length in contrast with 2·7 times that length in de Man's small male type.

I have examined the type specimens of *Munida alcocki*, Southwell, 1906, and find that the latter is a synonym of *M. elegantissima*. In Southwell's specimens the arrangement of the ciliated lines posterior to the cervical groove closely resembles the arrangement of those in de Man's figure.

15. *Munida tricarinata*, Alcock, 1894.

*Munida tricarinata*, Alcock **1894**(2), p. 324: Illust. Invest. **1895**, pl. 12, fig. 1; Alcock **1901**, p. 246; Doflein and Balss **1913**, p. 173 (distribution).

Loc. Providence: D. 7, 70 fms., 1 ♀ (*c*). Saya de Malha: C. 6, 145 fms., 2 ♂ (*a*, *b*).

| | male *a* mm. | male *b* mm. | female *c* mm. |
|---|---|---|---|
| Body l. | 19·0 | 25·5 | 17·0 |
| C. l., including rostrum | 9·0 | 11·5 | 8·0 |
| C. b. | 7·0 | 9·0 | 6·2 |
| Ch. l. | – | 48·5 | – |

The cheliped of male *b* has merus l. 17 mm., carp. l. 10 mm., upper bord. prop. l. 11 mm., dact. l. 8·5 mm. W.L. 1 of male *b* has merus l. 14·5 mm., carp. l. 3·25 mm., prop. l. 9 mm., dact. l. 5·5 mm.

In each of the three specimens an additional pair of spines of the anterior tergal row are enlarged in each of the abdominal segments 2, 3 and 4; the members of this pair are well to the outer sides of the pair described by Alcock and near to the ends of the row. Though not described by Alcock they are nevertheless figured by him for segment 4. There is in each of the specimens an enlarged median spine on the 4th abdominal tergum posterior to the anterior tergal spines. Though not described by Alcock this spine appears in his figure. In all three examples the tergum of the 1st abdominal segment is pitted, not "sharply rugose" as described by Alcock. In all three examples the spine of the inner margin of the merus of the external maxillipede is placed about the middle of its length instead of "near the proximal end" as Alcock describes.

The chelipeds of the male have not been hitherto described. They are present only in male *b* of the present examples and are very similar in general appearance to those of the female described and figured by Alcock but longer in proportion to the body-length. The whole appendage is nearly twice the length of the extended body and a little more than four times that of the carapace. On the merus and carpus are 3 longitudinal rows of spines, one on the anterior margin, and one on the outer and another on the inner side of this. The carpus is elongated but the ratio carpus-length divided by merus-length is rather smaller than in the female, being ·59 instead of Alcock's "more than two-thirds."

This is the only other record of the species besides the original one.

## Subfamily **Munidopsinae.**

### Genus *Munidopsis*, Whiteaves, 1874.

16. *Munidopsis* (*Galathodes*) *tridentata* (Esmark, 1857).

*Galathea tridentata*, Esmark **1857**, p. 239.
*Galathodes tridentatus*, Milne-Edwards and Bouvier **1900**, pl. 31, figs. 5–7.
*Munidopsis* (*Galathodes*) ? *tridentata*, Alcock **1901**, p. 264 (description).
*Munidopsis* (*Galathodes*) *tridentata*, Doflein and Balss **1913**, p. 158; also p. 177, for distribution.

Loc. Saya de Malha: C. 21, 450 fms., 2 ♂ (*a*, *b*).

Male *a*. Body l. 24 mm., C. l. 14 mm., larger (left) Ch. l. 25 mm. Male *b*. Body l. 14·5 mm., C. l. 8·5 mm., each Ch. l. 11 mm.

In *a* there are 6 teeth on each lateral margin of the carapace: the two posterior are close together and just behind the cervical groove, and the gap between the 4th and 5th counting from before backwards is greater than that between any other two and is twice as great as that between the 3rd and 4th. In *b* the 1st and 2nd of each side are present as spinules while the rest are obscure. In neither specimen are these teeth, except the 1st or antero-lateral pair, so well-marked as in the figure of Milne-Edwards and Bouvier.

In both specimens only one (the inner) longitudinal row of spines is present on the merus of the cheliped; in the larger specimen it consists of 4 spines of which the most distal is one of 4 situated on the distal margin, and the pen-distal is very prominent and rises from about half way along the merus; in the smaller specimen these two alone represent the longitudinal row.

The fingers of the larger (left) cheliped of the larger specimen do not meet except at their tips, the space between them being a not very wide slit, but the fingers of the right cheliped meet throughout their length; in the smaller example the chelipeds are of smaller size proportionally and the fingers of both meet along their entire length.

In the 3 following legs the anterior border of the merus is spinous, the spines increasing in size distally. W.L. 1 has about 6 spines, W.L. 2 has about 5, and W.L. 3 about 4 spines. In both specimens the anterior (inner) border of the carpus has a stout distal spine and a more proximal one which is less marked; to the outer side of these is a carina which terminates distally in a small spine.

## Family **Porcellanidae.**

### Genus *PETROLISTHES*, Stimpson, 1858.

### 17. *Petrolisthes lamarcki* (Leach, 1820).

*Pisidia lamarckii*, Leach **1820**, p. 54.

*Petrolisthes lamarcki(i)*, Miers **1884**, p. 268 (description of certain points in Leach's type specimen in British Museum): also p. 557 (Amirante); Borradaile **1898**, p. 464 (synonymy); Riddell **1911**, p. 262; Doflein and Balss **1913**, p. 162 (Mahé, Seychelles: Diego Garcia, Chagos Archipelago).

*Porcellana dentata*, de Man **1888**, p. 216 (description).

*Petrolisthes rufescens*, Lenz **1905**, p. 374 (Zanzibar, Bawi); Nobili **1906**, p. 130; Bouvier **1915**, p. 205; Balss **1915**, p. 7.

*Petrolisthes dentatus*, Lenz **1905**, p. 374 (Zanzibar, Bawi, Kokotoni, Aldabra); Lenz **1910**, p. 565 (O. Madagaskar); Gravier **1920**, p. 377 (Madagascar); Sendler **1923**, p. 4.

*Petrolisthes speciosus*, Balss **1913(2)**, p. 30, pl. 1, fig. 3 (an excellent photograph which well represents some of the present specimens).

**Loc.** Seychelles: Praslin, reef, 1 ♂ (*a*), 1 ♀ (*b*). Coetivy: 1 ♂ (*m*). Chagos: Coin, Peros Banhos, 4 ♂ (*c–f*), 3 ♀ (*g–i*); Salomon, 1 ♂ (*k*), 1 ♀ (*l*).

| | C. l. in mm. | Epibranchial spine | Teeth on anterior border of wrist: Left | Right |
|---|---|---|---|---|
| Female *b* | 5·5 | tooth | 4 | missing |
| Female *g* | 6·0 | absent | missing | 5 |
| Female *i*, ovig. | 7·0 | absent | 4– 2nd–4th inconspicuous | 5 |
| Female *h* | 7·75 | absent | 5 | 5 (3rd inconspicuous) |
| Female *l*, ovig. | 8·75 | absent | 5 2nd inconspicuous | 5 (3rd inconspicuous) |
| Male *a* | 5·0 | tooth | 3 | 3 |
| Male *c* | 5·25 | small tooth | 4 | 4 |
| Male *f* | 5·75 | well developed spine | missing | 3 |
| Male *m* | 7·0 | tooth | 4 2nd–4th inconspicuous | 4 (2nd–4th inconspicuous |
| Male *k* | 7·25 | tooth | 3 | 3 |
| Male *d* | 7·5 | small tooth | missing | 4 |
| Male *e* | 9·5 | small tooth | 5 | 5 |

Borradaile includes in *P. lamarcki* forms which have been described under 12 different specific names. The examples which I have before me fall under de Man's re-description of *Porcellana dentata*, H. M.-Edw. But one point must be noted in them, the variability in development of the epibranchial spine, which may be entirely absent. Except as

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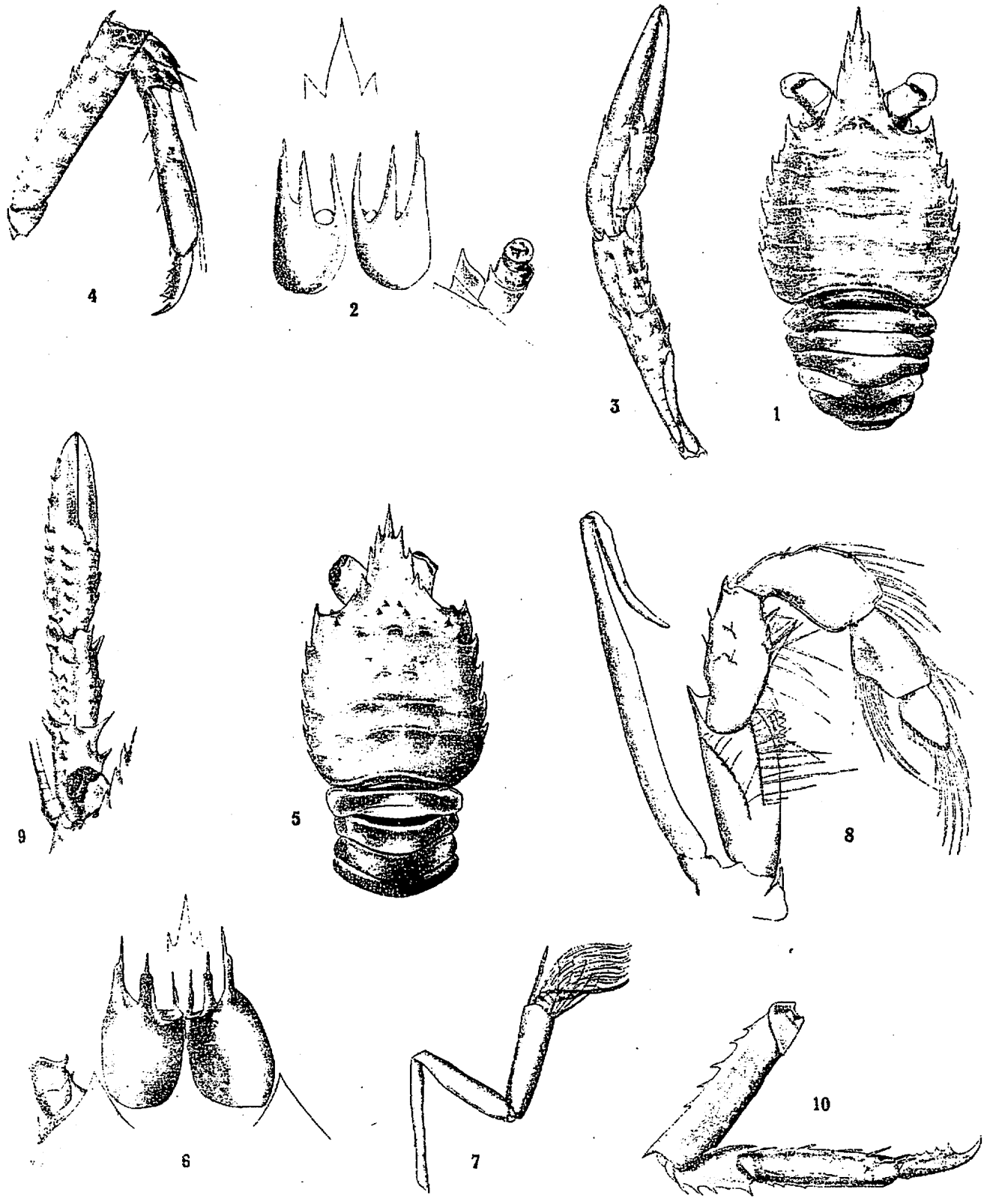
## EXPLANATION OF PLATES 8, 9.

### PLATE 8.

Fig. 1. *Galathea providentia*, sp. nov. ♀ ovigerous, dorsal view.
Fig. 2. Basal joints of 1st antennae, etc., of specimen figured in fig. 1, from below.
Fig. 3. Left cheliped of same, outer surface.
Fig. 4. 1st walking leg of same.
Fig. 5. *Galathea submagnifica*, sp. nov. ♀ ovigerous, dorsal view.
Fig. 6. Basal joints of 1st antennae, etc., of specimen figured in fig. 5, from below.
Fig. 7. 1st antenna of specimen figured in fig. 5.
Fig. 8. External maxillipede of same.
Fig. 9. Left (smaller) cheliped of same, outer surface.
Fig. 10. 1st walking leg of same, inner surface.

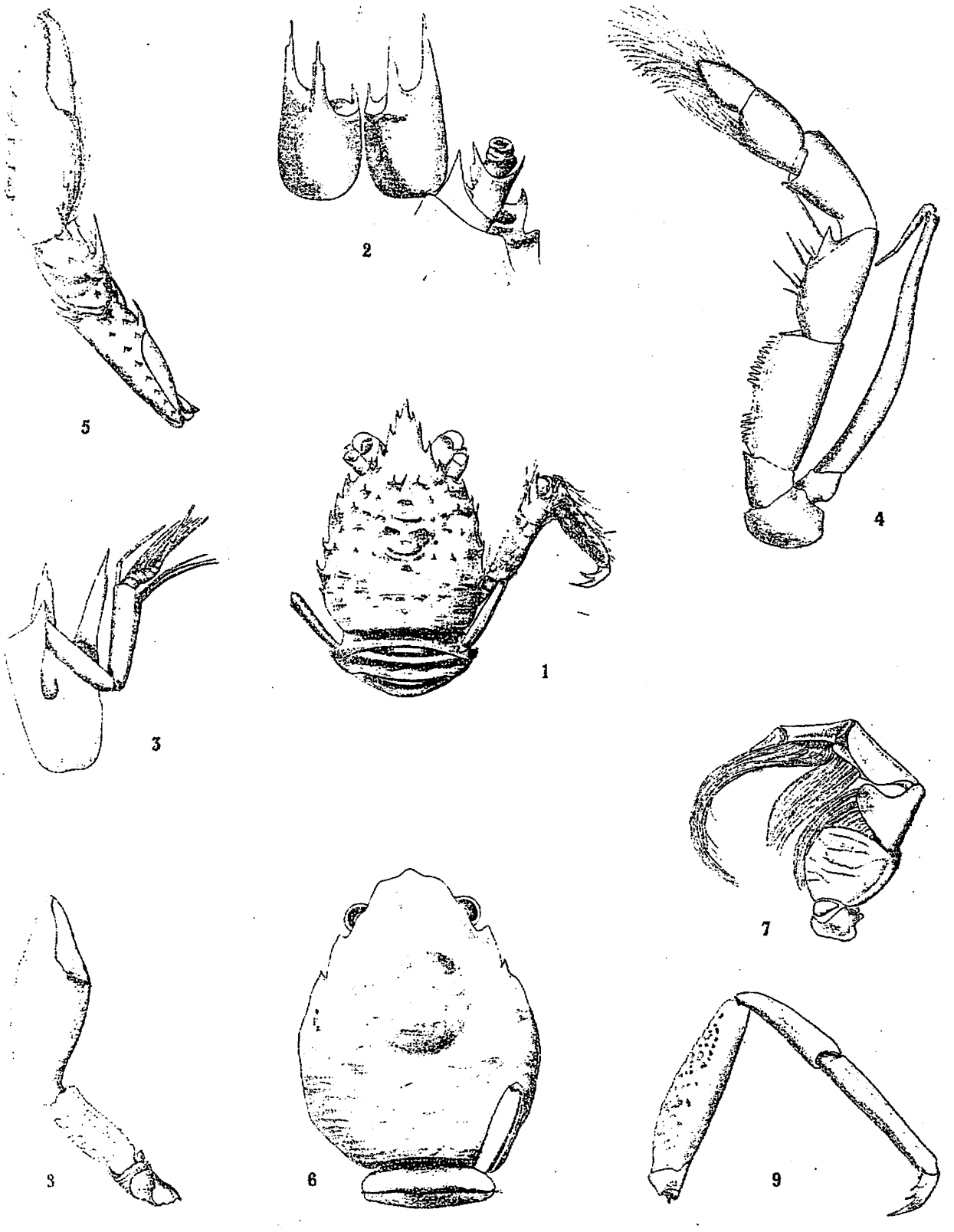
### PLATE 9.

Fig. 1. *Galathea gardineri*, sp. nov. ♂, dorsal view.
Fig. 2. Basal joints of 1st antennae, etc., of specimen figured in fig. 1, from below.
Fig. 3. 1st antenna of same.
Fig. 4. External maxillipede of same.
Fig. 5. Left cheliped of same, outer surface.
Fig. 6. *Petrolisthes alobatus*, sp. nov. ♀ ovigerous, dorsal view.
Fig. 7. External maxillipede of specimen figured in fig. 6.
Fig. 8. Left (larger) cheliped of same, outer surface. (Drawn to a scale one-half that of fig. 6.)
Fig. 9. 1st walking leg of same.




Mabyn Thompson del.

ANOMURA FROM THE INDIAN OCEAN

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