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GALATHEIDEA (CRUSTACEA, DECAPODA, ANOMURA) COLLECTED BY THE F.I.S. *ENDEAVOUR*

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Figures 1 and 2.

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ABSTRACT

Eleven species of Galatheidae and five of Porcellanidae are reported from the collections of the *Endeavour* off the Australian coast. *Munida elegantissima* De Man, *M. japonica* Stimpson, *M. microps* Alcock, and *Galathea balssi* Miyake and Baba are reported from Australia for the first time, and the latter two species are illustrated. *Galathea whiteleggii* Grant and McCulloch, an Australian species not collected by the *Endeavour*, is illustrated and compared with the closely related *G. balssi*. Earlier Australian records of the other 12 *Endeavour* species are cited, and range extensions are established for eight of them. Keys to the known Australian species of *Munida* and eastern Australian species of *Galathea* are presented.

INTRODUCTION

While operating off the coast of Australia from 1909 to 1914, the Fisheries Investigation ship *Endeavour* collected a number of anomuran crustaceans of the superfamily Galatheidea. Most of this material was deposited in the Australian Museum. During a visit of several days to the Museum in 1968 I examined a portion of it, and Dr J. C. Yaldwyn, then Curator of Crustacea, arranged for the rest to be sent to the Allan Hancock Foundation for study. Earlier I had received a small series of *Endeavour* specimens from the Western Australian Museum.

In a report on macruran Crustacea collected by the *Endeavour*, Schmitt (1926: 311) indicated that he planned to treat the Anomura as well. However, no paper on any of the anomuran groups was ever published; several families of decapods from the *Endeavour* collection were sent to Dr Schmitt at the Smithsonian Institution but remained unworked and were eventually returned to the Australian Museum (Dr R. B. Manning, personal communication). It is probable, therefore, that the material reported upon in this paper represents all the Galatheidea that were collected and preserved during the vessel's fisheries investigations.

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No Chirostylidae are represented, although some members of that family are known to occur within the geographic and bathymetric limits of the *Endeavour's* collecting activities. The collection is rather small, containing only 11 species in the family Galatheidae and five in the family Porcellanidae. However, four species of galatheids are new to Australian waters, and several species in both families were found to occur outside their previously known ranges in Australia. A few additional range extensions are noted herein.

Most of the *Endeavour* collecting localities mentioned in the text are shown on the map accompanying Schmitt's paper (Schmitt, 1926: 314–315).

The present report is one of a series of studies on Australian anomurans. Some of the species will be treated subsequently and are only briefly discussed here. A few others, which I do not anticipate reporting upon again, are given more detailed treatment. I have also taken this opportunity to include a key to the species of *Munida* now known from Australia and a key to the species of *Galathea* known from eastern Australia.

Measurements given in this paper refer to carapace length including the rostrum, unless there is a statement to the contrary. Synonymies are not intended to be complete, but for each species I have included a reference to its original description and those of its junior synonyms, and all references I have been able to find that cite its occurrence in Australian waters. I have also included references to certain other papers containing pertinent information. Samples belonging to the Western Australian Museum are identified by the initials W.A.M. before the register number; all others are part of the collections of the Australian Museum.

SYSTEMATIC ACCOUNT

Family **GALATHEIDAE**

Munida Leach, 1820

Munida elegantissima De Man, 1902

Munida elegantissima De Man, 1902: 726, pl. 24 figs 42, 42 a, b.—Tirmizi, 1966: 190, text-fig. 12.—Baba, 1969b: 37, text-figs 3, 4.

Munida alcocki Southwell, 1906: 222, text-fig. 2.

Diagnosis.—Carapace strongly rugose; anterior margin nearly transverse, with a small supra-antennal spine. Lateral spines well developed, anterolateral somewhat larger than the others. A transverse row of ten subequal anterior gastric spines; a spine near each end of the first transverse stria, one or two on each anterior branchial area, and two on the first postcervical stria. Supraocular spines more than half length of rostrum. Corneas only slightly broader than eyestalks. Abdominal segments unarmed. Outer terminal spine of basal antennular segment much longer than inner terminal spine. Pereiopods 1–3 with an epipod.

Material.—Between Fremantle and Geraldton, Western Australia; 1912; 1 ♀, W.A.M 4983.

Measurements.—Ovigerous female 14.0 mm.

Distribution.—I have examined material from several additional localities in Western Australia; also a specimen from NE of Cape Moreton, Queensland, 60–70 fathoms, which was sent for identification by Dr A. J. Bruce and is now in the collections of the Allan Hancock Foundation. These records are the first for the species in Australian waters. It is otherwise known from east Africa off Zanzibar; Amirantes and Providence Island; Gulf of Mannar between India and Ceylon; East Indian Archipelago; and Japan. The bathymetric range is shallow water to 78 fathoms (142 metres).

Munida japonica Stimpson, 1858

Munida japonica Stimpson, 1858: 238, 252; 1907: 235.—Balss, 1913: 15, text-fig. 14.—Melin, 1939: 85, text-figs 54–57.—Tirmizi, 1966: 190, 195, text-figs 15, 16.—Miyake and Baba, 1967: 240, text-figs 11, 12.—Lewinsohn, 1969: 131, text-fig. 26.

Munida honshuensis Benedict, 1902: 251, 261, text-fig. 11.

Munida japonica japonica.—Yanagita, 1943: 14, 24, text-fig. 7.

Diagnosis.—Carapace distinctly rugose; anterior margin oblique, unarmed. Lateral spines well developed, anterolateral somewhat larger than the others. A transverse row of 10–13 anterior gastric spines, pair just behind supraoculars the largest; a spine near each end of the first transverse stria, and two on the first postcervical stria. Supraocular spines half or less than half length of rostrum. Breadth of corneas variable. Second abdominal segment usually armed with about eight to ten spines, none occurring near midline. Outer and inner terminal spines of basal antennular segment about the same length. Epipod wanting on all pereiopods.

Material.—Between Fremantle and Geraldton, Western Australia; 80–120 fms; 1912; 3 ♂, 4 ♀, W.A.M. 4982.

Measurements.—Males 10.9 to 13.3 mm, ovigerous females 10.2 to 11.7 mm.

Remarks.—Several writers have commented on the great intra-specific variation that is characteristic of *Munida japonica.* I have examined a number of Western Australian specimens, which will be discussed elsewhere; these agree very closely with one another and do not show marked differences in width of the eyes, spinulation of the carapace and abdomen, relative length of the supraocular spines, and other variable characters.

Distribution.—Munida japonica is now reported from Australia for the first time. It ranges from the Red Sea eastward to Japan, East Indian Archipelago, and Bismarck Archipelago, to depths of at least 500 metres.

Munida microps Alcock, 1894

Fig. 1

Munida microps Alcock, 1894: 326; 1901: 238, 240.—Alcock and Anderson, 1895: pl. 13 fig. 5.—Tirmizi, 1966: 190, 194, text-fig. 14.

Diagnosis.—Carapace strongly rugose, areas well defined; anterior margin oblique, unarmed. Anterolateral and second hepatic spines much stronger than other lateral spines. Anterior gastric area with three or four pairs of spines, inner (first) pair very

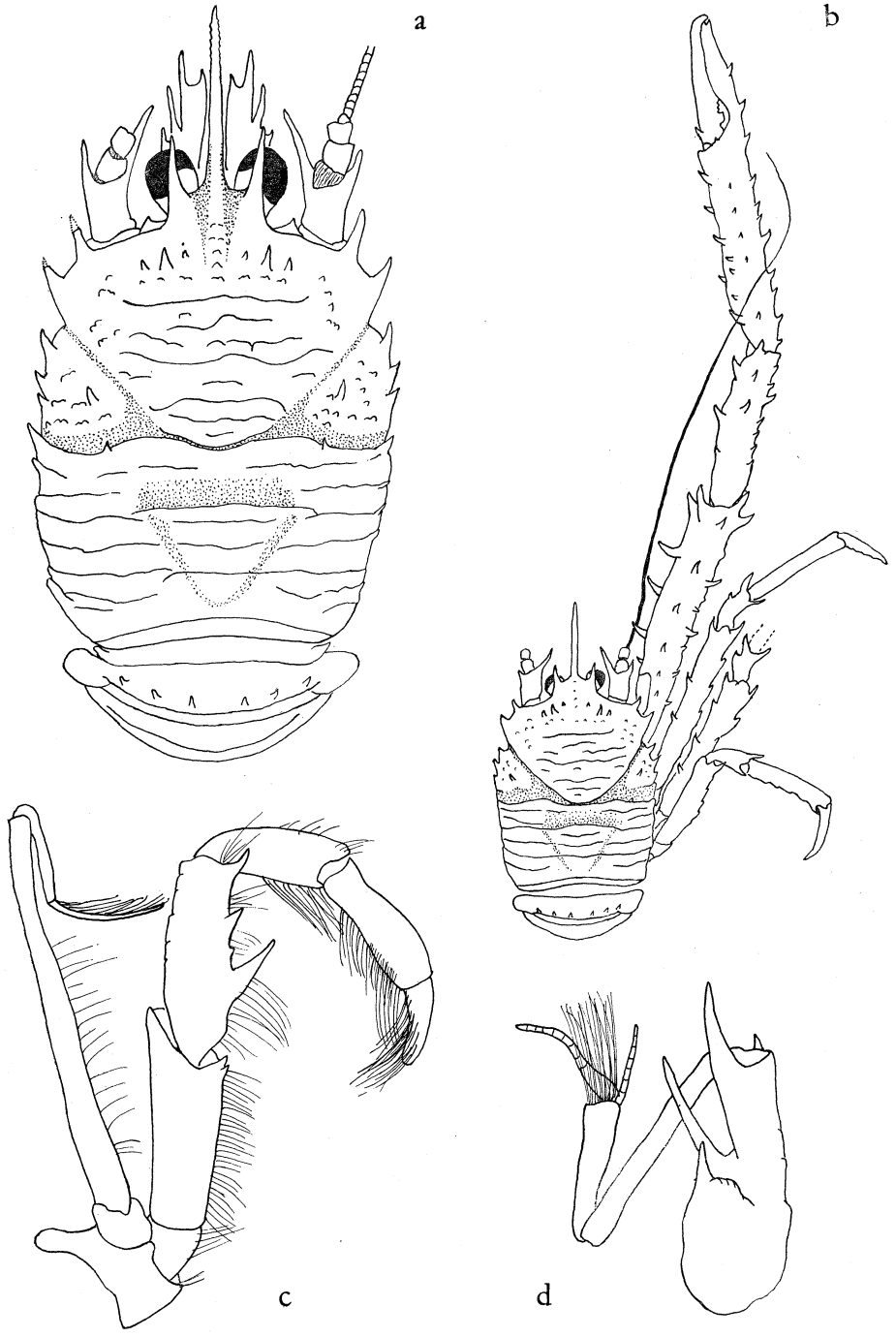

Figure 1.—*Munida microps* Alcock, male. Off Green Cape, New South Wales, E.3142. a, carapace, x3½; b, carapace and pereiopods, x1½; c, right third maxilliped, ventral view, x7; d, right antennule, ventral view, x7

small, second pair distinctly larger than the others; spinules or sharp granules often present, several on hepatic area and one near each end of the first transverse stria; one or two spines on each anterior branchial area and two on the first postcervical stria. Supraocular spines less than half length of rostrum. Eyes small; corneas scarcely broader than stalks, at least in adults. Second abdominal segment with six to ten spines. Outer terminal spine of basal antennular segment much longer than inner terminal spine. Epipod wanting on all pereiopods.

Material.—33 miles E by S from Green Cape, New South Wales; 470 fms; 1912; 1 ♂, 1 ♀, E.3142.

Measurements.—Male 24.3 mm, ovigerous female 11.7 mm.

Remarks.—In the small female specimen the second hepatic spine is smaller than the anterolateral; the supraocular spines are slightly longer in relation to the rostrum than in the male; the keel extending from the rostrum to the first transverse stria is spinulose posteriorly instead of scaly; the corneas are slightly broader than the eyestalks; and the spines on the first movable segment of the antennal peduncle are shorter than in the figured specimen, the inner one not extending beyond the end of the second segment.

Alcock (1894: 327) recognized a variety *lasiocheles*, based on two male specimens, in which the chelipeds are much longer than in typical *microps* and one cheliped is markedly longer than the other. In a later paper (1901: 242) he considered these specimens to be merely dimorphic males of *M. microps*. However, in the illustration of this form under the name *Munida lasiocheles* (Alcock and Anderson, 1895: pl. 13 fig. 8) the rostral, supraocular, and gastric spines are quite unlike those of typical *microps*; if they are accurately depicted, Alcock's "variety" is probably a distinct species.

Distribution.—This species was previously reported from the Andaman and Arabian Seas in the Indian Ocean, in 375 to 675 fathoms (686 to 1,234 metres). Its known range is now extended to southeastern Australia.

Munida haswelli Henderson, 1885

Munida haswelli Henderson, 1885: 411; 1888: 139, pl. 3 figs 5, 5 a, b.—Whitelegge, 1900: 193.—Hale, 1927a: 80, text-fig. 76; 1941: 273.

Diagnosis.—Carapace distinctly rugose, the striae numerous; anterior margin oblique, unarmed. Anterolateral spine well developed, other laterals small. Anterior gastric area with a pair of large spines behind supraoculars, and another pair directly behind these on the first transverse stria; numerous spines or spinules on anterior gastric and hepatic areas, one or two spines (occasionally more) on each anterior branchial area, and two spines on the first postcervical stria. Supraocular spines about half length of rostrum. Corneas much broader than eyestalks. Second abdominal segment usually with six to ten spines, third segment sometimes with two or three. Inner terminal spine of basal antennular segment much longer than outer terminal spine. Epipod wanting on all pereiopods.

Material.—Off Gabo I., Victoria; 80–100 fms; 1913; 1 ♂, E.4781.—S and SW of Mt Cann, Gippsland, Victoria; 70–100 fms; 2 ♂, 5 ♀, 2 juv., E.6114.—40 miles SSW of Mt Cann; 70 fms; 27 August 1914; 3 ♂, 2 ♀, E.6276.—ENE of Maria I., Tasmania; 127–180 fms; 1914; 2 ♂, 6 ♀, E.5175.—35 miles SE of Bruny I., D'Entrecasteaux Channel, Tasmania; 150–230 fms; 1914; 2 ♀, E.5154.—Great

Australian Bight ESE of Eucla, Western Australia, 130° 50′ E; 1913; 1 ♂, E.3688.—Great Australian Bight 60–80 miles W from Eucla; 80–120 fms; March, 1912; 4 ♂, 1 ♀, 6 juv., E.3172, and 2 ♂, 7 ♀, 4 juv., P.3555.

Measurements.—Males 9.0 to 31.3 mm, non-ovigerous females 10.2 to 34.0 mm, ovigerous females 8.0 to 13.2 mm.

Distribution.—New South Wales off Twofold Bay (Henderson, 1885, 1888) and off Botany Bay and Wollongong (Whitelegge, 1900); off Maria Island, Tasmania (Hale, 1941); off coast of South Australia (Hale, 1927a). The bathymetric range is reported as 50 to 150 fathoms (about 90 to 270 metres). The material collected by the *Endeavour* extends the known geographic range westward to Western Australia and the bathymetric range downward to 230 fathoms (420 metres).

Munida subrugosa Dana, 1852

Galathea subrugosa White, 1847: 66 (nomen nudum).—Miers, 1874: pl. 3 fig. 2.

Munida subrugosa Dana, 1852: 479; 1855: pl. 30 figs 7 a-c.—Miers, 1874: 3.—Filhol, 1885: 425.—Sayce, 1902: 155.—Lagerberg, 1905: 7, 10, pl. 1 figs 5, 7.—Matthews, 1932: 473 *et seq.*, pl. 4 figs 1, 4, text-figs 1 a-f.—Healy and Yaldwyn, 1970: 68, fig. 33.

Munida subrugosa, var. *australiensis* Henderson, 1888: 125, pl. 13 figs 3, 3 a, b.—Ortmann, 1892: 254.

Munida australiensis.—Benedict, 1902: 306.

Diagnosis.—Carapace strongly rugose; anterior margin oblique, unarmed. Antero-lateral spine well developed, other laterals small. Anterior gastric area with a pair of large spines and usually two to four spinules; sometimes a small spine near each end of the first transverse stria, a pair on the posterior part of the gastric area, and one on each anterior branchial area; first postcervical stria with four spines. Supraocular spines variable in length but shorter than rostrum. Corneas much broader than eyestalks. Second abdominal segment with four spines, third segment with two to four, fourth segment with two on anterior margin and rarely a smaller pair posteriorly. Inner terminal spine of basal antennular segment much longer than outer terminal spine. Epipod wanting on all pereiopods.

Material.—40 miles SSW of Mt Cann, Victoria; 70 fms; 27 August 1914; 1 ♂, P.17560.—E coast Flinders I., Bass Strait; 17 May 1909; 1 ♂, 5 ♀ (part of a large series), E.1057.—E coast Flinders I.; 1909; 2 ♂, 4 ♀ (part of a large series), P.2330.—Entrance to Oyster Bay, Tasmania; 30 July 1909; 3 ♂, 11 ♀, E.5682.—Maria I., Tasmania; 7 October 1910; 11 ♂, E.1341.

Measurements.—Males 11.5 to 25.4 mm, non-ovigerous females 17.1 to 19.5 mm, ovigerous females 11.0 to 18.9 mm.

Distribution.—This species was previously reported from Australia at Port Phillip, Victoria (Sayce, 1902) and in Bass Strait (Filhol, 1885; Henderson, 1888; Ortmann, 1892; Healy and Yaldwyn, 1970) to a maximum depth of 40 fathoms (72 metres). The known geographic range is now extended southward to Maria Island off the Tasmanian coast, and the bathymetric range in Australian waters is extended to 70 fathoms (126 metres).

Munida subrugosa is also known from New Zealand and its subantarctic islands, the southern part of South America (where it extends as far north as 50° S. Lat. on the west coast and 35° S. Lat. on the east coast), and Falkland Islands. The greatest depth recorded for the species is 600 fathoms (1,097 metres).

Key to Species of Munida known from Australia

1 Terminal spines of basal antennular segment about the same length, or outer spine much the longer 2

— Inner terminal spine of basal antennular segment much longer than outer terminal spine 5

2 (1) A row of six to eight anterior gastric spines; second lateral spine about as large as anterolateral ..... *M. microps*

— A row of 10–13 anterior gastric spines; second lateral spine smaller than anterolateral 3

3 (2) A small spine on anterior margin of carapace; pereiopods 1–3 with an epipod ..... *M. elegantissima*

— Anterior margin of carapace unarmed; epipod wanting on all pereiopods....4

4 (3) Abdominal segments 2 and 3 each with a single median transverse groove, segments 4–6 smooth (in Australian specimens); two or three lateral spines in anterior branchial area ..... *M. japonica*

— Abdominal segments 2–6 each with several transverse grooves; four lateral spines in anterior branchial area ..... *M. spinulifera* (Miers, 1884: 279, pl. 31 fig. A, not fig. B as stated).

5 (1) A pair of well-developed spines just behind large anterior gastric pair; abdominal segment 2 with six to ten spines, segment 4 unarmed ..... *M. haswelli*

— No spines just behind large anterior gastric pair; abdominal segment 2 with four spines, segment 4 with two spines ..... *M. subrugosa*

Allogalathea Baba, 1969

Allogalathea elegans (White, 1848)

Galathea elegans White, 1847: 66 (nomen nudum).—White in Adams and White, 1848: pl. 12 fig. 7.—Miers, 1884: 278.—Grant and McCulloch, 1906: 43, 50, pl. 4 figs 6, 6a.—Potts, 1915: 83, pl. 1 fig. 5, text-fig. 4A.—Balss, 1921: 22.—Miyake and Baba, 1967: 228, text-fig. 3.—McNeill, 1968: 33.—Gillett, 1968: 15.—Lewinsohn, 1969: 123, text-fig. 24.—Healy and Yaldwyn, 1970: 68, pl. 31.

?*Galathea longirostris* Dana, 1852: 482; 1855; pl. 30 fig. 11.

?*Galathea grandirostris* Stimpson, 1858: 238, 252; 1907: 234.

Galathea deflexifrons Haswell, 1882a: 761; 1882b: 163.

Galathea elegans?.—Haswell, 1882b: 163.

Galathea longirostris Yokoya, 1936: 138, text-fig. 6.

Allogalathea elegans.—Baba, 1969a: 6, text-fig. 1.

Diagnosis.—Anterior half of carapace with several uninterrupted transverse striae; dorsal surface unarmed. Rostrum very long and narrow, with five to nine small teeth on each lateral margin. Abdominal segments 2 and 3 with two transverse grooves, the more anterior one sometimes indistinct. Terminal segment of antennular peduncle without a pronounced tuft of hairs. Merus of third maxillipeds with two or three strong spines on inner margin; outer margin unarmed or with one or two spinules. First pair of pereiopods with an epipod.

Material.—25 miles SE from Double Island Point, Queensland; 33 fms; 1913; 1 ♂, E.4512.

Measurements.—Length of carapace including rostrum 9.5 mm; length of chelipeds 22.3 mm.

Remarks.—The highly variable colour pattern of this species has been mentioned by many writers. Most of the colour has faded on the specimen collected by the *Endeavour*, but it appears to have had three narrow, longitudinal dark stripes, one median and two sublateral, on the carapace and abdomen.

Baba (1969a: 6) noted that the type of *Galathea elegans* White, from the Philippine Islands, has an epipod on the first pereiopods only, as confirmed by Drs Isabella Gordon and R. W. Ingle at the British Museum (Natural History). Baba found the same situation to exist in all the Japanese specimens examined by him; but he mentioned material from the Palau Islands in which an epipod is present on the second and third pereiopods as well. Since the number of epipods is constant within a given species, it appears that there are two forms confused under the name *elegans*. Baba suggested that the nominal species *Galathea longirostris* Dana (type-locality Fiji Islands), *G. grandirostris* Stimpson (type-locality Kagosima Bay, Japan), and *G. deflexifrons* Haswell (type-locality Albany Passage, Queensland), as well as a number of records of *G. elegans*, should be removed from the synonymy of White's species until the number of epipods can be determined by re-examination of material on which these records were based. Baba retained *G. longirostris* Yokoya (a junior homonym of *G. longirostris* Dana) as a synonym of *elegans*, so presumably he was able to examine Yokoya's type-material.

The question can probably never be settled for *Galathea longirostris* Dana and *G. grandirostris* Stimpson, for the types of those species are almost certainly lost. The holotype of *G. deflexifrons* Haswell is in the Australian Museum (P.3885), but it is unfortunately dry and could not be examined for epipods without damaging the specimen. However, I think there can be little doubt that it is a synonym of *Allogalathea elegans* and that all the Australian records belong to that species. I have examined many specimens from Queensland and from Western Australia and in all of them there is an epipod on the chelipeds only. Until evidence is introduced to the contrary, it seems best to assume that the form with an epipod on the second and third pereiopods does not occur in Australia.

Distribution.—*Allogalathea elegans* has been reported from off Cape Jaubert, Western Australia (Balss, 1921) and in Queensland from Torres Strait south to Port Curtis (Haswell, 1882a, 1882b; Miers, 1884; Grant and McCulloch, 1906; Potts, 1915; McNeill, 1968; Gillett, 1968; Healy and Yaldwyn, 1970). The known range is now extended southward in Queensland.

The species is reported from the Red Sea and east coast of Africa eastward to the Fiji Islands but, as noted above, some of the published records need confirmation. It is recorded from the littoral to 80 fathoms (146 metres), frequently in association with comatulid Crinoidea.

Galathea Fabricius, 1793

Remarks.—The best source of information on *Galathea* from the east coast of Australia is the review by Grant and McCulloch (1906: 43–52). Their key, until now the only one available for identification of Australian members of the genus, is very much out of date. *G. elegans* and *G. pusilla* have been removed from *Galathea* and placed by Baba (1969) in *Allogalathea* and *Phylladiorhynchus*, respectively; *G. corallicola*, which Grant and McCulloch considered a synonym of *G. australiensis*, has proved to be a distinct species; and four additional forms have been reported from Queensland since publication of their paper. A new key to the species of *Galathea* from eastern Australia, reflecting these changes, is given in the present report. It includes the nine species now known to occur along the east coast of the continent, but this number will undoubtedly be increased when the Galatheidae of the area are studied in more detail. The key should not be used to identify *Galathea* from tropical Western Australia, where the composition of the genus is quite different. Western Australian members of the genus are now under study and will be treated elsewhere.

Members of the genus *Galathea* (as restricted by Baba, 1969a) are described by some writers as having four teeth on each lateral margin of the rostrum. Other writers, who consider the most proximal of these teeth to be supraocular rather than rostral, state that the number of rostral teeth is three on each side. I concur with the latter point of view, and therefore refer to three pairs of rostral teeth throughout the following discussion.

Galathea australiensis Stimpson, 1858

Galathea australiensis Stimpson, 1858: 238, 251; 1907: 230.—Haswell, 1882b: 161.—Miers, 1884: 277 (in part), pl. 31 fig. B (not fig. A as stated).—Whitelegge, 1900: 189.—Sayce, 1902: 155.—Grant and McCulloch, 1906: 43, 44 (in part), pl. 4 figs. 1, 1a.—Lewinsohn, 1967: 178 *et seq.*, text-figs 1–13; 1969: 103, text-fig. 18f.

Galathea australiense.—Hale, 1927a: 78, text-fig. 74.

Diagnosis.—Anterior half of carapace with several uninterrupted transverse striae; a pair of anterior gastric spines but no other spines on dorsal surface. Rostrum nearly as broad as long, with three strong teeth on each lateral margin. Abdominal segments 2 and 3 with three transverse grooves. Terminal segment of antennular peduncle without a pronounced tuft of hairs. Merus of third maxillipeds with two strong spines on inner margin and two or three spinules on outer margin. Pereiopods 1–3 with an epipod.

Material.—Cliffy I. off Corner Inlet, Victoria; 16 October 1909; 1 ♂, E.1340.—Spencer Gulf, South Australia; 16 fms; 1913; 4 ♂, 1 ♀, E.4515.

Measurements.—Males 3.8 to 6.7 mm, female 5.7 mm.

Remarks.—Two males from E.4515 bear a sacculinid parasite which caused the development of female as well as male pleopods.

Distribution.—Lewinsohn (1967) gave a detailed description of this species and showed that records of *Galathea australiensis* from tropical Australia, as well as numerous extra-Australian ones, are all based on other forms. *G. australiensis* appears to be confined to temperate Australian waters. Reliable records include the following: New South Wales at Port Stephens (Haswell, 1882b) and Port Jackson (Stimpson, 1858, 1907; Haswell, 1882b; Miers, 1884; Grant and McCulloch, 1906; Lewinsohn, 1967); Port Phillip, Victoria (Sayce, 1902; Grant and McCulloch, 1906); Flinders Island and elsewhere off the coast of South Australia (Miers, 1884; Hale, 1927a); and possibly Shark Bay, Western Australia (Miers, 1884). The species occurs in shallow water.

Galathea balssi Miyake and Baba, 1964

Fig. 2 a-f

Galathea australis.—Balss, 1913: 2 (error for *australiensis*).

Galathea australiensis.—Balss, 1913: 13, text-fig. 13.

Galathea balssi Miyake and Baba, 1964: 205, text-figs 1, 2; 1967: 228.

?*Galathea whiteleggei*.—Tirmizi, 1966: 175, 186, text-fig. 9.

Diagnosis.—Anterior half of carapace with several uninterrupted transverse striae; one or two pairs of small anterior gastric spines, and a spine toward each end of the second continuous stria. Rostrum about one and a half times as long as broad or slightly longer, with three strong teeth on each lateral margin. Abdominal segments 2 and 3 with a median transverse groove. Terminal segment of antennular peduncle with a long tuft of hairs on outer distal margin. Merus of third maxillipeds with two spines on inner margin, the proximal one larger; two smaller spines on outer margin. Epipod wanting on all pereiopods.

Material.—E of Rockhampton, Queensland; 17 fms; 1913; 1 ♀, E.4514.

Measurements.—Ovigerous female 6.7 mm.

Remarks.—The single specimen from the *Endeavour* collection agrees closely with the description and illustrations of *Galathea balssi* except in a few details. It shows considerably less development of short striae and scales between the major transverse striae of the carapace. There are two pairs of anterior gastric spines instead of a single pair. The rostrum is only about 1.5 times as long as broad (width measured at the base of the third, or proximal, pair of rostral teeth), whereas it is about 1.8 times as long as broad in the holotype and twice as long as broad in the specimen illustrated by Balss (1913: text-fig. 13). *G. balssi* is known from only a few specimens and it is too soon to determine whether these differences fall within the normal range of variation for the species.

A specimen from the Indian Ocean, doubtfully referred to *Galathea whiteleggii* by Tirmizi (1966), seems to be closer to *G. balssi*. It agrees with the latter species, and differs from *G. whiteleggii*, in the shape of the rostral and supraocular teeth and in the presence of a single transverse groove on abdominal segments 2 and 3. On the other hand, the merus of the third maxillipeds differs from that of typical *G. balssi* in having three spines instead of two on both the inner and outer margins. Although there are four small anterior gastric spines as in the Australian example of *G. balssi*, they are more or less equidistantly spaced instead of being grouped as shown in fig. 2a, this paper. Because of these differences, and because Tirmizi did not mention the number of epipods in her specimen, I hesitate to place it definitely with *G. balssi*.

With Tirmizi's record eliminated, *Galathea whiteleggii* Grant and McCulloch (fig. 2g) is known only from the Arafura Sea and the east Australian coast. It resembles *G. balssi* in having a narrow, scaly rostrum, setiferous striae on the eyestalks and a fringe of setae at the base of the corneas, a spine near each end of the second complete stria of the carapace, a tuft of hairs on the terminal segment of the antennular peduncle, and spine-tipped scales on the chelipeds. It differs sharply in the form of the rostral teeth: their outer side is markedly convex, and the incurving of the third, or proximal, pair causes the rostrum to be very narrow at the base. In *G. balssi* the outer margin of the rostral teeth is nearly straight and the rostrum is relatively broader at the base. *G. whiteleggii* is further distinguished by the following characters: the supraocular teeth are relatively broader than in *G. balssi*; there is an epipod on the chelipeds; the

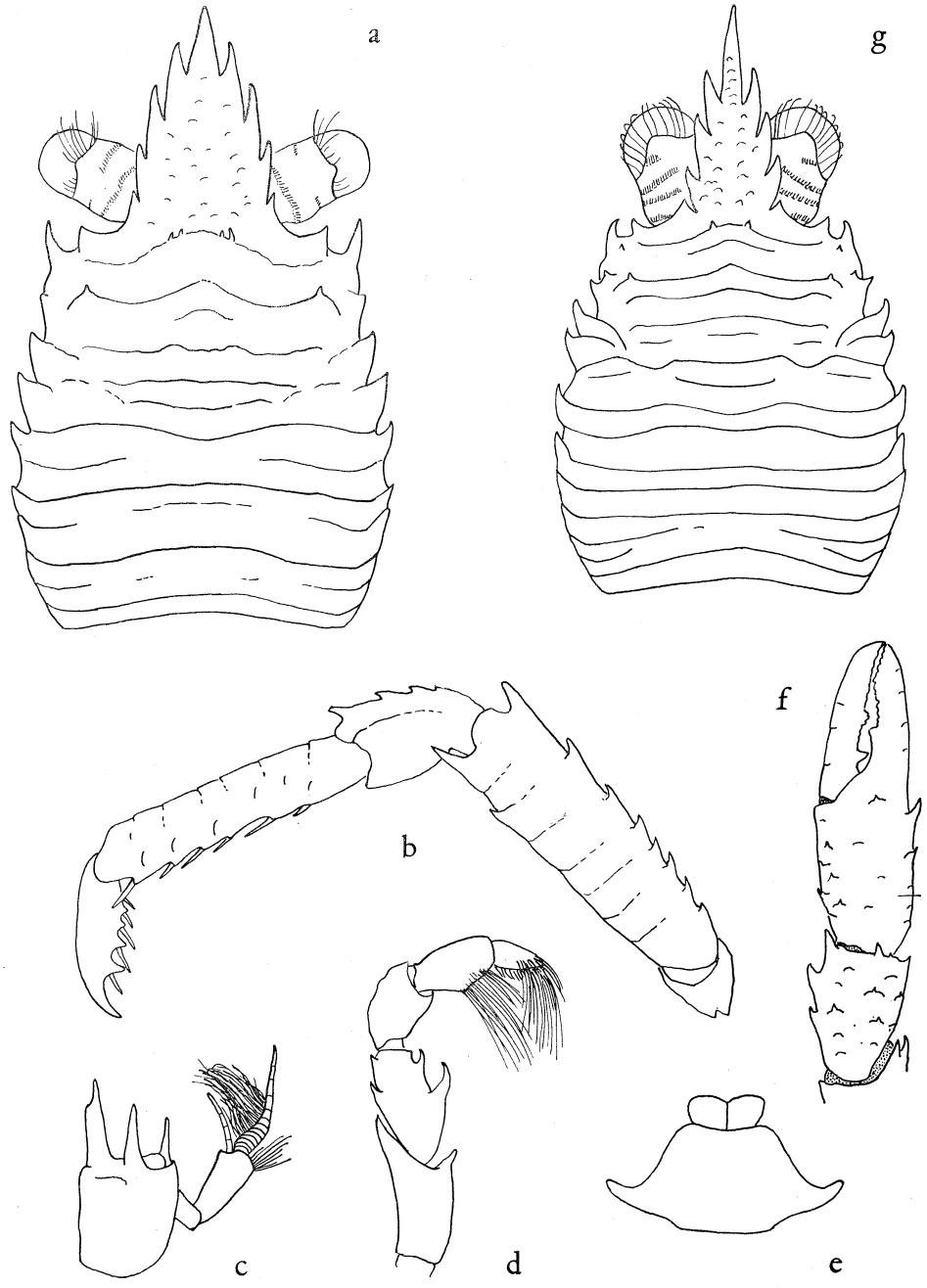

Figure 2.—a-f: *Galathea balssi* Miyake and Baba, female. Off Rockhampton, Queensland, E.4514. a, carapace, x12; b, left first walking leg, x16; c, right antennule, ventral view, x16; d, right third maxilliped, ventral view, x16; e, sternum of third maxillipeds and first pereiopods, x16; f, carpus and chela of right cheliped, x7. g: *Galathea whiteleggii* Grant and McCulloch, male. Off Dunwich, Moreton Bay, Queensland, 4 fms, 1946, coll. J. S. Hynd, P.15815. Carapace, x14½

merus of the outer maxillipeds is armed with three subequal spines on the inner margin; and there are three distinct transverse grooves on abdominal segments 2 and 3. In all specimens I have seen the carapace striae are very pronounced and fringed with long setae, but this character is probably subject to some variation.

Distribution.—*Galathea balssi* was previously reported from Japan and the East China Sea in 84 to 150 metres; its known range is now extended to the coast of Queensland where it was taken at a depth of about 31 metres.

Galathea aculeata Haswell, 1882

Galathea aculeata Haswell, 1882a: 761; 1882b; 162.—Whitelegge, 1900: 190.—Grant and McCulloch, 1906: 43, 48, pl. 4 figs. 4, 4a.—McNeill, 1968: 33.

?*Galathea australiensis.*—Miers, 1884: 277 (in part).

Diagnosis.—Striae on anterior half of carapace broken up into short, rounded scales; a pair of anterior gastric spines, and several other small spines on dorsal surface. Rostrum about one and a half times as long as broad, with three strong teeth on each lateral margin. Abdominal segments 2 and 3 with a median transverse groove. Terminal segment of antennular peduncle with a long tuft of hairs on outer distal margin. Merus of third maxillipeds with two or three strong spines on inner margin and two or three smaller, but distinct, spines on outer margin. Pereiopods 1–3 with an epipod.

Material.—18 miles NW of Double Island Point, Queensland; 17 fms; 1913; 1 ♀, P.17561.

Measurements.—Ovigerous female 4.3 mm.

Distribution.—This species has been reported from a relatively small area on the Queensland coast, between Lookout Point and Port Molle in Whitsunday Passage (Haswell, 1882a, 1882b; McNeill, 1968), in depths down to 20 fathoms (36 metres). According to Lewinsohn (1967: 178), the material from Port Denison and Port Molle attributed to *Galathea australiensis* by Miers (1884: 277) is probably *G. aculeata.* The known range is now extended for a considerable distance southward on the Queensland coast. I have examined material from Western Australia and Northern Territory.

Tirmizi (1966: 178, text-figs 3, 4) reported *Galathea aculeata* from the Red Sea, but her identification is questioned by Lewinsohn (1969: 111). Johnson (1970: 4) reported it from Singapore; this record should be left in doubt pending re-examination of his material, since Johnson made no mention of certain critical characters such as the presence or absence of epipods and of a tuft of hairs on the terminal segment of the antennular peduncle.

Galathea magnifica Haswell, 1882

Galathea magnifica Haswell, 1882a: 761; 1882b: 162.—Whitelegge, 1900: 187.—Grant and McCulloch, 1906: 43, 47, pl. 4 figs 3, 3a.—Balss, 1921: 23.—Hale, 1927a: 78, 79, text-fig. 75.

Galathea setosa Baker, 1905: 267, pl. 35 figs. 2, 2 a, b.

Diagnosis.—Striae on anterior half of carapace broken up into short, rounded scales; a pair of anterior gastric spines but usually no other spines on dorsal surface. Rostrum nearly as broad as long with three strong teeth on each lateral margin. Abdominal

segments 2 and 3 with a median transverse groove. Terminal segment of antennular peduncle without a pronounced tuft of hairs. Merus of third maxillipeds with two strong spines on inner margin; outer margin unarmed. First pair of pereiopods with an epipod.

Material.—Between Port Stephens and Newcastle, New South Wales; 22–60 fms; 1 ♀, E.286.—Spencer Gulf, South Australia; 16 fms; 1913; 1 ♀, P.17562.

Measurements.—Females 4.8 and 6.6 mm.

Distribution.—Queensland off Mast Head Island, Capricorn Group, and at Port Curtis (Grant and McCulloch, 1906); New South Wales at Broughton Islands near Port Stephens (Haswell, 1882a, 1882b) and off Botany Bay (Whitelegge, 1900); Investigator Straits, South Australia (Baker, 1905); off Cape Jaubert, Western Australia (Balss, 1921). The known bathymetric range is 7 to 43 fathoms (13 to 77 metres). The species has not been reported outside of Australia.

Key to Species of Galathea known from Eastern Australia

1 Anterior gastric spines present 2
— No anterior gastric spines 8
2 (1) Anterior half of carapace with uninterrupted transverse striae 3
— Anterior half of carapace with short, curved scales only 7
3 (2) Second complete stria unarmed 4
— Second complete stria with a spine toward each lateral margin 6
4 (3) Antennular peduncle with a terminal tuft of hairs; chelipeds with an epipod ..... *G. corallicola*
(Haswell, 1882a: 761; Whitelegge, 1900: 190.)
— Antennular peduncle without a terminal tuft 5
5 (4) Pereiopods 1–3 with an epipod ..... *G. australiensis*
— Epipod wanting on all pereiopods ..... *G. affinis*
(Ortmann, 1892: 252, pl. 11 fig. 9; Miyake and Baba, 1966: 57, text-figs. 1, 2; Lewinsohn, 1969: 112, text-fig. 21).
6 (3) Merus of third maxillipeds with two spines on inner margin; epipod wanting on all pereiopods ..... *G. balssi*
— Merus of third maxillipeds with three spines on inner margin; chelipeds with an epipod ..... *G. whiteleggii*
(Grant and McCulloch, 1906: 45, pl. 4 fig. 2.)
7 (2) Merus of third maxillipeds spined on outer margin; pereiopods 1–3 with an epipod ..... *G. aculeata*
— Merus of third maxillipeds unarmed on outer margin; an epipod on chelipeds only ..... *G. magnifica*
8 (1) Carapace with about 12 transverse striae; carapace and abdomen with five dark and four light longitudinal stripes ..... *G. minuta*
(Potts, 1915: 87, pl. 1 fig. 6, text-fig. 4B. Perhaps = *G. amboinensis* De Man, 1888: 457, pl. 19 fig. 3).
— Carapace with about eight transverse striae; carapace and abdomen dark, with a broad light longitudinal stripe on each side of the midline ..... *G. inflata*
(Potts, 1915: 85, pl. 1 fig. 7, text-fig. 4C; Baba, 1969b: 33, text-figs. 1, 2).

Phylladiorhynchus Baba, 1969

Phylladiorhynchus pusillus (Henderson, 1885)

Galathea pusilla Henderson, 1885: 407; 1888: 121, pl. 12 figs 1, 1 a, b.—Whitelegge, 1900: 185.—Grant and McCulloch, 1906: 43, 49, pl. 4 figs 5, 5a.—McNeill, 1926: 305.—Hale, 1927a: 78, 80.—Guiler, 1952: 36.—Miyake and Baba, 1967: 234, text-fig. 6.—Lewinsohn, 1967: 179.—Zarenkov, 1968: 177, text-fig. 22; 1970: 176, text-fig. 22.

Galathea integra Benedict, 1902: 247, 248.

Phylladiorhynchus pusillus.—Baba, 1969a: 4.

Diagnosis.—Anterior half of carapace with a few uninterrupted transverse striae; two pairs of anterior gastric spines, the small outer pair sometimes wanting. Rostrum narrow, with a single marginal spine on each side near tip; unarmed portion of lateral margins somewhat convex. Abdominal segments 2 and 3 with a median transverse groove. Terminal segment of antennular peduncle with a long fringe of hairs on outer distal margin. Merus of third maxillipeds with a submedian spine on inner margin and a distal spine on outer margin. Epipod wanting on all pereiopods.

Material.—S of Cape Everard, Victoria; 1 ♂, E.6158.—S and SW of Mt Cann, Gippsland, Victoria; 70–100 fms; 2 ♂, 1 ♀, P.17563.—About 15 miles SE of St Helens Point, Tasmania; 60 fms; 1 ♀, E.6170.

Measurements.—Males 5.0 to 6.9 mm, females 4.7 and 5.0 mm.

Remarks.—Two males, one from E.6158 and the other from P.17563, are parasitized by a sacculinid which is attached to the abdomen. In each case, female as well as male pleopods are developed. The presence of rhizocephalan parasites in this species was previously reported by Henderson (1888) and Whitelegge (1900).

Distribution.—Queensland at Capricorn Group (Grant and McCulloch, 1906; McNeill, 1926) and near Port Curtis (Lewinsohn, 1967); New South Wales off Bondi (Whitelegge, 1900), off Twofold Bay, 36° 59′S., 150° 20′E. (Henderson, 1885, 1888), and at 37° 40′S., 150° 00′E. (Zarenkov, 1968, 1970); Victoria off Port Phillip Heads (Grant and McCulloch, 1906); D'Entrecasteaux Channel, Tasmania (Guiler, 1952); and South Australia between Beachport and the Althorps (Hale, 1927a). I have examined specimens from several localities in Western Australia.

The species is also reported from New Zealand, from Japan, and from Providence Island in the Indian Ocean. Specimens from the Red Sea which Tirmizi (1966: 175) identified as *Galathea pusilla* undoubtedly belong to another species, as Lewinsohn (1969: 116) and Baba (1969a: 5) have already pointed out. *Phylladiorhynchus pusillus* has been found in the littoral and in depths to about 170 fathoms (310 metres); it appears to be common only in deeper water.

Family **PORCELLANIDAE**

Pachycheles Stimpson, 1858

Pachycheles sculptus (H. Milne Edwards, 1837)

Porcellana sculpta H. Milne Edwards, 1837: 253.—Studer, 1889: 185, 232.

Porcellana pisum H. Milne Edwards, 1837: 254.—Studer, 1889: 185.

Porcellana pulchella Haswell, 1882a: 758; 1882b: 148.

Pachycheles pulchellus.—Miers, 1884: 273, pl. 30 fig. A.—Henderson, 1888: 114.—Ortmann, 1894: 29, 30.—McNeill, 1968: 34.

Pachycheles pisum.—Rathbun, 1924: 30.—Ward, 1928: 245.

Pachycheles sculptus.—Haig, 1965: 102.—Nakasone and Miyake, 1968a: 61, pl. 5 figs 1–3, text-fig. 1.

Diagnosis.—See Haig, 1965: 102.

Material.—11–14 miles NW of Pine Peak, Queensland; 24–26 fms; 1912; 1 ♂, E.3194.—18 miles NW of Double Island Point, Queensland; 17 fms; 1913; 1 ♂, 3 ♀, P.17564.

Measurements.—Males 4.0 and 4.7 mm, non-ovigerous female 6.1 mm, ovigerous females 3.6 and 7.2 mm.

Remarks.—All five specimens from the *Endeavour* collection are of the "*pulchellus*" variety described and illustrated by Miers (1884).

Distribution.—This species is reported from Western Australia between Cottesloe and Troughton Island (Studer, 1889; Rathbun, 1924; Haig, 1965); off Bathurst Island, Northern Territory (Nakasone and Miyake, 1968a); Arafura Sea (Henderson, 1888; Nakasone and Miyake, 1968a); and Queensland from Torres Strait south to Bunker Group (Haswell, 1882a, 1882b; Miers, 1884; Henderson, 1888; Ortmann, 1894; Ward, 1928; McNeill, 1968). The known range is now extended southward along the Queensland coast.

Outside of Australia the species is known from Mergui Archipelago in the Indian Ocean, from the Ryukyu Islands south to the East Indian Archipelago, and eastward to the Tuamotu Archipelago. It is usually found in the littoral or at moderate depths, but has been reported from between 50 and 100 fathoms (about 90 to 180 metres).

Pisidia Leach, 1820

Pisidia gordoni (Johnson, 1970)

Porcellana (allied to *serratifrons*).—Miers, 1884: 277.

Porcellana serratifrons.—Henderson, 1888: 110 (in part: Arafura Sea specimen).—Grant and McCulloch, 1906: 39, 40.—McNeill, 1968: 34.

Porcellana spinulifrons.—Gordon, 1931: 530, text-figs. 4C, 5.

Pisidia cf. *spinulifrons*.—Haig, 1965: 105, 106.

Porcellana (*Pisidia*) *gordoni* Johnson, 1970: 29, fig. 3 m-p.

Diagnosis.—See Haig, 1965: 106.

Material.—Great Sandy Strait off Point Inskip, Queensland; 10 fms; 27 July 1910; 1 ♂, E.3185.

Measurements.—Male 4.2 mm.

Remarks.—This species has only recently been provided with a name and complete description, based on material from Singapore. It was named in honour of Dr Isabella Gordon. A few years ago a change in spelling to *gordonae* would have been required under Article 31 of the International Code of Zoological Nomenclature; but that article is now a Recommendation and the spelling *gordoni* must apparently stand.

Distribution.—Between Onslow and Broome, Western Australia (Haig, 1965); Northern Territory (Haig, 1965); Arafura Sea (Henderson, 1888); Queensland between Thursday Island and Mast Head Island, Capricorn Group (Miers, 1884; Grant and McCulloch, 1906; McNeill, 1968).

This species also occurs from the east coast of Africa eastward to the East Indian Archipelago, and along the east Asian coast as far north as Hong Kong. The bathymetric range is littoral to about 40 fathoms (72 metres).

Pisidia dispar (Stimpson, 1858)

Porcellana dispar Stimpson, 1858: 229, 242; 1907: 190, pl. 23 fig. 3.—Haswell, 1882b: 149.—Miers, 1884: 275, pl. 30 fig. C.—Whitelegge, 1889: 231.—Stead, 1898: 208.—Grant and McCulloch, 1906: 40.—Rathbun, 1924: 31.—Hale, 1927a: 82, text-fig. 79; 1927b: 309.

Porcellana rostrata Baker, 1905: 260, pl. 35 figs. 1, 1 a, b.

Pisidia dispar.—Haig, 1965: 105, 107.—McNeill, 1968: 34.—Nakasone and Miyake, 1968b: 97, text-fig. 1.—Shepherd, 1969: 107 *et seq.*, text-figs 6–9.

Diagnosis.—See Haig, 1965: 107.

Material.—Cape Marsden, Kangaroo I., South Australia; 17 fms; 18 August 1909; 3 ♂, 2 ♀, E.4522.—Sanders Bank, Kangaroo I.; 28 fms; 1913; 9 ♂, 6 ♀, 1 juv., E.4524.—15 miles NW of Cape Jervis, South Australia; 17 fms; 1913; 17 ♂, 6 ♀, 1 intersex, E.4520.

Measurements.—Males 1.7 to 5.3 mm, non-ovigerous females 3.1 to 5.2 mm, ovigerous female 3.2 mm.

Remarks.—An intersex, with carapace 4.4 mm long, from E.4520 has both male and female pleopods on the abdomen, and a rather poorly developed female genital opening on the coxa of each third pereiopod. The secondary sexual characters, such as the form of the chelipeds, are male.

Ten of the 24 individuals from E.4520 are parasitized with a bopyrid; half have the parasite in the left branchial chamber, half in the right. One specimen from E.4522 is similarly infected. A male from E.4524 has a sacculinid attached to the abdomen, accompanied by secondary development of female pleopods; in this specimen there is no trace of female genital pores.

Distribution.—Queensland at Low Isles and Batt Reef (McNeill, 1968), Port Curtis (Grant and McCulloch, 1906), and Dunwich, Moreton Bay (Shepherd, 1969); New South Wales at Port Stephens (Haswell, 1882b) and Port Jackson (Stimpson, 1858, 1907; Haswell, 1882b; Miers, 1884; Whitelegge, 1889; Stead, 1898); South Australia at Investigator Straits (Baker, 1905; Hale, 1927b) and Kangaroo Island (Hale, 1927b); Western Australia between Warnbro Sound and Broome (Rathbun, 1924; Haig, 1965).

Pisidia dispar was known only from Australia until recently, when Nakasone and Miyake (1968b) reported it from the Ryukyu Islands and the main island of Japan. The bathymetric range is littoral to about 30 fathoms (54 metres).

Aliaporcellana Nakasone and Miyake, 1969

Aliaporcellana suluensis (Dana, 1852)

Porcellana suluensis Dana, 1852: 414; 1855: pl. 26 fig. 4.—Rathbun, 1924: 30, pl. 1 figs 15, 16.

Polyonyx denticulatus Paulson, 1875: 89, pl. 11 fig. 6; 1961: 95, pl. 11 fig. 6.—Johnson, 1958: 98, 100, text-fig. 1.

Polyonyx hexagonalis Zehntner, 1894: 187, pl. 8 figs 18, 18a.

Polyonyx suluensis.—Haig, 1965: 112.—McNeill, 1968: 37.—Lewinsohn, 1969: 166, text-fig. 37.

Aliaporcellana suluensis.—Nakasone and Miyake, 1969: 19, 21, text-fig. 1.

Diagnosis.—See Haig, 1965: 112.

Material.—7 miles NNE of Bowen, Queensland; 16 fms; 3 August 1910; 1 ♂, E.3115.—18 miles NW of Double Is. Point, Queensland; 17 fms; 1913; 2 ♂, 1 ♀, E.4521.

Measurements.—Males 3.0 to 4.8 mm, ovigerous female 5.0 mm.

Remarks.—The 4.8 mm male from E.3115 has a sacculinid attached to the abdomen.

Distribution.—The species is reported from Australia off Cape Jaubert, Western Australia (Rathbun, 1924; Haig, 1965) and off Lookout Point, Queensland (McNeill, 1968). The known range is now extended for a considerable distance southward along the Queensland coast.

The general distribution for the species is Indian Ocean, including the Red Sea, and western Pacific from Kyushu Island, Japan, south to the East Indian Archipelago. It has been collected in the littoral and to depths of at least 70 fathoms (126 metres).

Polyonyx Stimpson, 1858

Polyonyx obesulus Miers, 1884

Porcellana obesula White, 1847: 130 (nomen nudum).

Polyonyx obesulus Miers, 1884: 272, pl. 29 fig. D.—Henderson, 1888: 115.—Johnson, 1958: 99, 108, text-fig. 4.—Haig, 1965: 112, 113.—McNeill, 1968: 37.

Polyonyx parvidens Nobili, 1905: 161.

Diagnosis.—See Haig, 1965: 113.

Material.—18 miles NW of Double Is. Point, Queensland; 17 fms; 1913; 1 ♀, P.17565.

Measurements.—Length of female 5.9 mm, width 8.1 mm.

Distribution.—From vicinity of Geraldton to off Troughton Island, Western Australia (Haig, 1965); Port Darwin, Northern Territory (Miers, 1884); Queensland from Flinders Passage south to Port Denison (Miers, 1884; Henderson, 1888; McNeill, 1968). The known range is now extended southward on the coast of Queensland.

Polyonyx obesulus is known from the Indian Ocean, including the Gulf of Iran, and in the western Pacific from the Philippine Islands south to the East Indian Archipelago. The bathymetric range is littoral to about 30 fathoms (54 metres).

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