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THE PORCELLANIDAE (CRUSTACEA, ANOMURA)
OF WESTERN AUSTRALIA, WITH DESCRIPTIONS OF
FOUR NEW AUSTRALIAN SPECIES

By

JANET HAIG

10.—The Porcellanidae (Crustacea, Anomura) of Western Australia with descriptions of four new Australian species

by Janet Haig*

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Abstract

Twenty-eight species of Porcellanidae are reported for Western Australia. Three are new species: *Pachycheles johnsoni*, *Porcellana furcillata*, and *Polyonyx maccullochi*. Fifteen previously known species are new records for Western Australia, and seven of those fifteen are new records for Australia. A new species, *Pachycheles granti*, from Queensland and New South Wales, is also described.

Introduction

Until now very little attention has been given to Western Australian crabs of family Porcellanidae. Only two papers have been published, dealing specifically with the Western Australian fauna, in which Porcellanidae were treated: these were Rathbun (1924) and Hale (1929). Porcellanids were mentioned incidentally in three additional works. Only ten species of the family have been recorded from Western Australia.

The incentive for the present study was provided by a large collection of crustaceans dredged off the coast of Western Australia by an expedition sponsored by the Bernice P. Bishop Museum of Honolulu, and donated to the Western Australian Museum (George, 1961). The Porcellanidae from that expedition, together with other members of the family in the collections of the Western Australian Museum, were turned over to me for study. I have also been able to borrow numerous Western Australian porcellanids from the Australian Museum; the Porcellanidae collected by the Hamburg Southwest-Australia Expedition 1905, and housed in the Zoologisches Museum, Hamburg; and a small group of specimens in the U.S. National Museum, comprising a portion of the Porcellanidae collected during Dr. E. Mjöberg's Swedish scientific expeditions to Australia 1910-1913 and reported by Rathbun (1924). During a visit to the British Museum (Natural History) I examined a small collection of Western Australian Porcellanidae housed in that institution.

In the synonymy of each species I have tried to include all references to its occurrence anywhere in Australia.

Discussion of zoogeographical implications will be included in a future report, which will treat the other anomuran families (hermit crabs excepted) represented in Western Australia.

The following abbreviations are used in the text: W.A.M.—Western Australian Museum; A.M.—Australian Museum; B.M.N.H.—British Museum (Natural History); Z.M.H.—Zoologisches Museum, Hamburg; U.S.N.M.—United States National Museum.

Key to Western Australian genera of Porcellanidae

1. Movable segments of antennal peduncle with free access to orbit 2
Movable segments of antennal peduncle excluded from orbit by a forward projection of basal segment, which meets anterior margin of carapace 4
2. (1) Posterior portion of lateral walls of carapace consists of one or more pieces separated by membranous interspaces from anterior portion *Pachycheles*
Lateral walls of carapace entire 3
3. (2) Front a strongly produced, triangular rostrum, armed with a row of strong spines; telson of abdomen five-plated *Petrocheles*
Front various, usually rather prominent but never produced into a strongly armed rostrum; telson seven-plated *Petrolisthes*
4. (1) Carapace broader than long 5
Carapace as long as, or longer than, broad 6
5. (4) Dactyl of walking legs with at least two well-developed fixed claws, and often with accessory spinules on lower margin *Polyonyx*
Dactyl of walking legs a straight, slender spine with no accessory spinules *Raphidopus*
6. (4) Carapace markedly longer than broad; dactyl of walking legs very short and stout, with four strong, fixed claws *Porcellanella*
Carapace at most only slightly longer than broad; dactyl of walking legs slender, with one or two fixed claws and a few movable spinules 7

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| <p>7. (6) One cheliped distinctly larger than the other, particularly in males; dactyl of small cheliped twisted out of plane with manus; dactyl of walking legs with a single terminal claw <i>Pisidia</i></p> <p>Chelipeds subequal or one distinctly larger than the other; dactyl not twisted out of plane with manus (except in occasional large specimens of <i>gravelei</i>); dactyl of walking legs bifurcate or with a single terminal claw <i>Porcellana</i></p> | <p>2. (1) Front broad, sinuously triangular; inner orbital angle not distinct, but marked by a large spinule <i>scabriculus</i></p> <p>Front narrow, with distinctly marked but unarmed inner orbital angle <i>militaris</i></p> <p>3. (1) Epibranchial spine present 4</p> <p>No epibranchial spine <i>teres</i></p> <p>4. (3) Carapace strongly to faintly rugose, not much longer than broad 5</p> <p>Carapace smooth, distinctly longer than broad <i>ohshimai</i></p> <p>5. (4) Merus of walking legs unarmed on anterior margin 6</p> <p>Merus of walking legs armed on anterior margin <i>moluccensis</i></p> <p>6. (5) Dorsal surface of chela with rugae and flattened tubercles; inner side of fingers pubescent <i>boscai</i></p> <p>Dorsal surface of chela with small, upstanding, well-separated granules; no pubescence, or at most only a fine trace, in gape of fingers <i>haswelli</i></p> |
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Genus **PETROCHELES** Miers

Diagnosis. Basal antennal segment short, not produced forward to meet anterior margin of carapace; movable segments with free access to orbit. Carapace conversely cordate, broader posteriorly than anteriorly and with a strongly produced, triangular rostrum. Lateral margins of carapace and rostrum armed with a row of strong spines. Chelipeds subequal; chelae long, slender, flattened; carpi armed with strong spines on margins and on dorsal surface. Telson of abdomen five-plated.

Petrocheles australiensis (Miers)

Petrolisthes (Petrocheles) australiensis Miers 1876a, p. 222 (Australia); 1876b, p. 61. Haswell 1882b, p. 147 (Mordialloc). Baker 1905, p. 264, pl. 36, figs 1, 1a (St. Vincent Gulf; Port MacDonnell).

Petrocheles australiensis, Hale 1927a, p. 81, text-fig. 78 (South Australia).

Diagnosis. Protogastric region of carapace with a pair of spines. Rostral spines four on either side. Inner margin of carpus of cheliped armed with six or seven strong spines.

Material examined. 3♀, Great Australian Bight, S. of Nullarbor Station, 5.i.1958, R. Hardie, W.A.M. 171-60. "Swims backwards like crayfish."

Remarks. Largest specimen 18.4 mm in carapace length.

Distribution. Australia (Victoria and South Australia). Now recorded from Western Australia.

Genus **PETROLISTHES** Stimpson

Diagnosis. Basal antennal segment short, not produced forward to meet anterior margin of carapace; movable segments with free access to orbit. Carapace rounded or subquadrate, usually about as broad as long; armature various. Front triangular or trilobate, often rather prominent, not strongly armed except near base (minutely denticulate in some species). Chelipeds subequal; chelae flattened; armature of carpi various. Telson of abdomen almost invariably seven-plated.

Key to Western Australian species of Petrolisthes

1. Supraocular spine present; spines on lateral margins of carapace posterior to epibranchial spine 2
- No supraocular spine, nor spines on lateral margins of carapace posterior to epibranchial spine 3

Petrolisthes scabriculus (Dana)

Porcellana scabricula Dana 1852, p. 424 (Sulu Sea); 1855, pl. 26, fig. 13.

Petrolisthes scabriculus, Stimpson 1858, p. 227. Haig 1964, p. 358, text-fig. 2.

Diagnosis. Carapace transversely rugose. Supraocular spine present. Front broad, triangular, forming a nearly even curve from tip to supraocular spine; inner orbital angle marked by a distinct spinule. Epibranchial region with two spines; midbranchial margin with a few spinules. Inner margin of carpus of chelipeds with four or five broad teeth; outer margin with row of strong spines. Chela with a median longitudinal crest; dorsal surface to outside of this crest covered with hairs, which form a heavy fringe along outer margin. Merus of walking legs armed on anterior margin with a row of spines.

Material examined. 1♀, W. of Flat I. off Onslow (near Long I.), 6-10 fm, 9.vi.1960, B. R. Wilson on "Davena", W.A.M. 36-62. 1♂, 2 miles S.W. of Peak I., 10 fm, 18.vi.1960, B. R. Wilson on "Davena", W.A.M. 136-60.

Remarks. For a discussion of differences between this species and *P. militaris*, see Haig (1964). Male 7.5 mm; ovigerous female 7.6 mm.

Distribution. Philippine Islands; East Indian Archipelago. Heller's (1865) record from the Nicobars needs confirmation because of possible confusion with *P. militaris*. Now recorded from Australia.

Petrolisthes militaris (Heller)

Porcellana annulipes White 1847, p. 63 (*nomen nudum*; Corregidor, Philippine Islands).

Porcellana militaris Heller 1862, p. 523 (Nicobars).

Petrolisthes annulipes, Miers 1884, p. 270, pl. 29, fig. B (Port Denison; Port Molle; Prince of Wales Channel; Thursday Island; Cape Capricorn). Henderson 1888, p. 106 (Flinders Passage).

Petrolisthes militaris, Ortman 1892, pp. 259, 265. Rathbun 1924, p. 29 (Cape Jaubert). Miyake 1943, p. 56, text-figs. 1-2 (Bathurst Island). Haig 1964, p. 357, text-fig. 1 (Queensland).

Diagnosis. Carapace transversely rugose. Supraocular spine present. Front narrow, triangular, with a distinctly marked but unarmed inner orbital angle. Epibranchial region with two spines; mid-branchial margin with a few spinules. Inner margin of carpus of chelipeds

with four or five broad teeth; outer margin with a row of strong spines. Chela with a median longitudinal crest, outer margin often with a scanty fringe of hairs. Merus of walking legs armed on anterior margin with a row of spines.

Material examined. 1♂, 12♀, Broome. June 1932, A.M. P.10256. 1♂, 10♀, entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14072. 1♂, 4♀, near entrance to Roebuck Bay, 5-8 fm, 26.ix.1929, A. A. Livingstone, A.M. P.14085. 2♂, 1♀, Roebuck Bay, 1932, Mrs. B. Grey, B.M.N.H. 1♂, 10 miles W. of Gordon Bay, 15 fm, W.A.M. 335-62. 3♂, 6♀, 10-20 miles W. of Lagrange Bay, 12-25 fm, W.A.M. 346-62. 1♂, 1♀, 40 miles W. of Cape Jaubert, 23 fm, W.A.M. 325-62. 1♂, 1♀, 45 miles W.S.W. of Cape Jaubert, 72 ft, 7.vii.1911, E. Mjöberg, U.S.N.M. 56408. 1♀, 45 miles W.S.W. of Cape Jaubert, 66 ft, 15.vii.1911, E. Mjöberg, U.S.N.M. 56409. 1♂, 45 miles W.S.W. of Cape Jaubert, 66 ft, 16.vii.1911, E. Mjöberg, U.S.N.M. 56407. 1♂, between Broome and Wallal on Ninety Mile Beach, c. 8 fm, 1930, Capt. R. Bourne, A.M. P.9923. 5♂, 5♀, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, Sept. 1929, A. A. Livingstone, A.M. P.14111. 4♂, 4♀, 2 juv., 72 miles W. x N. of Bedout I., 25 fm, W.A.M. 356-62. 5♂, 2♀, 60 miles W. x N. of Bedout I., 25 fm, W.A.M. 341-62. 1♂, 2♀, Port Walcott, 8 fm, W.A.M. 175-60. 1♂, Anchorage Bay, Rosemary I., Dampier Archipel., W.A.M. 352-62. 3♂, 6♀, 3-4 miles off E. end Delambre I., Dampier Archipel., 10 fm, W.A.M. 118-60. 1♂, Gidley I., Dampier Archipel., 10 fm, W.A.M. 129-60. 2♀, 25 miles N.W. of Angel I., Dampier Archipel., 37 fm, W.A.M. 151-60. 2♂, 2♀, between Malus and Gidley Is., Dampier Archipel., 10 fm, W.A.M. 137-60. 1♂, 3♀, Malus I., Dampier Archipel., 10 fm, W.A.M. 180-60. 1♂, 2♀, W. approaches to Mermaid Strait, Dampier Archipel., 20 fm, W.A.M. 117-60. 1♂, 1♀, 7-8 miles N. of Long I. near Onslow, 28 fm, W.A.M. 121-60. 2♂, 4♀, 3 juv., off Shark Bay, 121 m, "Umitaka Maru", W.A.M. 356-60.

Remarks. The ground colour on most of the specimens tended to be light, usually with the striations of carapace and chelipeds marked out in red, although this colouration was reduced to red flecks in some cases. In a few specimens the carapace and chelipeds were solid red. Most of the material showed a characteristic pattern on the walking legs, consisting of two narrow red bands on the merus and one broad band each on the carpus and propodus. Males to 8.4 mm; non-ovigerous females to 6.7 mm; ovigerous females to 10.1 mm. Ovigerous females in May at Dampier Archipelago; June at Broome, Port Walcott, Dampier Archipelago, and Onslow; July at Cape Jaubert; August at Roebuck Bay; September at Roebuck Bay and between Cape Jaubert and Wallal; October at Lagrange Bay, Cape Jaubert, and Bedout I.; December at Shark Bay.

Distribution. Indian Ocean (Seychelles; Cargados; Chagos; southern India and Ceylon; Nicobars); Japan southward through China Sea to Philippine Islands, East Indian Archipelago and Australia (Western Australia; Northern Territory; Queensland).

***Petrolisthes moluccensis* (de Man)**

Porcellana (Petrolisthes) moluccensis de Man 1888, p. 411, pl. 18, fig. 5 (Amboina).

Petrolisthes moluccensis, Ortmann 1894, p. 26. Miyake 1942, pp. 334, 337, text-figs. 3-4.

Petrolisthes bosci, Nobili 1906a, p. 66; 1906b, pp. 129, 130 (part).

Diagnosis. Carapace transversely rugose. No supraocular spine. Front broad, sinuously triangular, with distinct inner orbital angle. A single epibranchial spine. Inner margin of carpus of chelipeds with five (occasionally six) broad teeth; outer margin with a row of spines, increasing in size distally. Chela without longitudinal crest; covered with rugae or laterally elongate granules. Gape of fingers without pubescence. Merus of walking legs armed on anterior margin with a row of spines.

Material examined. 8♂, 6♀, Abrolhos Is., southern group, March-August 1960, J. Allchin via P. Barrett Lennard, W.A.M. 174-60.

Remarks. The material agrees well with the descriptions given by de Man and Miyake, who however indicated that the carapace is weakly rugose. In the Western Australian specimens the rugae on the carapace are strong. Examination of considerable additional material (including Paris Museum specimens from the Persian Gulf and Red Sea, reported by Nobili as *P. boscii*) has shown that, among specimens otherwise identical, there is variation in this character: in some specimens the transverse rugae are very fine, so that the carapace appears almost smooth in places, and in others they are very strong and distinct, particularly on the anterior half of the carapace.

Chelipeds and carapace dark red, with narrow, yellowish transverse bands. Under side of chelipeds dark reddish purple. Abdomen and posterior portion of carapace red with white mottlings. Merus of walking legs mottled; carpus red with a few white dots; propodus light with a very broad, median red band; dactyl similarly banded, but red area narrower. Males to 12.4 mm; non-ovigerous females to 11.7 mm; ovigerous females to 9.8 mm.

Distribution. Red Sea and Persian Gulf (Nobili, as *P. boscii*); Ryukyu Islands; Palau Islands; East Indian Archipelago (Amboina; Misool). Now recorded from Australia.

***Petrolisthes boscii* (Audouin)**

Porcellana boscii Audouin 1826, p. 89 (Red Sea).

?*Porcellana rugosa*?, White 1847, p. 63 (Torres Straits).

Petrolisthes boscii, Stimpson 1858, p. 227. Henderson 1893, p. 427 (North Australia). McCulloch 1913, p. 353, text-fig. 53 (Port Hedland). Hale 1929, p. 68 (Dirk Hartog Island).

Petrolisthes rugosus, Miers 1884, p. 270 (North Australia).

Diagnosis. Carapace with small, broken rugae over most of surface. No supraocular spine. Front rather narrow, sinuously triangular. A single epibranchial spine. Inner margin of carpus of chelipeds with four broad teeth; outer margin with three strong spines or teeth near distal end. Chela with elongate striae, low short rugae, and flattened tubercles. Gape of fingers with a short, thick pubescence extending to their tips. Merus of walking legs unarmed on anterior margin.

Material examined. 2♂, Northwest Australia, 1932, Mrs. B. Grey, B.M.N.H. 2 juv., Pender Bay, 1932, Mrs. B. Grey, B.M.N.H. 1♂, Cable Beach, Broome, shore, W.A.M. 349-62. 1♀, Gantheaume Point, between tides, June-Oct. 1929, A. A. Livingstone, A.M. P.14109. 4♀, off Roebuck Bay, 5-9 fm, June-Oct. 1929, A. A. Livingstone, A.M. P.14103. 1♂, 1♀, near entrance to Roebuck Bay, 5-8 fm, 26.ix.1929, A. A. Livingstone, A.M. P.14447. 1♂, 4♀, 3 juv., Port Hedland, W.A.M. 25-62 & 26-62. 2♂, 2♀, Rosemary I., Dampier Archipel., shore under stones, W.A.M. 28-62 & 319-62. 1♀, Eagle Hawk I., Dampier Archipel., under stone at low tide, W.A.M. 22-62. 1♀, S.W. corner Enderby I., Dampier Archipel., on fringing reef, W.A.M. 172-60. 5♂, 5♀, Onslow, July 1905, Gale for Hamburg S.W. Australia Exped., Z.M.H. 11623. 1 juv., Exmouth Gulf, 6 miles N. of Learmouth, W.A.M. 170-60. 2♂, 1♀, Point Gregory, N.W. side Peron Peninsula, Shark Bay, under stones on limestone reef flat just below high tide, W.A.M. 194-60. 1♂, at and near Brown Station, Dirk Hartog I., Shark Bay, ½-3 m, 18.ix.1905, St. 30, Hamburg S.W. Australia Exped., Z.M.H. 11706. 1♀, S.E. end Dirk Hartog I., Shark Bay, among coral, W.A.M. 204-57. 1 juv., Surf Point, outer bar (exit of South Passage), Shark Bay, ½-3½ m, 16.vi.1905, St. 25, Hamburg S.W. Australia Exped., Z.M.H. 11694. 1♂, Port Gregory, sub-littoral in lagoon under stones and coral, W.A.M. 5-63. 1♂, Port Gregory, under stones around coral heads, W.A.M. 3-63. 1♂, 3♀, Port Gregory, under stones on reef flat at low tide, W.A.M. 6-63. 1♂, Western Australia, W.A.M. 48-49. 1♂, no data, W.A.M. 182-60.

Remarks. Ground colour pale; tubercles and anterior margins of rugae on carapace, chelipeds, and merus of walking legs marked with red; a median red ring on propodus of walking legs. Males to 12.4 mm; non-ovigerous females to 8.9 mm; ovigerous females to 11.4 mm. Ovigerous females in June and August at Dampier Archipelago; July at Onslow; September at Port Hedland; December at Shark Bay and Port Gregory.

Distribution. Indian Ocean, from Red Sea to Mergui Archipelago; western Pacific from Japan to Malay Archipelago. Australia (Western Australia; "North Australia"; ? Queensland).

Petrolisthes haswelli Miers

Petrolisthes haswelli Miers 1884, p. 269, pl. 29, fig. A (Thursday Island; Port Curtis, Facing Island; Torres Straits).

Diagnosis. Carapace covered with faint, broken, transverse striae. No supraocular spine. Front rather narrow, sinuously triangular. A single epibranchial spine. Inner margin of carpus of chelipeds with four to six uneven teeth; outer margin with three strong teeth near distal end, one or two additional small ones sometimes developed. Chela covered with small, upstanding, well-separated granules. Gape of fingers bare or with a faint trace of pubescence. Merus of walking legs unarmed on anterior margin.

Material examined. 1♀, Yampi Sound, W.A.M. 157-60. 3♂, 2♀, Cockatoo I., low tide under stones, W.A.M. 353-62. 3♂, 1♀, Gantheaume

Point, W.A.M. 10877. 1♂, S. point of Cable Beach, Broome, W.A.M. 177-60. 2♂, 1♀, Riddell Beach, Broome, under rocks on surface of reef, W.A.M. 340-62. 1♀, Port Hedland, W.A.M. 35-62. 2♀, Rosemary I., Dampier Archipel., shore under stones, W.A.M. 319-62. 2♂, 3♀, S.W. corner Enderby I., Dampier Archipel., on fringing reef, W.A.M. 172-60. 3♂, 1♀, Exmouth Gulf, 6 miles N. of Learmouth, W.A.M. 170-60. 1♀, Exmouth Gulf, Wapet jetty under stone, W.A.M. 331-62. 1♂, Exmouth Gulf, shore, W.A.M. 322-62. 2♂, 1♀, Point Gregory, N.W. side Peron Peninsula, Shark Bay, under stones on limestone reef flat just below high tide, W.A.M. 194-60.

Remarks. Several authors have placed this species in synonymy with *Petrolisthes lamarckii* (Leach), a form found in Australia but not yet reported from Western Australia. *P. haswelli* differs consistently from typical members of that species in the strong granulation of the chelae and the presence of transverse striae on the carapace. It is perhaps even more closely related to *P. boscii*, from which it differs in the ornamentation of the chelae and the lack of a thick pubescence in the gape of the fingers. Very small specimens of *P. haswelli* and *P. boscii* are sometimes difficult to distinguish, for in juveniles of *P. boscii* the amount of pubescence on the inner side of the fingers is reduced and the tubercles on the chela may be more rounded and pronounced than in adults.

Miers (1884) noted a British Museum specimen of *P. haswelli* collected by the "Samarang" at Koo-Keang-San (Majico-shima Group, now known as Sakishima Islands, in the southern Ryukyu Islands). Two "Samarang" specimens from that locality, which I examined at the British Museum (Natural History), disagree in several details with a type from Thursday Island (BMNH) and with other Australian material examined; possibly they are examples of *P. lamarckii* with unusually granulate chelae. The record of Whitelegge (1897, p. 144), who listed *P. haswelli* from Funafuti, needs confirmation.

Carapace, chelipeds, and walking legs covered with small red spots. Propodus of walking legs frequently with a broad, median red ring as in *P. boscii*. Males to 15.4 mm; non-ovigerous females to 10.8 mm; ovigerous females to 9.2 mm. Ovigerous females in April at Exmouth Gulf; October at Cockatoo Island; December at Shark Bay.

Distribution. Possibly an Australian endemic. Queensland (Miers); specimens seen from Northern Territory. Now recorded from Western Australia.

Petrolisthes teres Melin

Petrolisthes inermis Haswell 1882a, p. 757 (Port Denison); 1882b, p. 146. Miyake 1943, p. 80, text-figs. 16-17 (Sandgate, Moreton Bay).

Petrolisthes japonicus var. *inermis*, Miers 1884, p. 268 (Port Moller; Port Curtis; Shark Bay). Grant and McCulloch 1906, p. 38 (Port Curtis).

Petrolisthes japonicus, Hale 1929, p. 68 (Dirk Hartog Island).

Petrolisthes teres Melin 1939, p. 104 (not text-figs. nor Bonin Islands records). Haig 1964, p. 364.

Diagnosis. Carapace nearly smooth, lateral margins subparallel, lateral walls hairy. No supraocular spine. Front rather broad, sinuously

triangular. No epibranchial spine. Inner margin of carpus of chelipeds with a shallow, pointed tooth at proximal end, and often a second, smaller one at about middle of margin; outer margin with two teeth, including the one at posterodistal angle. Chela narrow, nearly smooth, dorsal surface with indistinct, longitudinal crest; outer margin often with fringe of hairs. Gape of fingers with a long, thick tuft of pubescence. Merus of walking legs unarmed on anterior margin.

Material examined. 8 specimens, Northwest Australia, Mrs. B. Grey, B.M.N.H. 1 ♀, Entrance Point, Broome, between tides on rocky reef, August 1929, A. A. Livingstone, A.M. P.14457. 1 juv., Port Hedland, September 1961, Brown, W.A.M. 25-62. 3 ♀, Exmouth Gulf, Wapet jetty, under stone, 7.iv.1961, R. W. George, W.A.M. 323-62. 2 ♂, Dirk Hartog I., Shark Bay, August, 1960, via P. Barrett Lennard, W.A.M. 75-62. 4 ♂, 1 ♀, Point Gregory, Shark Bay, 30.xii.1961, D. G. Bathgate, W.A.M. 40-62. 1 ♀, Monkey Mia, Shark Bay, 25-30.viii.1960, A. Kalnins, W.A.M. 179-60. 1 ♀, Lagoon Point, saltwater lagoon, Shark Bay, 0- $\frac{1}{2}$ m, 11 and 13.vi.1905, St. 4, Hamburg S.W. Australia Exped., Z.M.H. 11639. 10 ♂, 14 ♀, Denham, Shark Bay, shore, 8-9.vi.1905, St. 5, Hamburg S.W. Australia Exped., Z.M.H. 11524. 21 ♂, 25 ♀, Denham, Shark Bay, shore, 19-20.ix.1905, St. 5, Hamburg S.W. Australia Exped., Z.M.H. 11582. 3 ♂, 6 ♀, N. side of Denham jetty, Shark Bay, under stones on sand flats at low tide, 29.xii.1959, B. R. Wilson, W.A.M. 195-60.

Remarks. For a discussion of the use of the name *teres*, see Haig (1964). Males to 8.7 mm; non-ovigerous females to 9.0 mm; ovigerous females to 8.1 mm. Ovigerous females in August at Broome and in December at Shark Bay.

Distribution: Recorded only from Gulf of Siam (Haig) and Australia (Western Australia and Queensland).

Petrolisthes ohshimai (Miyake)

Porcellana maculata H. Milne Edwards 1837, p. 253 (New Ireland).

Petrolisthes maculatus, Miers 1884, p. 558. Lenz 1905, p. 375, pl. 47, fig. 1.

Neopetrolisthes ohshimai Miyake 1937, p. 35, text-fig. (Ryukyu Islands); 1942, p. 350, text-fig. 13. McNeill 1953, p. 90 (Hope Island).

Petrolisthes ohshimai, Johnson 1960, p. 164. Gordon 1960, p. 166.

"Small species of crab," Saville-Kent 1897, p. 220, pl. 39 (Roebuck Bay or Lacepede Islands, *vide* Gordon 1960).

"Unidentified crab," McCulloch and McNeill 1923, p. 58 (Great Barrier Reef).

Diagnosis. Carapace smooth, hairless, convex, markedly elongate. No supraocular spine. Front very broad, partly covering and reaching well beyond eyes. Epibranchial spine present. Inner margin of carpus of chelipeds with two or three wide-set teeth, proximal one largest; outer margin unarmed except for a short, blunt tooth at distal end. Chela broad, flat, with strongly curved outer margin. Merus of walking legs unarmed on anterior margin. Red spots on carapace and chelipeds, and usually also on abdomen, maxillipeds, eyestalks, and walking legs. The red colour sometimes takes the form of large, irregularly-shaped blotches.

and sometimes of very regularly and evenly distributed small spots: compare e.g. the illustrations in Lenz 1905 and in Miyake 1942.

Material examined. 1 ♀, Roebuck Bay, 1932, Mrs. B. Grey, B.M.N.H. 1 ♂, 1 ♀, N.E. side Rosemary I., Dampier Archipel., low tide on hypostome of large anemone, 27.viii.1961, B. R. Wilson and G. W. Kendrick, W.A.M. 32-62.

Remarks. Johnson (1960) transferred Miyake's species to genus *Petrolisthes* and reported a specimen from Christmas Island, eastern Indian Ocean, which he considered a westward extension of range. However, Dr. J. Forest (*in litt.*) informs me that *Porcellana maculata* H. Milne Edwards is identical with Miyake's species. There are two dried type specimens in the Paris Museum, labelled "*Porcellana maculata*, Edw./MM. Quoy et Gaimard./Nlle Irlande"; one of them, a male 8.5 by 7 mm, was chosen as lectotype by Dr. Forest. On the basis of this record, and subsequent ones by Miers and Lenz, the range of the species may be extended to the western Indian Ocean. It is a commensal with giant sea anemones of genus *Stoichastis*.

Even though H. Milne Edwards' name antedates Miyake's, the latter must be used for the species because of Article 23b of the International Code of Zoological Nomenclature, which requires that a name unused as a senior synonym for more than 50 years is to be discarded. The name *maculatus* as applied to this species did not appear in print between its use by Lenz (1905) and by Jacquotte (1964).

The red colour in the Rosemary Island specimens is in small, evenly distributed spots as in Lenz's illustration, but there are large areas of unspotted ivory white: most of the frontal region, the fingers, distal and outer part of the palm, proximal and distal ends of carpus of the chelipeds, most of the merus of the walking legs, and the entire carpus, propodus, and dactyl of those appendages. Male 11.2 mm; female 10.0 mm.

Distribution. Indian Ocean: Zanzibar, Mozambique, Madagascar, Gulf of Mannar, Christmas Island. Pacific Ocean: Ryukyu Islands, Palau Islands, Bismarck Archipelago, Marshall Islands, Fiji Islands. Australia (Western Australia and Queensland).

Genus **PACHYCHELES** Stimpson

Diagnosis. Basal antennal segment short, not produced forward to meet anterior margin of carapace; movable segments with free access to orbit. Carapace rounded or subquadrate, usually about as broad as long in males, a little broader than long in females; unarmed except for spine, present in some species, at outer orbital angle. Front not prominent, usually rounded or transverse in dorsal view, trilobate in frontal view. Epimera (lateral walls of carapace) incomplete, the posterior (subbranchial) portion consisting of one or more pieces separated by membranous interspaces from anterior portion. Chelipeds large, thick, and robust, one almost always distinctly larger than the other. Telson of abdomen composed

of either seven or five plates (five in all Indo-West Pacific species). Male lacking pleopods in many species.

Key to Australian species of Pachycheles

1. Carapace covered with scattered setae; pleopods present in males *pisoides*
Carapace devoid of hairs; no pleopods in males 2
2. (1) Carpus and chela with longitudinal rows of strong, well-separated tubercles, these tubercles covered with short hairs *granti*
Chelipeds devoid of hairs 3
3. (2) Anterior regions of carapace smooth; chelae smooth, tuberculate, or with four longitudinal ridges *sculptus*
Anterior regions of carapace roughened; carpus and chela with large, scalloped-edged tubercles, latter often with free edges *johnsoni*

Pachycheles sculptus (H. Milne Edwards)

- Porcellana sculpta* H. Milne Edwards 1837, p. 253 (Java).
Porcellana pisum H. Milne Edwards 1837, p. 254 (China).
Porcellana pulchella Haswell 1882a, p. 758 (Holborn Island; Port Moller); 1882b, p. 148.
Pachycheles pulchellus, Miers 1884, p. 273, pl. 30, fig. A (Port Moller; Albany Island; Thursday Island; Prince of Wales Channel). Henderson 1888, p. 114 (Arafura Sea south of Papua; Flinders Passage). Ortmann 1894, pp. 29, 30 (Thursday Island).
Pachycheles sculptus, Ortmann 1894, p. 29. Haig 1964, p. 368.
Pachycheles pisum, Rathbun 1924, p. 30 (Cape Jaubert). Ward 1928, p. 245 (Capricorn and Bunker Groups).
? *Pachycheles sculptus*, Ward 1928, p. 245 (Capricorn and Bunker Groups).

Diagnosis. Front broad, transverse in dorsal view and trilobate in frontal view; anterior regions of carapace smooth; carapace and chelipeds devoid of hairs. Chelipeds, especially carpus and chela, extremely variable: Chela entirely smooth, or with incipient smooth, longitudinal ridges, or with surface somewhat pitted, or with four smooth, narrow, longitudinal ridges, latter often crossed by slightly oblique grooves to form rows of close-set tubercles; the wide interspaces between these rows smooth, pitted, or with small, wide-set tubercles. Chelae similar in ornamentation, or minor more strongly ridged and tuberculate than major. Carpus completely smooth, or with low, somewhat overlapping tubercles, or with irregular rows of strong, squamate tubercles, some of them transversely elongate. No pleopods in males.

Material examined. 1 ♂, 23 miles S.W. of Troughton I., 25 fm, W.A.M. 336-62. 1 ♂, 2 ♀, Pender Bay, 1932, Mrs. B. Grey, B.M.N.H. 10 ♂, 11 ♀, Broome, June 1932, A.M. P.10222. 1 ♂, off Roebuck Bay, 5-9 fm, June-Oct. 1929, A. A. Livingstone, A.M. P.14124. 2 ♂, entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14100. 1 ♂, 1 ♀, near entrance to Roebuck Bay, 5-8 fm, 26.ix.1929, A. A. Livingstone, A.M. P.14081. 1 ♂, Roebuck Bay, 1932, Mrs. B. Grey, B.M.N.H. 2 ♂, 10-20 miles W. of Lagrange Bay, 12-25 fm, W.A.M. 347-62. 2 ♀, 40 miles W. of Cape Jaubert, 23 fm, W.A.M. 326-62 & 329-62. 1 ♂, 1 ♀, 42 miles W.S.W. of Cape Jaubert, 70 ft, 26.v.1911, E. Mjöberg, U.S.N.M. 56400. 1 ♂, 42 miles W.S.W. of Cape Jaubert, 70 ft, 30.v.1911, E. Mjöberg,

U.S.N.M. 56401. 1 ♀, 42 miles W.S.W. of Cape Jaubert, 48 ft, 16.vii.1911, E. Mjöberg, U.S.N.M. 56399. 1 ♂, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, Sept. 1929, A. A. Livingstone, A.M. P.14106. 3 ♂, 3 ♀, 60 miles W. x N. of Bedout I., 25 fm, W.A.M. 342-62 & 343-62. 1 ♀, N.E. side Rosemary I., Dampier Archipel., under stones at low tide, W.A.M. 358-62. 11 ♂, 9 ♀, 3-4 miles off E. end Delambre I., Dampier Archipel., 10 fm, W.A.M. 125-60 & 126-60. 1 ♂, 1 ♀, 2 miles W. of Legendre I., Dampier Archipel., 23 fm, W.A.M. 128-60. 1 ♂, Malus I., Dampier Archipel., 10 fm, W.A.M. 180-60. 1 ♀, W. approaches to Mermaid Strait, Dampier Archipel., 20 fm, W.A.M. 117-60. 1 ♂, 1 ♀, Exmouth Gulf or Shark Bay, trawled, W.A.M. 76-62. 1 juv., off Shark Bay, 121 m, "Umitaka Maru", W.A.M. 356-60. 1 ♀, Point Gregory, N.W. side Peron Peninsula, Shark Bay, under stones at low tide, W.A.M. 196-60. 3 ♂, 2 ♀, N.E. side Peron Flats, Shark Bay, from sponges and trawl trash, W.A.M. 354-62 & 355-62. 1 ♂, N.W. of Middle Bluff, Shark Bay, 7-8 m, 21.ix.1905, St. 1, Hamburg S.W. Australia Exped., Z.M.H. 11635. 2 ♂, 2 ♀, 1 juv., N.N.E. of N. point Heirisson Prong, Shark Bay, 11-12½ m, 18.vi.1905, St. 15, Hamburg S.W. Australia Exped., Z.M.H. 11667. 2 ♂, near bar of South Passage, Shark Bay, 6 fm, W.A.M. 338-62. 5 ♂, 4 ♀, Shark Bay, W.A.M. 321-62, 332-62, 334-62, & 337-62. 1 ♂, 1 ♀, Cottesloe, W.A.M. 21-64

Remarks. See Haig (1964) for a discussion of nomenclature and intraspecific variation in this species. In that paper mention was made of two unnamed species of *Pachycheles*, both of which have been confused with *P. sculptus*. These two species are here described; both of them are Australian forms although only one is known from Western Australia.

The colour pattern has disappeared in most of the material examined. A few specimens show traces of a median longitudinal white stripe on the carapace. Males to 8.2 mm; non-ovigerous females to 3.5 mm; ovigerous females to 11.7 mm (not all material measured). Ovigerous females in January and April at Shark Bay; May at Cape Jaubert and Dampier Archipelago; June at Broome, Dampier Archipelago, and Shark Bay; July at Cape Jaubert and Shark Bay; August at Dampier Archipelago; September at Broome and Shark Bay; October at Cape Jaubert and Bedout Island.

Distribution. Mergui Archipelago, China, Philippines, East Indies, Ryukyu Islands, Loyalty Islands, Australia (Western Australia and Queensland). *Pachycheles sculptus* has been reported from a few localities in the western Indian Ocean, but these records are based on *P. natalensis* (Krauss). Several additional records need confirmation; some may be based on one or the other of the two species described below.

Pachycheles johnsoni, sp. nov.

(Fig. 1)

Description. Carapace strongly convex front to back, its surface smooth in median portion and with a series of transverse grooves along lateral margins, and distinctly roughened by grooves in anterolateral region. Front broad,

transverse in dorsal view and with a median triangular lobe in frontal view; inner orbital angles subrectangular. Orbits concave; outer orbital angle produced into a small, acute tooth. Separated portion of lateral wall of carapace consisting of a single large piece. Carapace devoid of hairs.

First movable antennal segment with a conical tubercle on anterior margin; second lightly granular, without anterior projection; third nearly smooth; flagellum setose.

Chelipeds not greatly differing in size in females, rather more unequal in large males; devoid of hair. Merus rugose to nearly smooth on dorsal surface; inner margin armed with a strongly projecting, subrectangular lobe. Carpus with three (rarely four) broad, strongly projecting teeth on inner margin, in some specimens proximal tooth largest and others successively smaller, in other specimens all teeth subequal in size; these teeth smooth or punctate on their dorsal surfaces, and their

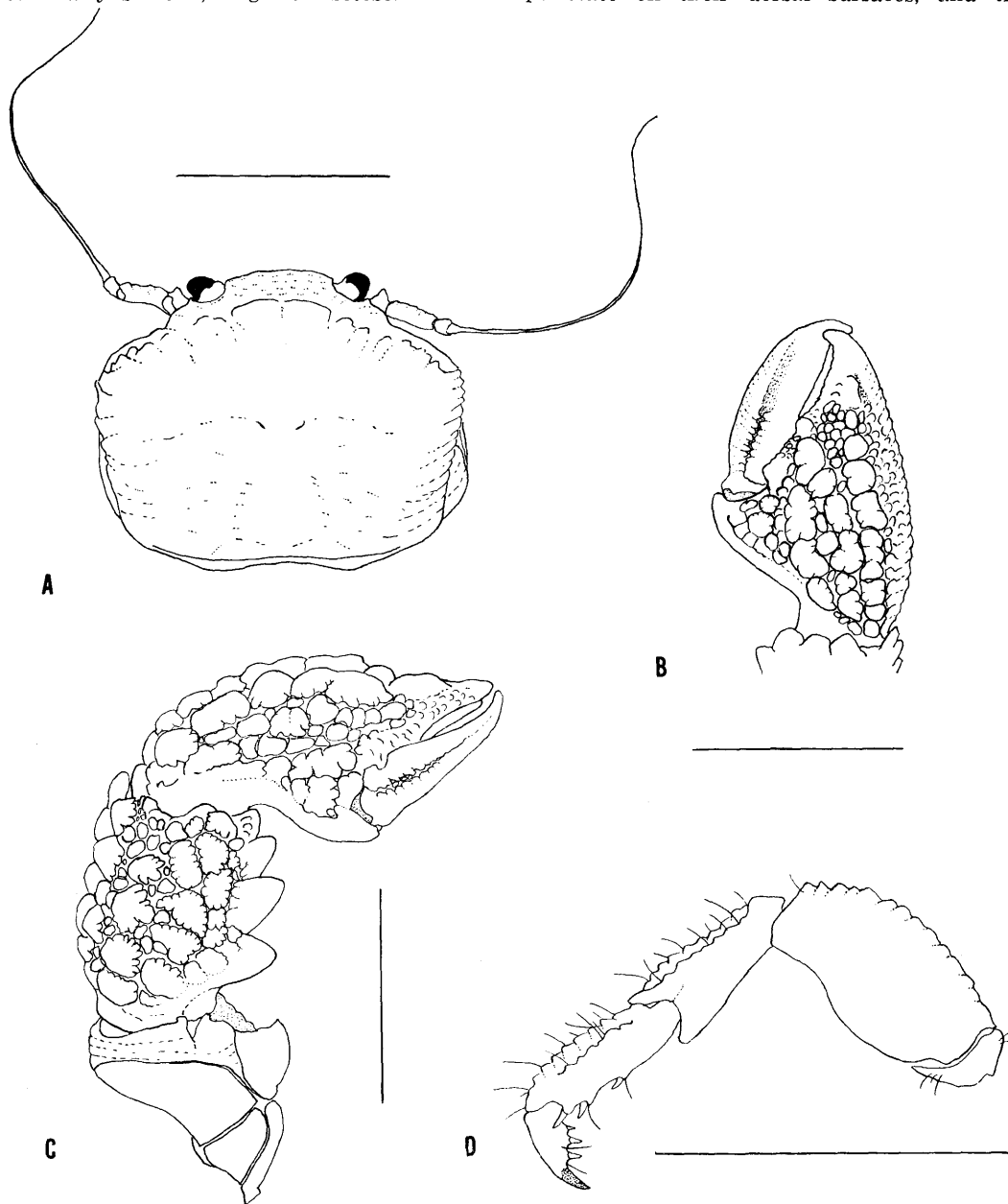


Figure 1.—*Pachycheles johnsoni*. Female paratype. A, dorsal view of carapace; B, right (minor) chela, straight dorsal view; C, left (major) cheliped; D, left walking leg. Scales = 5 mm.

margins entire in all Australian material examined. Upper surface of carpus (except anterior teeth) completely covered with large tubercles, which are rounded or somewhat elongate, high-topped, and with edges scalloped and sometimes free all the way around or at least on their distal side, thus forming mushroom-shaped structures similar to those found in several species of hermit crabs of genus *Pylopagurus*; edges of tubercles generally touching each other, but occasional gaps filled with smaller tubercles which may be less projecting than the large ones. Manus covered with mushroom-shaped tubercles of same size and structure as those of carpus; on manus, however, largest ones tend to be arranged in more or less even, longitudinal rows, spaces between the rows entirely filled with smaller, less projecting tubercles; outer row of tubercles sometimes partially coalesced to form a longitudinal ridge, deeply cut and scalloped along its margins. Dactyl smooth or punctate on upper surface; its proximal half with a deep, longitudinal groove which may be scalloped on its edges and filled with a few low tubercles; proximal portion of pollex tuberculate. Lower surface of chela somewhat punctate, that of carpus obliquely rugose near outer margin, elsewhere nearly smooth.

Walking legs covered with long, stiff, non-plumose hairs. Carpus and propodus roughened and grooved on their upper and outer surfaces. Dactyl with three well-developed, moveable spinules on lower margin, in addition to fixed terminal claw; proximal to these spinules one or two additional, smaller ones sometimes developed.

Telson of abdomen five-plated. No pleopods in males.

Holotype male (6.8 by 7.6 mm), Point Gregory, N.W. side of Peron Peninsula, Shark Bay, under stones on limestone reef flat, 1.i.1960, B. R. Wilson, W.A.M. 197-60.

Paratypes. NORTHERN TERRITORY: Between North and South Shell Is., Port Darwin, 3-7 fm, A. A. Livingstone: 1♂, 1♀, 2.vii.1929, A.M. P.14761; 1♂, 4.vii.1929, A.M. P.14760; 1♀, 5.vii.1929, A.M. P.14084. WESTERN AUSTRALIA: 2♀, Entrance Point, Broome, rocky reef between tides, Aug. 1929, A. A. Livingstone, A.M. P.14086. 1♀, Gantheaume Point, between tide marks, Sept. 1929, A. A. Livingstone, A.M. P.14090. 1♀, between Broome and Cape Bossutt, 5 fm, June-Oct. 1929, A. A. Livingstone, A.M. P.14075. 1♂, Port Hedland, Sept. 1961, Brown, W.A.M. 33-62. 1♀, Point Gregory, N.W. side Peron Peninsula, Shark Bay, under stones on reef flat, 1.i.1960, B. R. Wilson, W.A.M. 197-60. 1♀, at and near Brown Station, Dirk Hartog I., Shark Bay, ½-3 m, 18.ix.1905, St. 30, Hamburg S.W. Australia Exped., Z.M.H. 11707. 1♀, 3 miles W. of Carnac I., 16 fm on sponge, 13.viii.1962, R. W. George on "Bluefin", W.A.M. 324-62. 1♂, 1♀, Cape Leeuwin, W.A.M. 227/8-30.

Remarks. In a juvenile male (about 2.5 mm) the sculpturing on the margin of the tubercles of the chelipeds is clearly visible, although the roughness of the anterior margin of the carapace is less so. Juvenile *Pachycheles sculptus* of comparable size, while they may have rather

strongly tuberculate chelipeds, lack scalloping on the tubercles and the gaps between the rows of tubercles are smooth. Where the chelipeds differ in size in *P. johnsoni*, the degree of sculpturing is not appreciably different in the two; in *sculptus* it is often very different.

I have examined considerable material of a small *Pachycheles* collected on coral reefs in the Caroline and Marshall Islands. Although these specimens differ in several respects from the Australian material of *P. johnsoni*, I am inclined to believe that they represent no more than a variety of the latter. There tend to be more teeth (usually five) on the inner margin of the carpus, and the margins of these teeth are scalloped or dentate. The scalloped-edged tubercles on the carpus and chela form a flat paving instead of having strongly projecting, convex surfaces. There are usually five rather than three movable spinules on the lower surface of the dactyl of the walking legs. At least a part of the Palau Islands specimens treated by Miyake (1942, p. 374) as *P. sculptus* refer to *P. johnsoni* and show some of the characters just mentioned.

In those specimens still retaining traces of colour pattern, there is a median, longitudinal white stripe on the carapace very much as in *P. sculptus*. In one specimen the edges of the white area begin to diverge just posterior to the protogastric region, until at the posterior margin it occupies about half of the carapace breadth. Males to 6.8 by 7.6 mm; non-ovigerous females to 6.7 by 8.1 mm; ovigerous females to 7.4 by 9.5 mm. Ovigerous females in January of Shark Bay; July at Port Darwin; August at Broome; September at Gantheaume Point and Shark Bay.

I am pleased to dedicate this species to Dr. D. S. Johnson, to whom I am indebted for helpful suggestions concerning its status.

Distribution. Palau, Caroline and Marshall Islands; Australia (Western Australia and Northern Territory), at localities listed above. Other specimens now referred to *P. sculptus* may prove, on reexamination, to belong to *P. johnsoni*.

Pachycheles granti, sp. nov.

Pachycheles sculptus, Grant and McCulloch 1906, p. 40, pl. 2, fig. 1 (Mast Head Island; Cabbage Tree Bay). McNeill and Ward 1930, p. 364 (Collaroy).

Description. Carapace convex front to back; surface more or less smooth except in frontal region and along lateral margins; hepatic and protogastric regions well marked. Front broad, transverse in dorsal view and with a median triangular lobe in frontal view; inner orbital angles subrectangular. Orbits deeply concave; outer orbital angle produced into a strong, narrow, acute tooth. Separated portion of side walls of carapace consisting of a single large piece. Carapace devoid of hairs.

First movable antennal segment with a conical tubercle on anterior margin; second lightly granular, without anterior projection; third nearly smooth; flagellum setose.

Chelipeds markedly unequal in size. Merus nearly smooth or with several small tubercles on dorsal surface; inner margin armed with

a strongly projecting, conical lobe. Carpus with three broad, strongly projecting teeth on inner margin; these teeth smooth, with entire or minutely crenulate margins, and usually subequal in size. Upper surface of carpus (exclusive of marginal teeth) covered with five longitudinal rows of well-separated, strongly projecting tubercles, irregularly rounded or somewhat elongate, and covered except at their apices with very short, close-set hairs. Manus likewise with five rows of tubercles, similar in size, arrangement, and setation to those of carpus. Dactyl covered with tubercles, usually more strongly projecting in proximal portion, and with a deep, longitudinal groove; pollex with small, flattened tubercles. Lower surface of chela nearly smooth except for a row of small tubercles near outer margin.

Carpus and propodus of walking legs with long, stiff, non-plumose setae on their anterior margins.

Telson of abdomen five-plated. No pleopods in males.

Holotype male (6.8 by 7.1 mm). Shelly Beach, Yamba, near mouth of Clarence River, on reef, Jan. 1939, A. A. Cameron, A.M. P.14778.

Paratypes. QUEENSLAND: 1♂, 1♀, Mast Head I., presented by F. E. Grant, B.M.N.H. NEW SOUTH WALES: 1♂, 1♀, Angourie Point, Yamba, mouth of Clarence R., Sept. 1938, A. A. Cameron, A.M. P.11000. 2♀, Angourie Point, Oct. 1939, A. A. Cameron, A.M. P.11193. 1♂, 1♀, Angourie Point, Dec. 1939, A. A. Cameron, A.M. P.11249. 1♂, reef at Shelly Beach, Yamba, near mouth of Clarence R., A. A. Cameron, A.M. P.11027. 1♀, Shelly Beach, reef, Jan. 1939, A. A. Cameron, A.M. P.11017. 1♂, reef at Shelly Beach, Nov. 1939, A. A. Cameron, A.M. P.11190. 1♂, Shelly Beach, Jan. 1939, A. A. Cameron, A.M. P.11003. 1♂, Woody Head, Iluka, mouth of Clarence R., Sept. 1960, A. A. Cameron, A.M. P.13482. 3♂, 2♀, Long Reef, Collaroy, Apr. 1928, M. Ward, A.M. P.9073. 2♂, Cabbage Tree Bay (Shelly Beach) on coast at Manly, T. Whitelegge, A.M. P.14762. 1♀, Bottle and Glass Rocks, Port Jackson, Apr. 1933, G. P. Whitley, A.M. P.10295.

Remarks. Although many of the records do not so indicate, all the material listed above was presumably collected intertidally or in shallow water. In reference to the five specimens from Collaroy, McNeill and Ward (1930) state: "In canals of a tough encrusting sponge on the under surfaces of flat stones occurring in shallow water below low tide mark." Males to 6.8 by 7.1 mm; ovigerous females to 6.8 by 7.7 mm. Ovigerous females in April at Collaroy and Port Jackson; September, October, December, and January at Yamba.

Distribution. Known only from Queensland and New South Wales.

Pachycheles pisoides (Heller)

Porcellana pisoides Heller 1865, p. 73, pl. 6, fig. 3 (Nicobar Islands).

Pachycheles lifuensis Borradaile 1900, p. 424 (Loyalty Islands).

Pachycheles pisoides, Edmondson 1925, p. 19. Haig 1964, p. 371.

Pachycheles fronto Melin 1939, p. 114, text-figs. 69-71 (Bonin Islands).

Pisosoma fronto, Miyake 1943, p. 113, text-figs. 40-41.

Diagnosis. Front broad, sinuously triangular or faintly trilobate in dorsal view, trilobate in frontal view. Carapace with scattered, short, non-plumose hairs; chelipeds and walking legs covered with short and long non-plumose hairs. Inner margin of carpus of chelipeds with four strong, pointed teeth. Chela tuberculate near and on outer margin. Males with a pair of pleopods.

Material examined. 1♂, Port Gregory, under stones on reef flat at low tide, 26.xii.1962, B. R. Wilson, W.A.M. 4-63.

Remarks. The single specimen was pale orange, with a broad band of darker orange on the propodus of each walking leg. The carapace was 4.6 by 5.0 mm.

Distribution. Seychelles, Nicobar Is., Loyalty Is., Norfolk I., Kermadec Is., Ryukyu Is., Eonin (Ogasawara) Is., Hawaiian Is. Now recorded from Australia.

Genus PISIDIA Leach

Diagnosis. Basal antennal segment strongly produced forward and broadly in contact with anterior margin of carapace; movable segments far removed from orbit. Carapace usually rounded; armature various, but lateral carapace spines always present. Front prominent, strongly tridentate or trilobate. Chelipeds differing in size and form; fingers of one or both chelipeds twisted out of plane with manus, the distortion always most pronounced in the smaller cheliped. Sexually dimorphic: twisting of fingers more pronounced in adult males, less so in females and juveniles; spinulation of carapace and chelipeds frequently stronger in females and juveniles than in males. Dactyl of walking legs ending in a single terminal claw, lower margin with a row of movable accessory spinules, the most distal one often stout, enlarged. Telson of abdomen seven-plated.

Key to Western Australian species of Pisidia

1. Front strongly deflexed, median lobe much more strongly projecting than lateral lobes *dispar*
- Front not deflexed, the three lobes about equally advanced 2
2. (1) Lateral frontal lobes bidentate and medium lobe quadridentate, front thus consisting of eight small, subequally projecting teeth *spinuligera*
- Front consisting of three simple lobes, spinulate on their margins *cf. spinulifrons*

Pisidia spinuligera (Dana)

Porcellana armata Dana 1852, p. 426 (Mangsi Island N. of Borneo). Miyake 1942, p. 356, text-figs. 17-19.

Porcellana spinuligera Dana 1853, p. 1593 (new name for *P. armata*, preoccupied); 1855, pl. 26, fig. 14.

Porcellana latifrons Stimpson 1858, pp. 229, 243 (Hong Kong and Ousima Island); 1907, p. 190, pl. 23, fig. 4. Rathbun 1924, p. 31 (Cape Jaubert).

Porcellana danae Heller 1865, p. 74 (new name for *P. armata*).

Petrolisthes helleri Kingsley 1880, p. 405, footnote (new name for *Porcellana danae*, preoccupied).

Pisidia spinuligera, Haig 1960, p. 208.

Diagnosis. Front very broad, not deflexed, somewhat produced beyond eyes; median lobe broad and quadridentate, narrow lateral lobes

bidentate, entire front thus consisting of eight small, subequally projecting, pointed teeth. A strong hepatic spine; one or two minute spinules at epibranchial angle; three strong spines on lateral margin posterior to cervical groove. Merus of chelipeds with strong inner lobe, toothed on its margin. Carpus with three or four shallow teeth on inner margin; outer margin with three strong spines including one at distal end. Chela with a row of spinules on proximal half, just to inside of outer margin. Merus of walking legs unarmed on anterior margin.

Material examined. 3♂, 6♀, Pender Bay, Mar. 1931, Mrs. B. Grey, B.M.N.H. 2♂, 1♀, Broome, June 1932, A.M. P.14448. 1♂, near entrance to Roebuck Bay, 5-9 fm, 26.ix.1929, A. A. Livingstone, A.M. P.14450. 1♂, 1♀, entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14451. 1♂, 1♀, between tides, June-Oct. 1929, A. A. Livingstone, A.M. P.14077. 1♂, 2♀, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, Sept. 1929, A. A. Livingstone, A.M. P.14093 & P.14449. 1♂, 45 miles W.S.W. of Cape Jaubert, 72-80 ft., 7.vii.1911, E. Mjöberg, U.S.N.M. 56434. 2♀, at and near Brown Station, Dirk Hartog I., Shark Bay, ½-3 m, 18.ix.1905, St. 30, Hamburg S.W. Australia Exped., Z.M.H. 11708. 1♂, 1♀, S.E. Dirk Hartog I., Shark Bay, among coral, Jan. 1957, B. R. Wilson, W.A.M. 206/7-57. 2♂, entrance to South Passage, Shark Bay, 9 m, 16.vi.1905, St. 23, Hamburg S.W. Australia Exped., Z.M.H. 11687. 1♀, N.W. of Heirisson Prong, Shark Bay, 11-12½m, 13.ix.1905, St. 16, Hamburg S.W. Australia Exped., Z.M.H. 11676. 12♂, 11♀, 3 juv., N.N.E. of Heirisson Prong, Shark Bay, 11-12½m, 18.vi.1905, St. 15, Hamburg S.W. Australia Exped., Z.M.H. 11666. 1♂, 2♀, Freycinet Reach, Shark Bay, 11-16 m, 12.ix.1905, St. 14, Hamburg S.W. Australia Exped., Z.M.H. 11664. 1♀, c. 2½ miles S.W. of Denham, Shark Bay, 3 m, 10.vi.1905, St. 7, Hamburg S.W. Australia Exped., Z.M.H. 11651. 1♂, c. 6 miles S. of Denham, Shark Bay, 4½-5 m, 18.vi.1905, St. 8, Hamburg S.W. Australia Exped., Z.M.H. 11654. 3♂, 1♀, Wreck Point, Abrolhos Is., southern group, 20.iv.1958, A. Robinson, W.A.M. 114-60. 2♂, 5♀, Abrolhos Is., southern group, Mar.-Aug. 1960, W.A.M. 173-60.

Remarks. The name originally given by Dana to this species, *Porcellana armata*, was preoccupied by *Porcellana armata* Gibbes 1850 (= *Petrolisthes armatus*). Dana himself introduced *Porcellana spinulifrons* as a substitute, a fact which has been generally overlooked; Heller and Kingsley later introduced unnecessary substitute names into the synonymy. *Porcellana latifrons* Stimpson is a synonym of Dana's species.

Carapace, abdomen, and chelipeds orange, with irregularly shaped white spots. A red spot or streak about midway along upper margin of dactyl of cheliped; spines along lower margins of palm red. Merus and carpus of walking legs spotted; propodus white, with a thin, longitudinal orange stripe on upper margin and two each on inner and outer surfaces. Males to 7.1 mm; non-ovigerous females to 7.8 mm; ovigerous females to 4.9 mm. Ovigerous females

in March at Pender Bay; April at Abrolhos Islands; September between Cape Jaubert and Wallal.

Distribution. Ryukyu Is.; Palau Is.; Hong Kong; East Indian Archipelago. Reported once from Australia (off Cape Jaubert, Western Australia). Heller's (1865) Nicobar Islands record needs confirmation; to judge from his description he may have had a different species.

Pisidia cf. *Spinulifrons* (Miers)

Porcellana [allied to *serratifrons*], Miers 1884, p. 277 (Thursday Island).

?*Porcellana serratifrons*, Henderson 1888, p. 110 (part: Arafura Sea, not Hong Kong specimen nor pl. 11, figs. 5, 5a). Grant and McCulloch 1906, pp. 39, 40 (Mast Head Island; Port Denison).

Porcellana spinulifrons, Gordon 1931, p. 530, text-figs. 4c, 5.

Diagnosis. Front not deflexed; median lobe broad, spinulate on its distal margin, and slightly advanced beyond narrow lateral lobes which are spinulate on their inner margins. A strong hepatic spine; epibranchial margin with several fine spinules (very small in large specimens); three or four spines on lateral margin posterior to cervical groove. Merus of chelipeds with large inner lobe, its margin with a strong spine and several spinules. Carpus with two or three teeth on proximal portion of inner margin, and a few smaller spines on distal portion (in some large specimens, this armature reduced to very shallow lobes); outer margin sometimes with a row of spines, but these not always developed. Chela with a row of spines along outer margin (not always developed in large specimens). Merus of walking legs unarmed on anterior margin.

Material examined. 1♀, Broome, July 1905, Gale for Hamburg S.W. Australia Exped., Z.M.H. 11630. 19♂, 14♀, Broome, June 1932, A.M. P.10214. 1♀, Entrance Point, Broome, shore between tides on rocky reef, Aug. 1929, A. A. Livingstone, A.M. P.14769. 2♂, off Gantheaume Point, 4 fm, Aug. 1929, A. A. Livingstone, A.M. P.14079. 1♀, off Gantheaume Point, 4 fm, 30.viii.1929, A. A. Livingstone, A.M. P.14095. 2♀, off Roebuck Bay, 5-9 fm, June-Oct. 1929, A. A. Livingstone, A.M. P.14122. 13♂, 3♀, entrance to Roebuck Bay, 9 fm, diver, 15.viii.1929, A. A. Livingstone, A.M. P.14094 & P.14121. 2♂, near entrance to Roebuck Bay, 5-9 fm on Lithothamnion reef, 26.ix.1929, A. A. Livingstone, A.M. P.14114. 1♀, Roebuck Bay, 9 fm, Aug. 1929, A. A. Livingstone, A.M. P.14768. 4♂, 1♀, Roebuck Bay, between tides on sand flat, 8.viii.1929, A. A. Livingstone, A.M. P.14120. 1♂, Roebuck Bay, 5 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14096. 1♂, off Cape Bossutt, 4 fm, 9.ix.1929, A. A. Livingstone, A. M. P.14104. 5♂, 2♀, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, Sept. 1929, A. A. Livingstone, A.M. P.14099. 2♂, 1♀, off Ninety Mile Beach near Wallal, 5 fm on gorgonids, Sept. 1929, A. A. Livingstone, A.M. P.14119. 3♂, 1♀, Port Hedland, Sept. 1961, Brown, W.A.M. 26-62. 11♂, 3♀, Onslow, July 1905, Gale for Hamburg S.W. Australia Exped., Z.M.H. 11624.

Remarks. This species is the one discussed and illustrated by Gordon (1931) under the name *Porcellana spinulifrons* Miers (Hong Kong specimens). D. S. Johnson, who examined the

types of *P. spinulifrons* Miers 1879 in the British Museum (Natural History), has informed me (personal communication) that the latter species is not identical with the one treated by Gordon. Dr. Johnson plans to name Gordon's species and to discuss it and several closely related forms in a forthcoming publication.

The Australian specimens referred to *Porcellana serratifrons* Stimpson 1858 by Henderson and by Grant and McCulloch should be re-examined; they very likely belong to the present species. In addition to the Thursday Island specimens collected by the "Alert" and mentioned by Miers, I have seen considerable material of this species from Northern Territory and Queensland. As for its extra-Australian distribution, there has been so much confusion with *serratifrons*, *spinulifrons*, and other forms that the range cannot be determined until several species are redefined and many specimens reexamined.

Males to 7.6 mm; non-ovigerous females to 5.2 mm; ovigerous females to 6.4 mm. Ovigerous females between June and October at Roebuck Bay; in July at Onslow; August at Gantheaume Point; September at Ninety Mile Beach and Port Hedland.

Distribution. Indian and western Pacific Oceans; more precision will have to await future studies, as noted above. Australia: Thursday Island and several other localities in Queensland and Northern Territory. Now recorded from Western Australia.

Pisidia dispar (Stimpson), n. comb.

Porcellana dispar Stimpson 1858, pp. 229, 242 (Port Jackson); 1907, p. 190, pl. 23, fig. 3. Haswell 1882b, p. 149 (Port Jackson; Port Stephens). Miers 1884, p. 275, pl. 30, fig. C (Port Jackson). Whitelegge 1889, p. 231 (Neutral Bay). Stead 1898, p. 208 (Port Jackson). Grant and McCulloch 1906, p. 40 (Port Curtis). Rathbun 1924, p. 31 (Cape Jaubert). Hale 1927a, p. 82, text-fig. 79 (South Australia); 1927b, p. 309 (Investigator Straits; Kangaroo Island).

Porcellana rostrata Baker 1905, p. 260, pl. 35, figs. 1, 1a-b (Investigator Straits).

Diagnosis. Frontal region depressed, its margin appearing transverse or convex in dorsal view; medium lobe sharply deflexed, visible only in frontal view, broad, forming an acute angle, and more projecting than lateral lobes. A strong hepatic spine; epibranchial margin unarmed; one or two small spines on lateral margin posterior to cervical groove. Merus of chelipeds with a strong, unarmed inner lobe. Carpus with three low, shallow teeth, directed distally, or three broad, shallow lobes on inner margin, the median tooth or lobe sometimes obsolete; outer margin with two or three small spines or teeth. Chela with a row of sharp granules or small spinules along outer margin. Merus of walking legs unarmed on anterior margin.

Material examined. 3♂, 1♀, Broome, June 1932, A.M. P.10209. 1♂, 2♀, Entrance Point, Broome, Aug. 1929, A. A. Livingstone, A.M. P.14102. 1♂, Gantheaume Point, 5.viii.1929, A. A. Livingstone, A.M. P.14118. 2♂, entrance to Roebuck Bay, 15.viii.1929, A. A. Livingstone, A.M. P.14076. 1♂, near entrance to Roebuck Bay, 26.ix.1929, A. A. Livingstone, A.M. P.14766.

1♂, off Cape Bossutt, 9.ix.1929, A. A. Livingstone, A.M. P.14767. 2♂, 2♀, Surf Point, entrance to South Passage, Shark Bay, 16.vi.1905, St. 23, Hamburg S.W. Australia Exped., Z.M.H. 11687. 1♂, 1♀, near bar of South Passage, Shark Bay, W.A.M. 339-62. 1♂, 1♀, Triggs I., W.A.M. 46-62. 1♀, 5 miles N. of E. end Rott-nest I., W.A.M. 124-60. 1♂, 2 miles W.N.W. of Cottesloe, W.A.M. 350-62. 9♂, 3♀, Cottesloe, W.A.M. 10424/7, 10560/4, 11036, & 591-30. 2♀, Owen Anchorage off Sth. Fremantle Power House, W.A.M. 115-60. 1♂, N.E. of Garden I., W.A.M. 142-60. 1♂, 1♀, Careening Bay, Garden I., W.A.M. 138-60. 6♂, 3♀, Cockburn Sound, W.A.M. 133-60, 139-60, 141-60, 41-62, 42-62, 44-62, & 49-62. 1♂, Port Royal and N., Cockburn Sound, 30.ix.1905, St. 48, Hamburg S.W. Australia Exped., Z.M.H. 11723. 1♂, 1♀, Kwina-na, 2-300 yards N.W. of no. 2 light buoy, W.A.M. 123-60. 6♂, 14♀, Palm Beach, W.A.M. 134-60. 3♂, 3♀, Warnbro Sound, 29.ix.1905, St. 53, Hamburg S.W. Australia Exped., Z.M.H. 11731.

Remarks. Males to 5.0 mm; non-ovigerous females to 3.2 mm; ovigerous females to 4.2 mm. Collected on reefs between tides, on boom piles, and in depths to 19½ fms. Ovigerous females in January and April at Cockburn Sound; March at Garden I. and Triggs I.; May at Rottnest I.; June at Broome and Shark Bay; August at Broome; December at Fremantle and Cockburn Sound.

Distribution. Reported only from Australia (Western Australia, South Australia, New South Wales, and Queensland).

Genus PORCELLANA Lamarck

Remarks. *Porcellana*, as it now stands, contains an assemblage of species which are not very closely related and should probably be assigned to several genera or at least subgenera. Such a revision must await a comparative study on a worldwide basis, for at present the relationships of the various species to each other and to those placed in certain other genera are unclear. In the meantime, I find it impossible to devise a satisfactory diagnosis for *Porcellana*.

Of the Western Australian species, *Porcellana habei* is the only one belonging to a group of forms allied to the type species, *P. platycheles* (Pennant). *P. gravelei*, with its tendency toward distortion of the dactyl of the minor chela, approaches *Pisidia*, but has a quite different general appearance from most members of that genus, particularly as regards the stoutness of the carpi of the chelipeds and the rather shallowly lobed front. Its closest affinities are perhaps with *P. foresti* Chace, a West African species. *P. ornata* bears a superficial resemblance to some members of genus *Petrolisthes*, particularly in the form of the chelipeds with their broad, flattened chelae; more than one author has assigned it to that genus. *P. nitida* and *P. furcillata* belong to a group of species which have two strong fixed claws on the dactyl of the walking legs, but which differ greatly from one another in several other characters.

Key to Western Australian species of Porcellana

1. Dactyl of walking legs with a single terminal claw and a row of accessory spinules 2
 - Dactyl with two strong, subequal fixed claws 4
2. (1) Front horizontal, strongly tridentate in dorsal view *habei*
 - Front strongly deflexed, appearing triangular in dorsal view 3
3. (2) Carapace nearly smooth; chelipeds obliquely rugose *gravelei*
 - Carapace strongly areolated and tuberculated; chelipeds tuberculate *ornata*
4. (1) Chelipeds and lateral margins of carapace unarmed; frontal teeth with entire margins *nitida*
 - Chelipeds and lateral margins of carapace armed with spines; frontal teeth spined *furcillata*

Porcellana habei Miyake

Porcellana habei Miyake 1961, p. 240, text-fig. 3 (Kyushu, Japan).

Diagnosis. Carapace smooth, strongly convex laterally. Front strongly tridentate, horizontal; median tooth with distinct longitudinal groove, more produced than lateral teeth and separated from them by a broad U-shaped notch; the three teeth subequal in breadth. Outer orbital angle produced into a large, acute tooth. Lateral margin of carapace with a distinct notch at cervical groove. Chelipeds subequal. Merus with a prominent, unarmed lobe on inner margin. Carpus with a low, broad lobe on inner margin and with a median longitudinal crest, this crest continued on chela which lies obliquely to plane of carapace and has a fringe of hair along outer margin. No armature on anterior margins of walking legs; propodus unarmed on posterior margin except for pair of spinules at distal end; dactyl with a single terminal claw and with three or four ventral spinules, the most distal one enlarged.

Material examined. 1♂, 40 miles W. of Cape Jaubert, 23 fm on sponge, 13.x.1962, R. W. George on "Dorothea", W.A.M. 327-62.

Remarks. Except in a few details, the Cape Jaubert specimen agrees very closely with Miyake's description and illustration. The frontal teeth are minutely crenulate along their margins and the median tooth notched just at the tip, characters not mentioned by Miyake. There is a small notch at the epibranchial angle, instead of the pronounced tooth shown in Miyake's illustration; and the merus of the third walking legs is much shorter and stouter than that of the other two pairs, whereas in Miyake's illustration it is about the same in all three pairs of walking legs. Since *Porcellana habei* was described from only two specimens, and the present example is the first to be reported since, no statement can be made as yet about the degree of normal variation; should the differences just mentioned prove to be constant, the Western Australian specimen will probably have to be assigned to a separate species. *Porcellana pulchra* Stimpson 1858, which has been recorded only from Japan and China, is a closely related form but differs markedly in the shape of the front, the median tooth being much broader than the lateral ones.

There are indistinct patches of pale orange on the anterior part of the carapace and on the chelae, especially at the base of the dactyl; according to Miyake, specimens preserved in alcohol were pale orange. The Cape Jaubert specimen measured 4.9 by 4.1 mm as compared with 5.8 by 5.3 mm and 5.3 by 4.5 mm for the two male types. Miyake's specimens were associated with a hermit crab.

Distribution. Previously known only from Kyushu, Japan. Now recorded from Australia.

Porcellana gravelei Sankolli

Pachycheles sp., Gravely 1927, p. 140, pl. 20, fig. 9.

Porcellana gravelei Sankolli 1963, p. 280, text-fig. 1 (Ratnagiri, India).

Diagnosis. Carapace strongly convex front to back; nearly smooth but with regions well marked. Front broad, well produced beyond eyes, and composed of three rather shallow lobes; frequently the entire frontal region rather strongly deflexed so that the front appears broadly triangular in dorsal view. Hepatic margin, and lateral margins of carapace posterior to cervical groove, minutely crenulate or with one to three minute spinules. Chelipeds subequal in form, but one may be distinctly larger than the other, particularly in large males; covered with close-set, flattened granules and obliquely rugose. Merus with a large, strongly projecting, triangular lobe on inner margin; carpus stout, inner margin with two broad, triangular teeth, frequently coalesced to form a strong lobe. Chela lies obliquely to plane of carapace. Dactyl of minor chela sometimes slightly to strongly twisted out of plane with hand. In males, a thick tuft of pubescence usually present in gape of fingers of minor chela; this never present in females. No armature on anterior margins of walking legs; dactyl with a single terminal claw and with about four movable spinules on lower margin.

Material examined. 1♂, Pender Bay, 1932, Mrs. B. Grey, B.M.N.H. 7♂, Broome, June 1932, A.M. P.10208. 1♀, off Roebuck Bay, 5-9 fm, June-October 1929, A. A. Livingstone, A.M. P.14108. 1♂, entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14763. 2♀, near entrance to Roebuck Bay, 5-8 fm, 26.ix.1929, A. A. Livingstone, A.M. P.14105. 1♂, between Cape Bossutt and Broome, 5 fm, June-October 1929, A. A. Livingstone, A.M. P.14083. 1♂, off Cape Bossutt, 4 fm, 9.ix.1929, A. A. Livingstone, A.M. P.14110. 1♂, Cape Bossutt, shore on reef and sand flat, 13.x.1962, R. W. George on "Dorothea", W.A.M. 320-62. -♂, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, September 1929, A. A. Livingstone, A.M. P.14101. 1♀, off Ninety Mile Beach near Wallal, 5 fm on gorgonid, September 1929, A. A. Livingstone, A.M. P.14115. 2♂, 1♀, Point Gregory, N.W. side Peron Peninsula, Shark Bay, under stones on limestone reef flat at low tide, 1.i.1960, B. R. Wilson, W.A.M. 196-60. 2♂, 3♀, Port Gregory, under stones on reef flat at low tide, 26.xii.1962, B. R. Wilson, W.A.M. 1-63 and 2-63. 4♂, 3♀, Triggs I., 20.iii.1961, W. H. Butler, W.A.M. 39-62. 1♂, 2♀, Cottesloe, W.A.M. 10424/7 and 11036. 3♂, N.E. Garden I., 15 ft. on old

boom piles, 14.iii.1959, P. Barrett Lennard, W.A.M. 142-60. 1♂, Esperance, November 1960, W. H. Butler, W.A.M. 38-62.

Remarks. Sankolli did not mention the characteristic hair tuft, usually present in males but never in females, in the gape of the fingers of the minor cheliped. Neither did he mention the fact that in large males one chela is sometimes distinctly larger than the other, with the dactyl of the minor chela twisted and the fingers gaping instead of approximated along their inner edges. The latter character seems to be found only in the largest males; Sankolli's largest male specimens had a carapace length of no more than 2.5 mm, while some of the Australian examples were as large as 6.5 mm. Males to 6.5 mm; non-ovigerous females to 4.5 mm; ovigerous females to 6.0 mm. Ovigerous females in January at Shark Bay; March at Triggs I.; September at Roebuck Bay; December at Port Gregory.

Distribution. India at Ratnagiri (Sankolli) and at Krusadai Island, Gulf of Mannar (Gravely, as "*Pachycheles* sp."). Now recorded from Australia. In addition to the specimens from Western Australia, listed above, I have seen material from Northern Territory, Queensland, and New South Wales.

Porcellana ornata Stimpson

Porcellana ornata Stimpson 1858, pp. 299, 242 (Hong Kong); 1907, p. 188. Gordon 1931, p. 529, text-fig. 1. Miyake 1943, p. 118, text-figs. 42-43.

Porcellana corallicola Haswell 1882a, p. 759 (Port Molle); 1882b, p. 150.

Petrolisthes? corallicola?, Miers 1884, p. 271, pl. 29, fig. C (Port Molle).

Petrolisthes dorsalis Miers 1884, p. 271.

Porcellana (?Petrolisthes) corallicola var., Walker 1887, p. 113, pl. 8, fig. 5 (Queensland).

Petrolisthes corallicola, Rathbun 1924, p. 29 (Cape Jaubert).

Porcellana sp., Gravely 1927, p. 141, pl. 20, fig. 14.

Diagnosis. Carapace strongly areolated and tuberculated, and sometimes with a few spines developed on dorsal surface; a row of two to six well-developed spinules on lateral margins posterior to cervical groove. Front narrow, well produced beyond eyes, with a deep median groove, and spinulate along its anterior margin; in dorsal view triangular, but in frontal view trilobate with strong median lobe directed downward. A pronounced tooth at outer orbital angle. Chelipeds subequal, spiny-tuberculate; merus with a well-developed lobe on inner margin; carpus with margins subparallel and armed with spinules, dorsal surface with three longitudinal ridges defined by deep sulci. Chelae broad and flat, *Petrolisthes*-like, lying obliquely to plane of carapace; surface with a median longitudinal ridge, outer margins denticulate and fringed with hair. Merus of walking legs with a row of spines on anterior margin; dactyl with a single terminal claw and a row of small movable spinules on lower margin.

Material examined. 1♀, Broome, June 1932, A.M. P.10210. 1♂, Gantheaume Point, between tides, June-October 1929, A. A. Livingstone, A.M. P.14073. 1♀, entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14107. 1♂, off Roebuck Bay, 5-9 fm, June-October 1929,

A. A. Livingstone, A.M. P.14112. 1♂, 45 miles W.S.W. of Cape Jaubert, 72 ft, 7.vii.1911, E. Mjöberg, U.S.N.M. 56406. 1♂, 45 miles W.S.W. of Cape Jaubert, 72 or 80 ft, 7.vii.1911, E. Mjöberg, U.S.N.M. 56405.

Remarks. Examination of a series of specimens from several localities in the Pacific Ocean, in addition to the Australian material, shows that there is considerable intraspecific variation in the degree of areolation of the carapace, tuberculation of the chelipeds, and spinulation of frontal and cheliped margins. There seems to be little doubt that *Porcellana ornata* and *P. corallicola* are synonymous. Males to 5.3 mm; females to 6.0 mm.

Distribution. Southern India; Mergui Archipelago; Japan; Hong Kong; Singapore. Australia (Western Australia and Queensland).

Porcellana nitida Haswell

Porcellana nitida Haswell 1882a, p. 758 (Port Denison); 1882b, p. 148.

Porcellana nitida var. *rotundifrons* Miers 1884, p. 274, pl. 30, fig. B (Port Denison; Friday Island; Dundas Straits; Port Darwin; Arafura Sea).

Diagnosis. Carapace markedly convex both laterally and front to back, smooth, but completely and evenly covered with short, transverse lines. Front horizontal, not deflexed; projecting beyond eyes, trilobate with median lobe very broad, rounded-triangular, more produced than laterals which are very narrow and often not sharply defined; margins of frontal lobes entire. Outer orbital angle produced into a broad tooth, sometimes bifurcate-tipped; a sharp, strong tooth on hepatic margin; epi-branchial angles with a marked lateral projection, unarmed; lateral margins of carapace unarmed posterior to epi-branchial angles. Chelipeds subequal, smooth; carpus broadest distally, its margins unarmed; chelae elongate, lying nearly vertically to plane of carapace, smooth, unarmed; inner margin of fingers with a thick tuft of hair. Anterior margin of walking legs unarmed; dactyl with a deeply bifurcate tip, forming two sub-equal fixed claws, and with a single, small movable spinule on lower margin.

Material examined. 1♂, Broome, June 1932, A.M. P.10203. 1♂, between Broome and Wallal on Ninety Mile Beach, c. 8 fm, 1930, Capt. R. Bourne, A.M. P.9931. 1♂, 10-20 miles W. of Lagrange Bay, 12-25 fm, 13.x.1962, R. W. George on "Dorothea", W.A.M. 348-62. 2♀, 40 miles W. of Cape Jaubert, 23 fm, 13.x.1962, R. W. George on "Dorothea", W.A.M. 330-62. 1♂, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, Sept. 1929, A. A. Livingstone, A.M. P.14080. 1♂, Port Hedland, 1905, Gale for Hamburg S.W. Australia Exped., Z.M.H. 11512.

Remarks. The specimen from the Palau Islands referred to *Porcellana nitida* by Miyake (1942, p. 359, text-figs. 20-22; 1943, p. 129, text-fig. 50) cannot belong to this species because it has a strong tooth on the lateral margin of the carapace behind the epi-branchial angle; in none of the specimens examined, nor in the types, is there an indication of even incipient spinulation or crenulation on the carapace margins. With Miyake's record removed from the synonymy the species becomes restricted to

Australia, where it is perhaps an endemic. Miers' variety *rotundifrons* is based on adults of *P. nitida*, which was described by Haswell from juvenile material. The differences in the form of the front mentioned by Miers can be attributed to growth. Males to 7.4 mm; ovigerous females 7.2 and 7.3 mm, off Cape Jaubert in October.

Distribution. Australia (Northern Territory and Queensland). Now recorded from Western Australia.

***Porcellana furcillata*, sp. nov.**

(Fig. 2)

Description. Carapace a little longer than broad; nearly smooth, with protogastric regions lightly indicated and other regions scarcely marked. Front broad, horizontal, not deflexed, produced beyond eyes; median lobe broad, its surface concave, apex tipped with two or three strong spinules, a larger spine on either side near tip; separated by broad, U-shaped notches from narrow lateral lobes which have their tips acute and curved inward, inner margins armed with several spinules. Outer orbital angle produced into a strong spine; a strong

spine or tooth on hepatic margin; a small but distinct epibranchial spinule. Lateral margins posterior to cervical groove with three or four spinules.

First movable antennal segment with a small anterodistal spinule; second and third unarmed; flagellum long, slender, without hairs.

Chelipeds smooth, devoid of hairs. Merus with a strong inner lobe, its margin crenulate and bearing two teeth; outer margin with two strong spines; lower surface with a strong spine at inner distal angle. Carpus with five to seven shallow, wide-set teeth on inner margin, these teeth varying in size and some of them occasionally much reduced or obsolescent; outer margin with three strong spines including the one at distal end. Chelae elongate, one somewhat larger than other, lying at a very oblique angle to plane of carapace; outer margin with a sharp crest bearing a row of minute granules, these becoming larger on distal portion of manus and on pollex; just to inside of this margin, proximal half of chela with a row of five to eight strong spines. Fingers crossed at tips, which are not notched; outer margin of dactyl smooth, or with a row of fine spinules similar

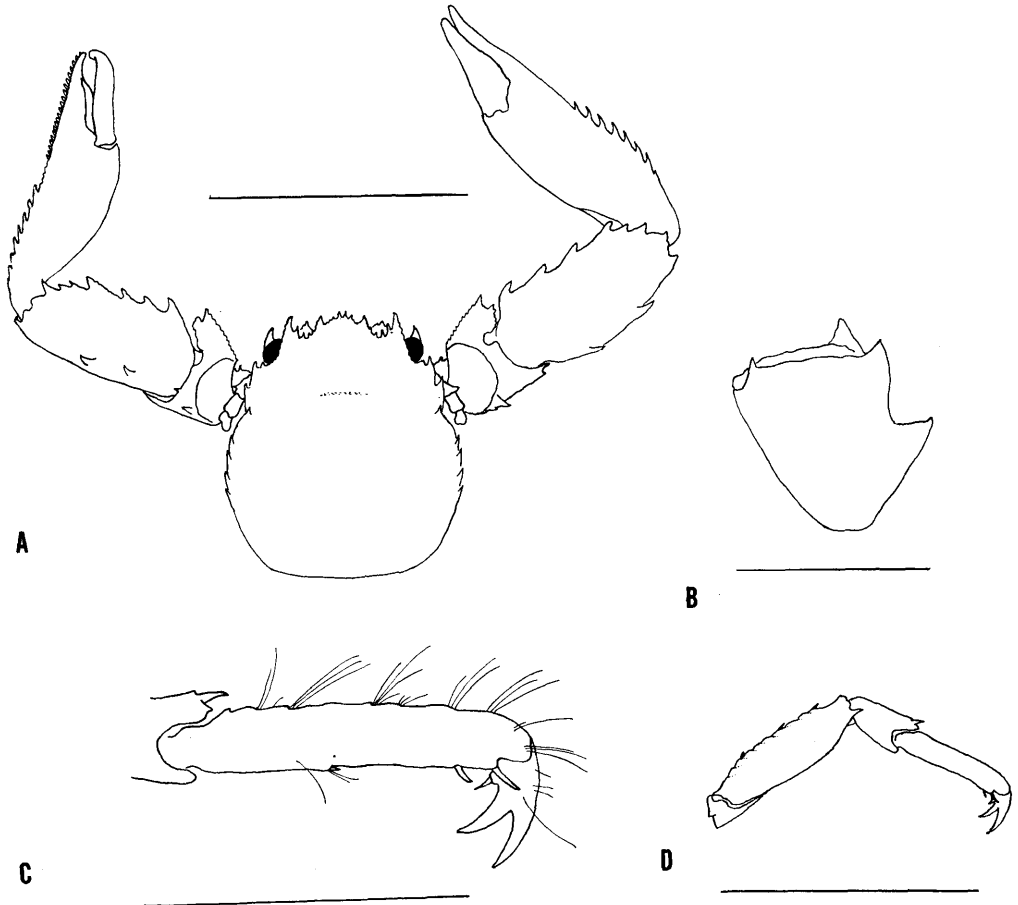


Figure 2.—*Porcellana furcillata*. A, dorsal view of holotype; B, basal segment of antennule; C, propodus and dactyl of right first walking leg; D, right first walking leg. Scales for A and D = 5 mm; for B, 0.5 mm; for C, 2 mm.

to those of outer margin of pollex; inner side of fingers at their bases with a short tuft of fine hair. In larger chela, fingers generally somewhat gaping, with a tooth on cutting edge of pollex, and shorter in comparison to length of manus than in smaller chela, which has fingers meeting along entire length of straight cutting edges.

Walking legs long and slender, with long, scattered setae. Anterior margin of merus armed with several spines. Carpus with an anterodistal spine, more strongly developed on first pair of legs. Propodus with a slender, movable spinule about midway along posterior margin and three similar spinules at posterodistal end. Dactyl deeply cleft into two strong, subequal fixed claws; lower margin with a single small, movable spinule.

Telson of abdomen seven-plated.

Holotype. Ovigerous female (5.1 by 4.6 mm), 60 miles W. x N. of Bedout Island, 25 fm, 12.x.1962, R. W. George on "Dorothea", W.A.M. 344-62.

Paratypes. QUEENSLAND: 1♂, 1♀, Albany Passage, Cape York, Aug.-Oct. 1907, C. Hedley and A. R. McCulloch, A.M. P.14764. WESTERN AUSTRALIA: 1♂, Roebuck Bay, 9 fm, Aug. 1929, A. A. Livingstone, A.M. P.14765. 1♀, off Roebuck Bay, 5-9 fm, June-Oct. 1929, A. A. Livingstone, A.M. P.14091. 1♂, 72 miles W. x N. of Bedout I., 25 fm, 12.x.1962, R. W. George on "Dorothea", W.A.M. 357-62. 1♂, 2 miles W. of Legendre I., Dampier Archipelago, 23 fm, 9.vi.1960, B. R. Wilson on "Davina", W.A.M. 128-60.

Remarks. *Porcellana furcillata* is perhaps allied to *P. quadrilobata* Miers 1884, a species which has been collected in Australian waters but is not yet recorded from Western Australia. In *P. quadrilobata* the median frontal lobe has a distinct notch, and the carpus of the chelipeds is unarmed along the outer margin. *P. furcillata* bears a superficial resemblance to *Pisidia spinuligera* (Dana), from which it is easily distinguished by the deeply bifurcate dactyl of the walking legs.

Males 3.5 by 3.0 mm to 4.0 by 3.6 mm; non-ovigerous female 3.6 by 3.2 mm; ovigerous females 4.9 by 4.5 mm and 5.1 by 4.6 mm. Ovigerous females between August and October at Cape York and in October off Bedout I.

Distribution. Known only from the localities listed above, in Western Australia and Queensland.

Genus PORCELLANELLA White

Diagnosis. Basal antennal segment strongly produced forward and broadly in contact with anterior margin of carapace; movable segments far removed from orbit. Carapace considerably longer than broad, smooth, sides subparallel; without spines except for projection of outer orbital angle. Front horizontal, not at all deflexed, produced well beyond eyes, strongly tridentate. Chelipeds subequal, smooth, unarmed. Chelae elongate, lying nearly vertical to plane of carapace, with a crest of hair on inner surface. Walking legs short, smooth, their anterior

margins unarmed. Dactyls very short; multi-unguiculate, with four strong, fixed spines. Telson of abdomen seven-plated.

Porcellanella triloba White

Porcellanella triloba White 1852, p. 394, pl. 5, figs. 2, 2a (off Cape Capricorn). Johnson 1964, p. 100 (Bowen).

Porcellana triloba, Haswell 1832b, p. 149.

Diagnosis. Lateral frontal lobes about three-fourths length of median lobe. Outer orbital angle acute or spiniform. Inner margin of merus of chelipeds with a strongly developed lobe. Most proximal spine of dactyl of walking legs much smaller than other three.

Material examined. 1♂, 1♀, 36 miles S.W. of Adele I., 40 fm, 17.x.1962, R. W. George on "Dorothea", W.A.M. 333-62. 1♂, between Broome and Wallal on Ninety Mile Beach, c. 7 fm, 1931, Capt. R. Bourne, A.M. P.10020. 1♂, Roebourne, 21.ix.1959, C. Lambert, W.A.M. 161-60. 2♂, 2♀, mainland at Antenni Mia, Point Samson, or Rosemary I., Dampier Archipel., on a pennatulid, 26-30.viii.1961, B. R. Wilson, W.A.M. 47-62. 1♂, 1♀, S.E. of Rosemary I., Dampier Archipel., 3-5 fm, 26.viii.1961, G. W. Kendrick and B. R. Wilson, W.A.M. 24-62. 1♂, N.W. of Heirisson Prong, Shark Bay, 11-12½ m, 13.ix.1905, St. 16, Hamburg S.W. Australia Exped., Z.M.H. 11676. 1♀, Freycinet Reach, W. of Middle Flat to N. point of Heirisson Prong, Shark Bay, 11-16 m, 12.ix.1905, St. 14, Hamburg S.W. Australia Exped., Z.M.H. 11665.

Remarks. Recently Johnson (1964) showed that *Porcellanella picta* Stimpson, which many authors have considered synonymous with *P. triloba*, may be separated on the basis of a number of constant characters. The material from Western Australia all agrees with *P. triloba* in Johnson's restricted sense. Johnson assigned earlier records to one or the other of the two species as far as was possible on the basis of reexamined material and published descriptions and illustrations, and concluded that the only certain localities for *P. triloba* are N.E. Australia and Palau Islands. The Palau Islands record, however, was based on a third species of *Porcellanella* recently described by Sankarankutty (1963, p. 273) as *p. haigae*. *P. triloba* should thus be considered a strictly Australian form, at least pending the re-examination of the specimens on which several published records were based.

Males to 9.5 by 6.8 mm; non-ovigerous females to 9.0 by 6.7 mm; ovigerous females to 8.4 by 6.3 mm. Ovigerous females in August at Dampier Archipelago or vicinity, and in October off Adele I.

Distribution. Definitely known only from Australia (Queensland, at Bowen and off Cape Capricorn). Now recorded from Western Australia.

Genus POLYONYX Stimpson

Diagnosis. Basal antennal segment strongly produced forward and broadly in contact with anterior margin of carapace; movable segments far removed from orbit. Carapace usually broader than long, particularly in females;

strongly convex front to back. Front deflexed, trilobate or transverse, usually appearing transverse in dorsal view. Chelipeds large, differing in size and form. Dactyl of walking legs with at least two well-developed fixed claws and often with spinules on lower margin. Telson of abdomen seven-plated. Pleopods present in males of all but a few species.

Key to Western Australian species of Polyonyx

1. Lateral margin of carapace armed with spines 2
Lateral margin of carapace unarmed 3
2. (1) Ventral claw of dactyl of walking legs not nearly at a right angle to axis of dactyl *suluensis*
Ventral claw of dactyl of walking legs nearly at a right angle to axis of dactyl *telestophilus*
3. (1) Claws of dactyl of walking legs subequal or at least with dorsal claw well developed in comparison to ventral claw 4
Ventral claw of dactyl of walking legs much larger than dorsal claw 6
4. (3) Ventral surface of chelae with a pronounced longitudinal crest in proximal half; a large lobe on inner margin of merus *triunguiculatus*
Ventral surface of chelae without such a crest; meral lobe vestigial or absent 5
5. (4) Dactyl of walking legs with a single rather large, stout spinule in addition to the two main claws; male with pleopods *obesulus*
Dactyl of walking legs with two small, slender spinules in addition to the two main claws; male pleopods lacking *biunguiculatus*
6. (3) Front transverse; merus of chelipeds with a vestigial lobe; propodus of walking legs with 12 or more ventral spinules *transversus*
Front with median lobe produced; merus of chelipeds with a well-developed lobe; propodus of walking legs with four or five ventral spinules *maccullochi*

Polyonyx suluensis (Dana)

Porcellana suluensis Dana 1852, p. 414 (Sulu Sea); 1855, pl. 26, fig. 4. Rathbun 1924, p. 30, pl. 1, figs. 15-16 (Cape Jaubert).

Polyonyx denticulatus Paulson 1875a, p. 32, pl. 1, fig. 11 (*nomen nudum*); 1875b, p. 89, pl. 11, fig. 6 (Red Sea). Johnson 1958, pp. 98, 100, text-fig. 1.

Polyonyx hexagonalis Zehntner 1894, p. 187, pl. 8, figs. 18, 18a (Amboina).

Polyonyx suluensis, Haig 1964, p. 373, text-fig. 3.

Diagnosis. Carapace roughly hexagonal, as broad as, or slightly broader than, long; surface with scattered long hairs. Lateral margins armed with spines. Front very broad, trilobate, median lobe prominent, acute. Merus of chelipeds with a prominent lobe on inner margin, armed with several spines. Carpus with about four strong spines on inner margin. Major cheliped nude or hairy; minor chela densely covered with long hairs. Propodus of walking legs with one ventral spinule in addition to three at distal end. Dactyl with two large, subequal fixed claws; no accessory movable spinules on lower margin.

Material examined. 1♀, 45 miles W.S.W. of Cape Jaubert, 72-80 ft, May-July 1911, E. Mjöberg, U.S.N.M. 56435. 1♀, off Ninety Mile Beach between Cape Jaubert and Wallal, 5 fm, Sept. 1929, A. A. Livingstone, A.M. P.14089.

Remarks. Both specimens were ovigerous; the carapace length of one of them was 3.2 mm. In view of its abundance throughout most of its range, it is surprising that this species has been so seldom collected in Western Australia.

Distribution. Indian Ocean (Red Sea; Seychelles; Saya de Malha; Cargados Carajos); Japan southward to Philippine Islands and East Indian Archipelago. In Australia reported only from Western Australia.

Polyonyx telestophilus Johnson

Polyonyx telestophilus Johnson 1958, pp. 98, 103, text-fig. 2 (Singapore). Haig 1964, p. 376, text-fig. 4.

Diagnosis. Carapace roughly hexagonal, a little broader than long; nearly or completely devoid of hairs. Lateral margins armed with spines. Front very broad, trilobate, median lobe prominent, acute. Merus of chelipeds with a prominent inner lobe, minutely denticulate or crenulate and sometimes bearing a single, larger tooth. Carpus with distal portion of inner margin produced as a strongly convex lobe; less produced proximal portion crenulate or with one to three teeth. Chelipeds slightly hairy or devoid of hairs. Propodus of walking legs with one ventral spinule in addition to three at distal end. Dactyl with two large, fixed claws, the ventral one distinctly larger and longer than the dorsal and directed at almost a right angle to axis of dactyl; no accessory movable spinules on lower margin.

Material examined. 1♀, between Malus and Cidlev Is., Dampier Archipelago, 10 fm, 1.vi.1960, Royce on "Davena", W.A.M. 137-60.

Remarks. The single Western Australian specimen, an ovigerous female, had a carapace length of 4.4 mm and breadth of 5.6 mm. Johnson (1958) found the species to be strictly commensal with alcyonarian corals of genus *Telesto* at Singapore.

Distribution. Gulf of Siam; Singapore; Amboina. Now recorded from Australia.

Polyonyx biunguiculatus (Dana)

Porcellana biunguiculata Dana 1852, p. 411 (type locality not stated); 1855, pl. 26, figs. 1a-d.

Polyonyx biunguiculatus, Stimpson 1858, p. 229. Johnson 1958, pp. 100, 105, text-fig. 3. Haig 1964, p. 377.

?*Porcellana biunguiculata*, Haswell 1882b, p. 147 (Holborn Island).

?*Polyonyx biunguiculatus*, Ortmann 1894, p. 30 (Thursday Island).

Polyonyx tuberculatus var., Rathbun 1924, p. 31, pl. 1, fig. 17 (Cape Jaubert).

Diagnosis. Carapace subrectangular, broader than long especially in females; surface devoid of hairs. Lateral margins unarmed. Front trilobate, median lobe subrectangular. Merus of chelipeds with a vestigial inner lobe. Inner margin of carpus straight, unarmed. No crest on proximal half of ventral surface of chela. Dorsal surface of chelipeds without hairs. Propodus of walking legs with one ventral spinule in addition to three at distal end. Dactyl with two large, subequal fixed claws; two small, movable spinules on lower margin. No pleopods in males.

Material examined. 1♀, King Sound, B.M.N.H. 1♀, 45 miles W.S.W. of Cape Jaubert, 72 ft, 7.vii.1911, E. Mjöberg, U.S.N.M. 56433.

1 ♂, 2 miles W. of Legendre I., Dampier Archipel., 23 fm, 9.vi.1960, B. R. Wilson on "Davena", W.A.M. 128-60. 1 ♂, Gidley I., Dampier Archipel., 10 fm, 1.vi.1960, R. D. Royce on "Davena", W.A.M. 129-60. 1 ♂, 3 ♀, W. approaches to Mermaid Strait, Dampier Archipel., 20 fm, 27.v.1960, R. D. Royce on "Davena", W.A.M. 117-60. 1 ♂, Malus I., Dampier Archipel., 10 fm, 31.v.1960, R. D. Royce on "Davena", W.A.M. 180-60. 2 ♂, Exmouth Gulf or Shark Bay, trawled, winter 1960, R. McKay on "Peron", W.A.M. 76-62.

Remarks. The U.S.N.M. specimen is part of the material reported by Rathbun (1924) as "*Polyonyx tuberculatus* de Man, var.". The Queensland records of Haswell and Ortmann need to be verified in the light of Johnson's (1958) revision of *Polyonyx*, in which he showed that *P. biunguiculatus* has frequently been confused with other species; but specimens I have examined from several Queensland localities are definitely referable to *P. biunguiculatus*.

Ground colour pale yellow, thickly speckled with orange-red; the colour especially concentrated on fingers of chelae. Broad bands on walking legs. Males to 6.9 by 8.4 mm; ovigerous females to 4.6 by 6.9 mm. Ovigerous females in May at Dampier Archipelago and in July at Cape Jaubert.

Distribution. Indian Ocean (Eritrea; Seychelles; ? Ceylon); western Pacific Ocean from Formosa Strait southward to East Indian Archipelago. Australia (Western Australia and Queensland).

***Polyonyx obesulus* Miers**

Porcellana obesula White 1847, p. 130 (*nomen nudum*; ? Madgica-Sima Islands). Adams in Adams and White 1848, p. iii.

Polyonyx obesulus, Miers 1884, p. 272, pl. 29, fig. D (Port Darwin; Prince of Wales Channel; Port Denison; West Island). Henderson 1888, p. 115 (Flinders Passage). Johnson 1958, pp. 99, 108, text-fig. 4. Haig 1964, p. 378.

?*Porcellana (Polyonyx) tuberculosa* de Man 1888, p. 424, pl. 19, fig. 1 (Amboina).

Polyonyx parvidens Nobili 1905, p. 161 (Gulf of Iran).

Diagnosis. Carapace subovate, broader than long, particularly in females; surface devoid of hairs. Lateral margins unarmed. Front trilobate, median lobe rounded or subrectangular. Merus of chelipeds with a vestigial inner lobe. Inner margin of carpus straight, unarmed. No crest on proximal half of ventral surface of chela. Dorsal surface of chelipeds without hairs. Propodus of walking legs with one ventral spinule in addition to three at distal end. Dactyl with two large, subequal fixed claws; a single rather large, stout spinule on lower margin.

Material examined. 1 ♂, 23 miles S.W. of Troughton I., 25 fm, 22.x.1962, R. W. George on "Dorothea", W.A.M. 336-62. 1 ♂, Broome, W.A.M. 9457/8. 1 ♂, Broome, June 1932, A.M. P.10265. 1 ♀, near entrance to Roebuck Bay, 5-8 fm, 26.ix.1929, A. A. Livingstone, A.M. P.14453. 1 ♂, 2 miles S.W. of Peak I., 10 fm, 18.vi.1960, B. R. Wilson on "Davena", W.A.M. 136-60. 1 ♀, 9 miles S.W. of Geraldton, 20 fm in large sponge, 30.x.1956, R. W. George, W.A.M. 43-62.

Remarks. The type locality of *P. obesulus*, according to White (1847) and as indicated in records at the British Museum (Natural History), was the Madgica-Sima Group, which is in the

Ryukyu Archipelago (see Haig 1964, p. 380). But Adams in Adams and White (1848, p. iii) stated that what were evidently the type specimens were dredged in the Sulu Sea. The latter locality seems more likely in view of the fact that the species is not otherwise reported as far north as the Ryukyu Islands.

Males to 5.0 by 7.1 mm; ovigerous female 5.7 by 7.7 mm. Ovigerous female in October at Geraldton.

Distribution. Indian Ocean including Gulf of Iran; western Pacific Ocean, from Philippine Islands (perhaps from Ryukyu Islands?) southward to East Indian Archipelago. Australia (Northern Territory and Queensland). Now recorded from Western Australia.

***Polyonyx triunguiculatus* Zehntner**

Polyonyx triunguiculatus Zehntner 1894, p. 185 (Amboina). Johnson 1958, pp. 99, 110.

Polyonyx acutifrons de Man 1896, p. 384 (Atjeh, Sumatra); 1898, pl. 32, figs. 49, 49a-d.

Diagnosis. Carapace subovate or subrectangular, broader than long, especially in females; surface devoid of hairs. Lateral margins unarmed. Front trilobate, median lobe prominent, narrow, acute. Merus of chelipeds with a well-developed lobe on inner margin. Inner margin of carpus straight, unarmed. Chela with a pronounced longitudinal crest on proximal half of ventral surface. Dorsal surface of chelipeds without hairs. Propodus of walking legs with one ventral spinule in addition to three at distal end. Dactyl with two large, subequal fixed claws; one or two small movable spinules on lower margin.

Material examined. 1 cheliped, Broome, June 1932, A.M. P.14454. 1 ♀, 40 miles W. of Cape Jaubert, 23 fm on sponge, 13.x.1962, R. W. George on "Dorothea", W.A.M. 328-62. 2 ♀, 3-4 miles off N.E. end Delambre I., Dampier Archipel., 10 fm, 5.vi.1960, B. R. Wilson on "Davena", W.A.M. 126-60. 1 ♂, 2 mi. S.W. of Peak I., 10 fm, 18.vi.1960, B. R. Wilson on "Davena", W.A.M. 136-60. 1 ♂, Exmouth Gulf or Shark Bay, trawled, winter 1960, R. McKay on "Peron", W.A.M. 76-62. 3 ♂, 1 ♀, Shark Bay, 8.vii.1962, "Peron", W.A.M. 334-62.

Remarks. Colour of preserved specimens pale orange, with darker orange areas on carapace and chelipeds. On the dorsal surface of the carapace there is a large patch of the darker shade on either side, leaving a pale median stripe with parallel sides which joins pale areas on frontal and posterior parts of the carapace. On the chelipeds there is irregularly-shaped light and dark mottling. Males to 7.0 by 8.9 mm; non-ovigerous female 3.7 by 4.7 mm; ovigerous females to 6.9 by 9.3 mm. Ovigerous females at Dampier Archipelago in June, Shark Bay in July, and Cape Jaubert in October.

Distribution. Throughout the Indian Ocean including the Red Sea; in the western Pacific reported only from Singapore, Amboina, and Sumatra. Now recorded from Australia.

***Polyonyx transversus* (Haswell)**

Porcellana transversa Haswell 1882a, p. 759 (Bowen); 1882b, p. 150.

Polyonyx transversus, Baker 1905, p. 262, pl. 36, figs. 2, 2a (off Newland Head). Hale 1927a, p. 83, text-fig. 80. McNeill and Ward 1930, p. 363, pl. 59, fig. 3 (Botany Bay);

Port Curtis; Western Port). Pope 1946, p. 91, text-fig. (Pittwater). Dakin 1952, p. 352 (Gunnamatta Bay). Johnson 1958, pp. 99, 115.

Diagnosis. Carapace subovate or subrectangular, broader than long particularly in females; surface devoid of hairs except for fringe on frontal margin. Lateral margins unarmed. Front transverse, with median lobe very slightly developed. Merus of chelipeds with a vestigial lobe. Inner margin of carpus developed into a prominent, convex lobe, broadest distally and unarmed. Dorsal surface of chelae and inner margin of carpus thickly hairy. Propodus of walking legs with more than 12 spinules along lower margin. Dactyl with two fixed claws, ventral much larger than dorsal one; two stout spines on lower margin.

Material examined. 1♂, 1♀, Cockburn Sound, 5.iv.1959, Stn. 146, W.A.M. 113-60. 4♀, S. end Careening Bay, Garden I., Cockburn Sound, from *Chaetopterus* tubes, 1.iii.1959, Mar. Group Nat. Club, W.A.M. 119-60. 14♂, 11♀ Careening Bay, Garden I., from *Chaetopterus* tubes on intertidal flats, 26.xi.1961, B. R. Wilson and marine group, W.A.M. 37-62.

Remarks. The type specimens were taken from the siphons of a bivalve mollusc, *Aspergillum*. Johnson (1958) stated that there is no definite information as to the habitat of the species in the more southern records. However, McNeill and Ward (1930, pp. 363 and 364) gave rather detailed information about the habitat of specimens in the collections of the Australian Museum. Of specimens from Botany Bay they stated: "Both specimens were taken from "U"-shaped worm tubes, occupied by a species of the polychaet *Chaetopterus*, where they were found reclining in the inflated basal portion of their sanctuaries, at a depth of about fourteen inches from the surface of the tidal flats exposed at low tide." Of the Port Curtis specimens collected by M. Ward: "He remarked that they [worm tubes] were found in the soft mud at the extreme low tide line, or close thereto in shallow drains and pools. In each worm tube examined a male and female crab were present. The tubes were not more than one foot deep in the mud, and, owing to the fragile nature of their structure, great difficulty was experienced in digging them out." They concluded: "The fact that so very few specimens have been recorded. . . . combined with the evidence already to hand, suggest that the creature. . . . is invariably a commensal. This would account for its apparent rarity in collections." Further information on the *Polyonyx-Chaetopterus* association is provided by Pope (1946).

The ground colour of preserved specimens is pale orange, with mottlings of darker orange on the carapace and chelipeds. Males to 6.4 by 8.3 mm; non-ovigerous females to 7.6 by 10.5 mm; ovigerous females to 8.0 by 11.0 mm. All three lots of specimens examined included egg-bearing females.

Distribution. Apparently an Australian endemic; reported from Queensland, New South Wales, Victoria, and South Australia. Now recorded from Western Australia.

Polyonyx maccullochi, sp. nov.

(Fig. 3)

Polyonyx obesulus (?), Grant and McCulloch 1906, p. 41 (Port Curtis).

Description. Carapace subovate, only slightly broader than long (c. 1.2 times in both males and females); surface smooth, hairless except for fringe on frontal margin; sides sparsely hairy. Front narrow, with a strong median lobe forming a slightly acute angle and extending well beyond the obtuse lateral lobes; in dorsal view appearing transverse or slightly convex.

All segments of antennal peduncle smooth; flagellum long, slender, with a few vestigial hairs. Ventral surface of outer maxillipeds not hairy.

Chelipeds rather sparsely hairy; no hairs on upper surface, some on lower surface of merus and chela and in gape of fingers, and a sparse fringe on outer margins of chelae. Upper surface of chelipeds smooth, sometimes lightly punctate but without rugosities or tubercles. Merus with a well-developed, convex lobe on inner margin. Carpus with inner margin produced into a prominent lobe, unarmed and evenly convex throughout its length. Males: Major chela swollen, without crest on surface; fingers strongly curved outward; fixed finger with a strong rounded tooth on cutting edge at base, movable finger with a tooth at base and another about midway along cutting edge; outer margins of fingers smooth. Minor chela rather slender, without crest, less swollen than major chela; fingers long and slender, not out-curved, their inner margins minutely crenulate; outer margin of fixed finger with a row of small, sharp tubercles, movable finger with a few similar tubercles on outer surface near tip. Females: Major chela with fingers longer and much less out-turned than in males, on the whole resembling minor chela; teeth on cutting edges of fingers not well developed. Minor chela as in males. Walking legs with a fringe of long, plumose hairs on margins. Merus unarmed on lower margin, that of third walking leg about twice as long as broad. Propodus armed on lower margin with four or five stout movable spinules including the pair at distal end, that of third walking leg about twice as long as broad. Dactyl very narrow in comparison to propodus; one or two minute spinules on its lower margin proximal to bifid tip. Male with a pair of pleopods.

Holotype male (4.2 by 5.1 mm). Entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14117.

Paratypes. QUEENSLAND: 1♀, Port Curtis, 7 fm, F. E. Grant, A.M. G.5754. WESTERN AUSTRALIA: 1♂, 1♀, Broome, June 1932, A.M. P.10268. 1♀, entrance to Roebuck Bay, 9 fm, 15.viii.1929, A. A. Livingstone, A.M. P.14123. 1♂, 1♀, Denham, Shark Bay, 4-22.ix.1905, St. 65, Hamburg S.W. Australia Exped., Z.M.H. 11733. 1♀ (juv.), c. 2½ miles S.W. of Denham, Shark Bay, 3 m, 10.vi.1905, St. 7, Hamburg S.W. Australia Exped., Z.M.H. 11651. 1♂ (juv.), Brown Station, Dirk Hartog I., Shark Bay, 2½-4½ m, 18.vi.1905, St. 28, Hamburg S.W. Australia Exped., Z.M.H. 11698. 1♂, 1♀, entrance to Useless Inlet, Shark Bay, ¾-2 m, 13.ix.1905, St. 18,

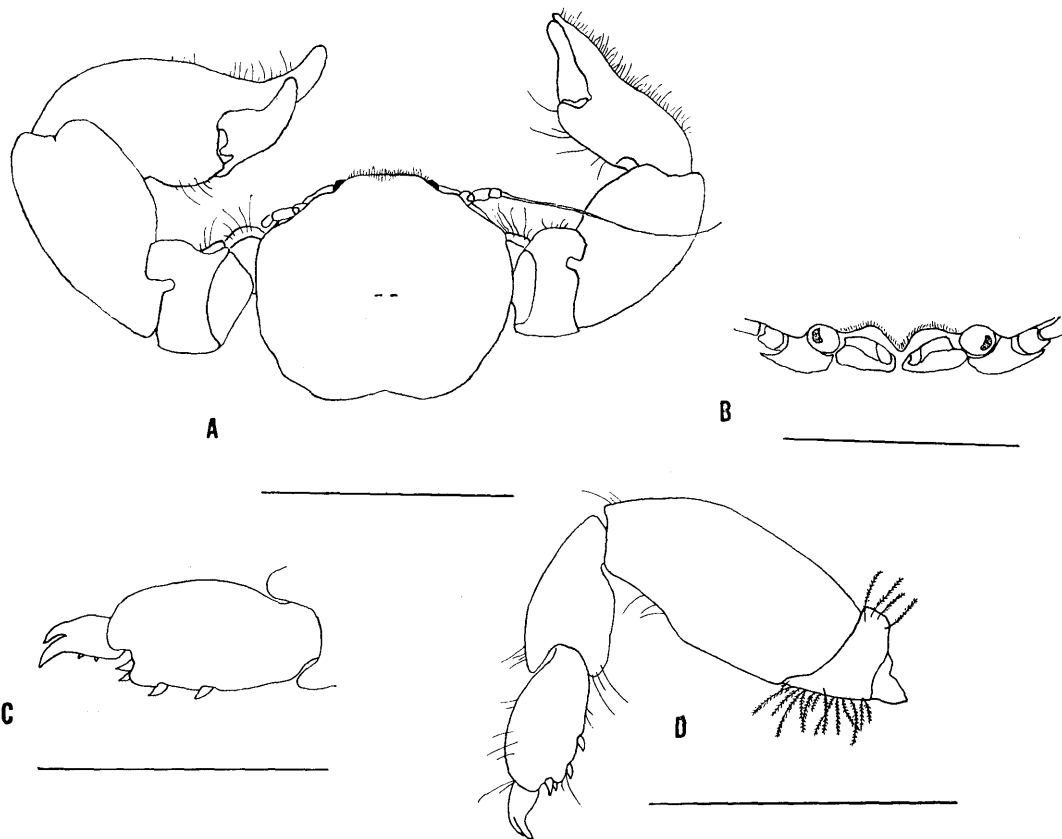


Figure 3.—*Polyonyx maccullochi*. A, dorsal view of holotype; B, anterior view of frontal region, paratype; C, propodus and dactyl of left third walking leg, paratype; D, left third walking leg, paratype. Scale for A = 5 mm; for B, 3 mm; for C, 1 mm; for D, 2 mm.

Hamburg S.W. Australia Exped., Z.M.H. 11679. 2♂, Shark Bay, 8.vii.1962, "Peron", W.A.M. 334-62.

Remarks. *Polyonyx maccullochi* belongs to a well-defined group of *Polyonyx* species (designated the "*P. sinensis* group" by Johnson 1958) in which the lateral margins of the carapace, and the inner margins of the merus and carpus of the chelipeds, are unarmed; the chelipeds are hairy; and the dorsal claw of the dactyl of the walking legs is much smaller than the ventral claw. The two species of this group now reported from Western Australia, *P. maccullochi* and *P. transversus*, can be readily distinguished from each other by the characters given in the key and diagnoses. Of the other Indo-West Pacific members of group *sinensis* treated by Johnson, only *P. cometes* Walker and *P. utinomii* Miyake agree with *P. maccullochi* in having a well-developed lobe on the inner margin of the merus of the chelipeds. In *P. cometes* the dorsal surface of the chelipeds is densely hairy, whereas in *P. maccullochi* this surface is devoid of hairs. In *P. utinomii* the median frontal lobe is weakly produced, and the propodus of the walking legs bears only three spinules on its lower margin.

The specimen from Queensland listed above is the one questionably referred by Grant and McCulloch (1906) to *Polyonyx obesulus*.

Substrates, where mentioned on the labels with the material examined, were sand or sand and mud. There was no indication of commensalism, but it is likely that members of this species occur at times in association with *Chaetopterus* or other organisms as do most species of group *sinensis*. Males to 5.1 by 6.2 mm; females to 5.1 by 6.4 mm.

Distribution. Known only from the localities listed above, in Western Australia and Queensland.

Genus **RAPHIDOPUS** Stimpson

Diagnosis. Basal antennal segment strongly produced forward and broadly in contact with anterior margin of carapace; movable segments far removed from orbit. Carapace subovate, broader than long. Front transverse and tridentate, not prominent nor greatly deflexed. Chelipeds subequal. Dactyl of walking legs a straight, slender spine, with an acute tip; no supplementary spinules. Telson of abdomen seven-plated.

Raphidopus ciliatus Stimpson

Raphidopus ciliatus Stimpson 1858, pp. 228, 241 (Hong Kong); 1907, p. 185, pl. 22, fig. 5.

Rhaphidopus ciliatus, Grant and McCulloch 1906, p. 42 (Port Curtis).

Diagnosis. Sides of carapace, inner and outer margins of chelipeds, upper and lower surface of chelae, and walking legs very heavily setose. Lateral margins of carapace and outer margin of carpus of chelipeds armed with spines. Upper surface of carpus with a median longitudinal row of tubercles or spinules.

Material examined. 1♀, Roebuck Bay, shore on sand flat between tides, 8.viii.1929, A. A. Livingstone, A.M. P.13737.

Remarks. The single specimen had a carapace length of 6.0 mm and breadth of 7.7 mm.

Distribution. Japan; Hong Kong. Australia at Port Curtis, Queensland. Now recorded from Western Australia.

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List of Genera and Species

Genus *Petrocheles* Miers
australiensis (Miers)

Genus *Petrolisthes* Stimpson
scabriculus (Dana)
militaris (Heller)
moluccensis (de Man)
boscii (Audouin)
haswelli Miers
teres Melin
ohshimai (Miyake)

Genus *Pachycheles* Stimpson
sculptus (H. Milne Edwards)
johnsoni sp. nov.
granti sp. nov.
pisoides (Heller)

Genus *Pisidia* Leach
spinuligera (Dana)
cf. *spinulifrons* (Miers)
dispar (Stimpson)

Genus *Porcellana* Lamarck
habei Miyake
gravelei Sankolli
ornata Stimpson
nitida Haswell
furcillata sp. nov.

Genus *Porcellanella* White
triloba White

Genus *Polyonyx* Stimpson
suluensis (Dana)
telestophilus Johnson
biunguiculatus (Dana)
obesus Miers
triunguiculatus Zehntner
transversus (Haswell)
maccullochi sp. nov.

Genus *Raphidopus* Stimpson
ciliatus Stimpson

References

- Adams, A. and White, A. (1843).—Crustacea. In "The Zoology of H.M.S. Samarang . . . during the years 1843-1846." (London.)
- Audouin, V. (1826).—Explication sommaire des planches de crustacés de l'Égypte et de la Syrie, publiées par Jules-César Savigny . . . Description de l'Égypte, ou Recueil des observations et des recherches qui ont été faites en Égypte pendant l'Expédition de l'armée française, Hist. Nat. I (4): 77-98. (Paris.)
- Baker, W. H. (1905).—Notes on South Australian decapod Crustacea. Part III. *Trans. Roy. Soc. S. Aust.* 29: 252-269.
- Borradaile, L. A. (1900).—On the Stomatopoda and Macrura brought by Dr. Willey from the South Seas. In "Zoological Results Based on Material from New Britain, New Guinea, Loyalty Islands and Elsewhere, Collected During the Years 1895, 1896 and 1897, by Arthur Willey . . . Part IV" : 395-428. (Cambridge.)
- Dakin, W. J. with Bennett, Isobel and Pope, Elizabeth (1952).—"Australian Seashores. A Guide for the Beach-lover, the Naturalist, the Shore Fisherman, and the Student." (Angus & Robertson: Sydney.)
- Dana, J. D. (1852-53).—Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842 . . . 13: (viii) 1-635 (1852), 636-1618 (1853). (Philadelphia.)
- (1855).—Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842 . . . 14, Atlas: 1-27, pls. 1-96. (Philadelphia.)
- Edmondson, C. H. (1925).—Marine zoology of tropical Central Pacific. Crustacea. *Bull. Bishop Mus., Honolulu* 27: 3-62.
- George, R. W. (1961).—Narrative of the personnel from the Western Australian Museum who took part in the Bernice P. Bishop Museum of Hawaii Expedition to Western Australia (May-June, 1960). *Annu. Rep. Mus. W. Aust.* 1959-60: 24-25.
- Gordon, Isabella (1931).—Brachyura from the coasts of China. *J. Linn. Soc. (Zool.)* 37: 525-558.
- (1960).—Additional note on the porcellanid sea-anemone association. *Crustaceana* 1: 166-167.

- Grant, F. E. and McCulloch, A. R. (1906).—On a collection of Crustacea from the Port Curtis district, Queensland. *Proc. Linn. Soc. N.S.W.* 31: 2-53.
- Gravely, F. H. (1927).—The littoral fauna of Krusadal Island in the Gulf of Manaar. Orders Decapoda (except Paguridea) and Stomatopoda. *Bull. Madras Govt. Mus. (n.s.)* 1 (1): 135-155.
- Haig, Janet (1960).—The Porcellanidae (Crustacea Anomura) of the eastern Pacific. *Allan Hancock Pacif. Exped.* 24: (viii) 1-440.
- (1964).—Papers from Dr. Th. Mortensen's Pacific Expedition 1914-1916. 81. Porcellanid crabs from the Indo-West Pacific, Part I. *Vidensk. Medd. Dansk Naturh. Foren. Kbh.* 126: 355-386.
- Hale, H. M. (1927a).—"The Crustaceans of South Australia." Part I. (Govt. Printer: Adelaide.)
- (1927b).—The fauna of Kangaroo Island, South Australia. No. 1. The Crustacea. *Trans. Roy. Soc. S. Aust.* 51: 307-321.
- (1929).—Notes on the fauna of Dirk Hartog Island, Western Australia. No. 4. Crustacea. *Trans. Roy. Soc. S. Aust.* 53: 67-70.
- Haswell, W. A. (1882a).—Description of some new species of Australian Decapoda. *Proc. Linn. Soc. N.S.W.* 6: 750-763.
- (1882b).—"Catalogue of the Australian Stalk-and Sessile-eyed Crustacea." (Australian Mus.: Sydney.)
- Heller, C. (1862).—Neue Crustaceen, gesammelt während der Weltumseglung der k. k. Fregatte Novara. Zweiter vorläufiger Bericht. *Verh. Zool.-Bot. Ges. Wien* 12: 519-528.
- (1865).—Crustaceen. Reise der oesterreichischen Fregatte 'Novarra' um die Erde, in den Jahren 1857, 1858, 1859 . . . Zoologischer Theil 2 (3) (1): 1-280. (Vienna.)
- Henderson, J. R. (1888).—Report on the Anomura collected by H.M.S. Challenger during the years 1873-76. Rpt. Zool. Challenger Exped. 27: (xi) 1-221 (London, Edinburgh & Dublin.)
- (1893).—A contribution to Indian carcinology. *Trans. Linn. Soc. Lond. (Zool.)* (2) 5: 325-458.
- Jacquotte, R. (1964).—Notes de faunistique et de biologie marines de Madagascar I. Sur l'association de quelques crustacés avec des cnidaires récifaux dans la région de Tuléar (sud-ouest de Madagascar). *Bull. Rec. Trav. Sta. Mar. Endoume* 32 (48): 175-178.
- Johnson, D. S. (1958).—The Indo-West Pacific species of the genus *Polyonyx* (Crustacea, Decapoda, Porcellanidae). *Ann. Zool., Agr* 2: 95-118.
- (1960).—On a porcelain crab, *Petrolisthes ohshimai* (Miyake), from Christmas Island, Indian Ocean, with a note on the genus *Neopetrolisthes* Miyake. *Crustaceana* 1: 164-165.
- (1964).—On the species *Porcellanella picta* Stimpson (Decapoda, Porcellanidae). *Crustaceana* 7: 98-102.
- Kingsley, J. S. (1880).—On a collection of Crustacea from Virginia, North Carolina, and Florida, with a revision of the genera of Crangonidae and Palaemonidae. *Proc. Acad. Nat. Sci. Philad.* 31: 383-427.
- Lenz, H. (1905).—Wissenschaftliche Ergebnisse der Reisen in Madagaskar und Ostafrika in den Jahren 1889-95 von Dr. A. Voeltzkow. Ostafrikanische Dekapoden und Stomatopoden. *Abh. Senckenb. Naturf. Ges.* 27: 341-392.
- McCulloch, A. R. (1913).—Studies in Australian Crustacea. No. 3. *Rec. Aust. Mus.* 9: 321-353.
- and McNeill, F. A. (1923).—Notes on Australian Decapoda. *Rec. Aust. Mus.* 14: 49-59.
- McNeill, F. A. (1953).—Carcinological notes No. 2. *Rec. Aust. Mus.* 23: 89-96.
- and Ward, M. (1930).—Carcinological notes. No. 1. *Rec. Aust. Mus.* 17: 357-383.
- Man, J. G. de (1888).—Bericht über die von Herrn Dr. J. Brock im indischen Archipel gesammelten Decapoden und Stomatopoden. *Arch. Naturgesch.* 53 (1): 215-600.
- (1896).—Bericht über die . . . zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden. Dritter Theil. *Zool. Jb. Syst.* 9: 339-336.
- (1898).—Bericht über die . . . zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden. Sechster (Schluss-) Theil. *Zool. Jb. Syst.* 10: 677-708.
- Melin, G. (1939).—Paguriden und Galatheiden von Prof. Dr. Sixten Bocks Expedition nach den Bonin-Inseln 1914. *K. Svenska VetenskAkad. Handl.* (3) 18 (2): 1-119.
- Miers, E. J. (1876a).—Descriptions of some new species of Crustacea, chiefly from New Zealand. *Ann. Mag. Nat. Hist.* (4) 17: 218-229.
- (1876b).—"Catalogue of the Stalk- and Sessile-eyed Crustacea of New Zealand." (Colonial Mus. and Geol. Surv. Dept., N.Z.)
- (1884).—Crustacea. In "Report on the Zoological Collections Made in the Indo-Pacific Ocean during the voyage of H.M.S. 'Alert' 1881-2": 178-322, 513-575. (Brit. Mus. (Nat. Hist.): London.)
- Milne Edwards, H. (1837).—"Histoire Naturelle des Crustacés, Comprenant l'Anatomie, la Physiologie et la Classification de ces Animaux." Vol. 2. (Paris.)
- Miyake, S. (1937).—A new crab-shaped anomuran living commensally with a gigantic sea-anemone (*Neopetrolisthes ohshimai* gen. et sp. nov.). *Zool. Mag., Tokyo* 49: 34-36.
- (1942).—Studies on the decapod crustaceans of Micronesia. III. Porcellanidae. *Palao Trop. Biol. Stud.* 2: 329-379.
- (1943).—Studies on the crab-shaped Anomura of Nippon and adjacent waters. *J. Dep. Agric. Kyushu Univ.* 7: 49-158.
- (1961).—Three new species of the Anomura from Japan (Crustacea, Decapoda). *J. Fac. Agric. Kyushu Univ.* 11: 237-247.
- Nobill, G. (1905).—Décapodes nouveaux des côtes d'Arabie et du Golfe Persique (diagnoses préliminaires). *Bull. Mus. Hist. Nat., Paris* 11: 158-164.
- (1906a).—Mission J. Bonnier et Ch. Pérez (Golfe Persique, 1901). Crustacés décapodes et stomatopodes. *Bull. Sci. Fr. Belg.* 40: 13-159.
- (1906b).—Faune carcinologique de la Mer Rouge. Décapodes et stomatopodes. *Ann. Sci. Nat. Zool.* (9) 4: 1-347.
- Ortmann, A. (1892).—Die Decapoden-Krebse des Strassburger Museums . . . IV. Theil. Die Abtheilungen Galatheaidea und Paguridea. *Zool. Jb. Syst.* 6: 241-326.
- (1894).—Zoologische Forschungsreisen in Australien und dem Malayischen Archipel . . . ausgeführt in den Jahren 1891-1893 von Dr. Richard Semon . . . Fünfter Band: Systematik und Thiergeographie. I. Lieferung. Crustaceen. *Denkschr. Med.-Naturw. Ges. Jena* 8: 3-80.
- Paulson, O. M. (1875a).—[Carcinological observations.] *Mém. Soc. Nat. Kieff.* 4 (1): 27-32.
- (1875b).—"Studies on Crustacea of the Red Sea." Part I. (English translation, 1961: Israel Program for Scientific Translations.)
- Pope, Elizabeth C. (1946).—Chaetopterus—a strange and beautiful worm. *Aust. Mus. Mag.* 9: 87-92.
- Rathbun, Mary J. (1924).—Results of Dr. E. Mjöberg's Swedish scientific expeditions to Australia 1910-1913. 37. Brachyura, Albunidae and Porcellanidae. *Ark. Zool.* 16 (23): 1-33.
- Sankarankutty, C. (1963).—On three species of porcellanids (Crustacea-Anomura) from the Gulf of Mannar. *J. Mar. Biol. Ass. India* 5: 273-279.
- Sankolli, K. N. (1963).—On a new species of porcellanid crab (*Decapoda, Anomura*) from India. *J. Mar. Biol. Ass. India* 5: 280-283.
- Saville-Kent, W. (1897).—"The Naturalist in Australia." (Chapman & Hall: London.)
- Stead, D. G. (1898).—Notes on the habits of some of the Australian malacostracous Crustacea. *Zoologist* (4) 2: 202-212.

- Stimpson, W. (1858).—*Prodromus descriptionis animalium evertibratorum ... Pars VII. Crustacea Anomura. Proc. Acad. Nat. Sci. Philad.* 10: 225-252.
- (1907).—Report on the Crustacea (Brachyura and Anomura) collected by the North Pacific Exploring Expedition, 1853-1856. *Smithson. Misc. Coll.* 49: 1-240.
- Walker, A. O. (1887).—Notes on a collection of Crustacea from Singapore. *J. Linn. Soc. (Zool.)* 20: 107-117.
- Ward, M. (1928).—The Crustacea of the Capricorn and Bunker Groups, Queensland. *Aust. Zool.* 5: 241-246.
- White, A. (1847).—"List of the Specimens of Crustacea in the Collection of the British Museum." (Brit. Mus. (Nat. Hist.): London.)
- (1852).—Descriptions of some apparently new species of Annulosa, (collected by Mr. Macgillivray during the voyage of H.M.S. Rattlesnake). In "Narrative of the Voyage of H.M.S. Rattlesnake ... During the years 1846-1850 ..." Vol. 2, Appendix 6. (London.)
- Whitelegge, T. (1889).—List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood. *J. Roy. Soc. N.S.W.* 23: 163-323.
- (1897).—The atoll of Funafuti, Ellice Group: its zoology, botany, ethnology, and general structure based on collections made by Mr Charles Hedley ... VI. The Crustacea. *Mem. Aust. Mus.* 3: 127-151.
- Zehntner, L. (1894).—Voyage de MM. M. Bedot et C. Pictet dans l'Archipel Malais. Crustacés de l'Archipel Malais. *Rev. Suisse Zool.* 2: 135-214.