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J. West



**THE SUB-LITTORAL GONEPLACIDAE AND PINNOTHERIDAE
(CRUSTACEA: BRACHYURA) OF MORETON BAY**

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THE SUB-LITTORAL GONEPLACIDAE AND PINNOTHERIDAE
(CRUSTACEA: BRACHYURA) OF MORETON BAY

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ABSTRACT

Typhlocarcinops tonsurata, a new species close to *T. decrescens* Rathbun, is described and the following species are recorded and discussed: *Rhizopa gracilipes* (= *Speocarcinus luteus* McNeill); *Xenophthalmodes dolichophallus* (= *X. moebii*: Barnard); *Eucrate sexdentata*; *E. dorsalis*; *Ommatocarcinus macgillivrayi* (= *O. huttoni*); *Xenophthalmus pinnotheroides*; and *Pinnotheres spinidactylus*, both sexes of which are redescribed and figured. Illustrations include the male first pleopods.

The material reported on has been obtained primarily from dredging and trawling operations carried out in Moreton Bay (M.B.) by the Zoology Department of the University of Queensland (Z.D.U.Q.) under the direction of Professor W. Stephenson (W.S.). Most of this material has been deposited at the Queensland Museum (Qd Mus.) and some duplicate material has been sent to the Australian Museum, Sydney (Aust. Mus.). Additional specimens in the collections of these institutions have also been examined.

Localities are indicated with reference to the charts of Moreton Bay published by the Department of Harbours and Marine, Queensland, 1964 edition. To facilitate location of these localities Moreton Bay is here arbitrarily divided into sections (see fig. 1) and a grid reference to these sections is included in bold face with each locality listed.

Measurements relating to the size of a specimen are given as width across the widest part of the carapace. All drawings have been made with the aid of a camera lucida.

Family GONEPLACIDAE

Genus *Rhizopa* Stimpson*Rhizopa gracilipes* Stimpson

(Figs. 2A-C, 6A.)

Rhizopa gracilipes Stimpson, 1858, p. 95. Rathbun, 1910, pp. 342-3, fig. 27. Tesch, 1918, p. 201 (in key). Serene, 1964, pp. 198-203, fig. 2, pl. 17A.

Speocarcinus luteus McNeill, 1929, pp. 152-4, figs. 1-4, pl. 36.

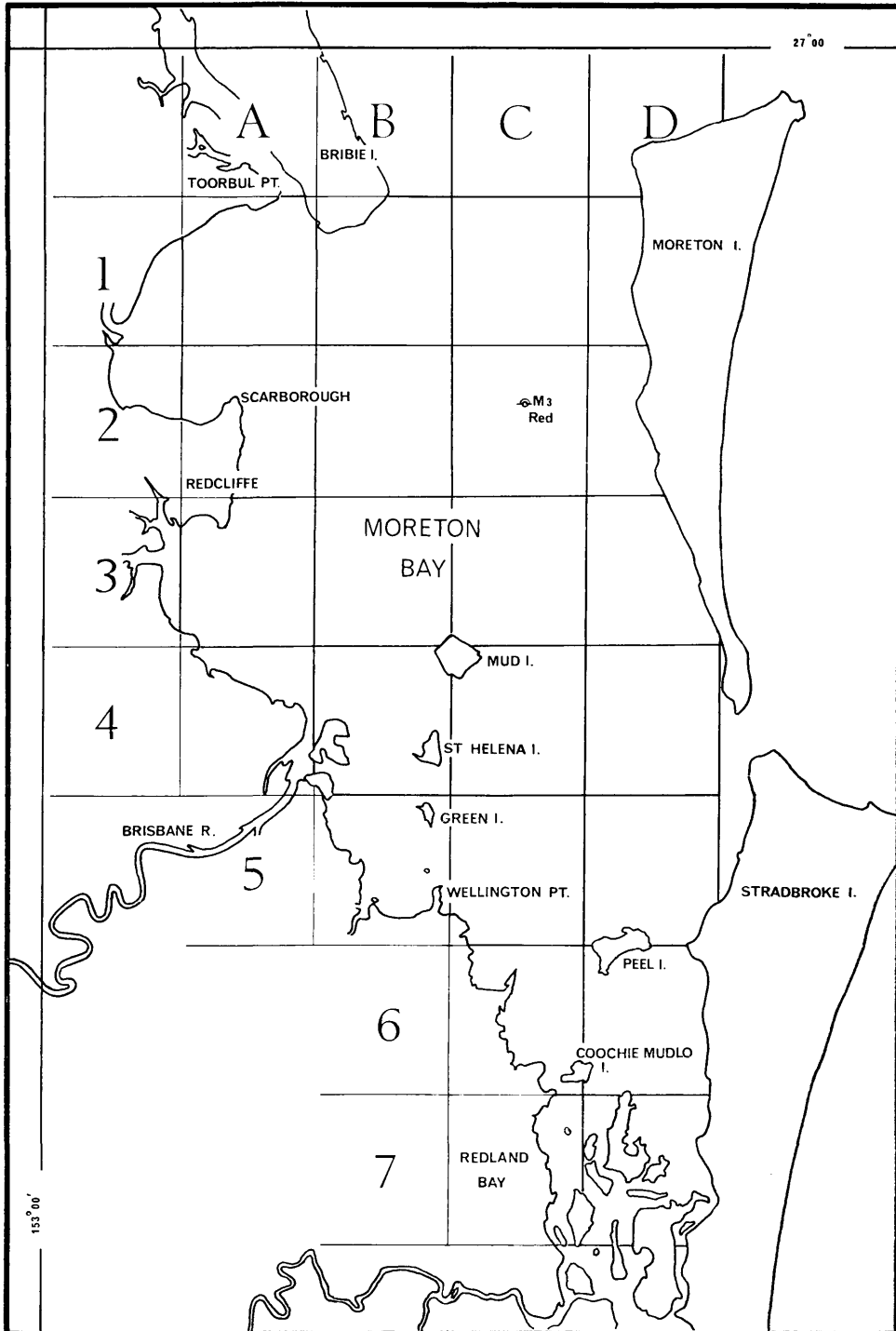
MORETON BAY MATERIAL: Female (14.5 mm), 3 miles SW. of M3 red beacon, 2C, dredged, mud, 10.xi.1961, W.S., Qd Mus. W2713. Female (13.5 mm), 1¼ miles N. of Hope Beacon, 4C, 4 fms, gritty mud, 18.vii.1967, Z.D.U.Q., Qd Mus. W2857. Female (ovig.) (14.5 mm), NW. of Hanlon Light, 5D, dredged, muddy sand, 12.x.1961, W.S., Qd Mus. W2897. Male (11 mm), 1 mile NE. of Hanlon Light, 5D, dredged 3½ fms, muddy sand, 12.ii.1968, Z.D.U.Q., Qd Mus. W2955. Male (11 mm), 2¼ miles N. of Pat's Pt., 6D, dredged 4½ fms, sandy mud, 12.ii.1968, Z.D.U.Q., Qd Mus. W2954. Female (ovig.) (7 mm), female (12 mm), off SW. point of Peel I., 6D, dredged 5-6 fms, 5.xii.1961, T. Hailstone, Qd Mus. W2895-6. Female (ovig.) (16.5 mm), 1 mile NE. of Coochiemudlo I., 6D, 2½ fms, gritty sand, 13.x.1967, Z.D.U.Q., Qd Mus. W2900. Female (13 mm), 1¼ miles SW. of Goat I., 6D, 6½ fms, gritty sand, 12.x.1967, Z.D.U.Q., Qd Mus. W2898. Male (14.5 mm), 2 miles SE. of Sandy I., 6C, 2½ fms, shelly sand, 6.x.1967, Z.D.U.Q., Qd Mus. W2899.

Male (16.5 mm), Mud I., M.B., 19.ii.1942, V. F. Collin, Qd Mus. W1475.

ADDITIONAL MATERIAL: Male (17 mm), female (13 mm), taken in suction dredge "Triton" off Pott's Point, Port Jackson, N.S.W., 30.x.1942, M. Ward, Qd Mus. W1534. Male (21 mm), (holotype of *Speocarcinus luteus*), two males (16,20 mm), female (11 mm) (paratypes of *S. luteus*), Salamander B., Port Stephens, N.S.W., dredged 6 fms, mud, 24.ix.1919, A. R. McCulloch, Aust. Mus. P4489. Three males, female (13-18.5 mm), Port Jackson, N.S.W., about 6 fms, pres. Capt. L. Comtesse, Aust. Mus. P11449. Female (22 mm), Refuge Bay, Hawkesbury R., N.S.W., on mud flat at low tide, 14.xi.1953, pres. Mrs. L. Woolacott, Aust. Mus. P12338. Male (15.5 mm), female (19 mm), near Sow and Pigs Shoal, Port Jackson, N.S.W., about 5 fms, 1931, pres. Capt. L. Comtesse, Aust. Mus. P10087. Three males, three females (12-18.5 mm), off Dawes Pt., Port Jackson, N.S.W., about 5 fms, ? 1933, pres. W. J. Hale, Aust. Mus. P10285.

The small series of specimens from Moreton Bay agrees with previous descriptions of this species, especially by Rathbun (1910), and by Serene (1964). Thus, the surface of the carapace is smooth except near the lateral margins where numerous very small granules are present but obscured by very short hairs which occur mainly near the lateral margins and in the grooves on each side of the cardiac region. The two notches along the anterolateral margins are shallow and very poorly defined, especially the anterior one. The central groove running back from the front is very shallow indeed but is partly defined by short tomentum. The anterior and anterolateral margins bear a fringe of long hairs which extends across above the orbits and just backward of the margin of the front itself. The eyestalks are quite large and the cornea well developed, ventral

FIG. 1: Moreton Bay, showing arbitrary grid reference (based on intervals of 0° 05' lat. and long.) used to group localities.



and terminal. The merus of the third maxilliped is hardly expanded at its anterolateral corner and the surface is smooth or very finely granular; the proximal part of the medial edge is somewhat more strongly granular.

However, this material differs markedly from previous descriptions in the ornamentation of the chela. In all females examined by us the outer surface of the hand is not smooth but bears prominent more or less round tubercles, particularly along the elevated crest on the ventral edge, towards the dorsal edge where they are covered by long hairs, and on the outer surface proximally and ventrally, more or less in oblique longitudinal rows. There are also small tubercles beneath long hairs on the proximal part of the dactyl dorsally.

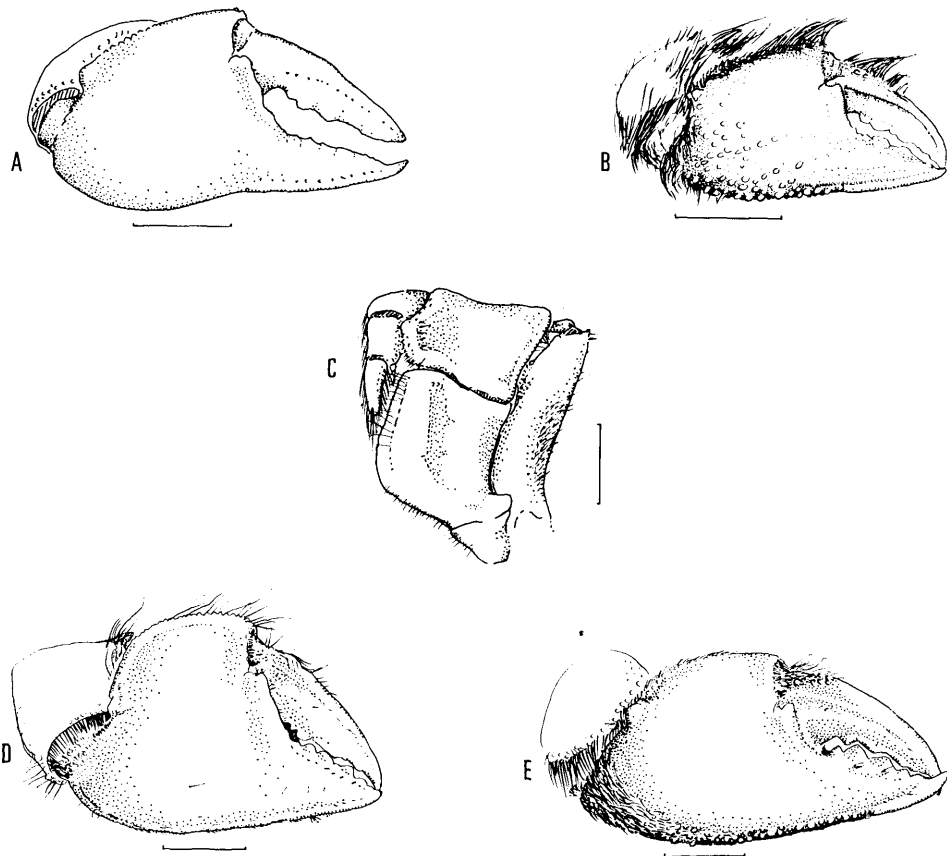


FIG. 2: A-C, *Rhizopa gracilipes*. A, chela of male, 21 mm, Aust. Mus. P4489; B, chela of female, Aust. Mus. P12338; C, third maxilliped, male 21 mm, Aust. Mus. P4489.

D, *Xenophthalmodes dolichophallus*, Qd Mus. W2901, chela.

E, *X. moebii*, Aust. Mus. P2700, chela.

Scale lines 5 mm in A and B, 2 mm in C-E.

Examination of the series of specimens used by McNeill in the original description of *Speocarcinus luteus* shows firstly, that these specimens are conspecific with the Moreton Bay material discussed above and are referable to *Rhizopa gracilipes* and secondly, that the tuberculation of the outer face of the chela is highly variable with sex and size.

McNeill's original description is detailed and accurate but the illustrations are variable and that showing the third maxillipeds is inaccurate, especially as to shape of the merus, the anterolateral angle (in the holotype—a male, cw. 21 mm) not being greatly produced nor truncate as shown. The outer surface of the chela of the holotype is granular dorsally only, not ventrally as apparently indicated in McNeill's pl. 36, fig. 2; the ventral proximal region actually shows traces of a few short hairs. In the holotype and paratype males, the abdomen differs slightly from the figure given by Serene (fig. 2B) in that the lateral angle of the third segment is slightly more acute and the lateral margins of the sixth and seventh segments are almost straight, not concave; the lateral margin of the third segment is weakly convex distally, not concave as in Serene's figure. Examination of other specimens shows the shape of the abdomen to be slightly variable. These same differences are apparent when Serene's figure is compared with Rathbun's (fig. 27a).

In regard to granulation of the outer surface of the chela, examination of all available material shows that specimens of both sexes 12–15 mm or smaller possess numerous granules covering most of the ventral half but diminishing in number and size distally. The same is true of larger females in which the chelae of the largest specimens are still fairly strongly granulate. In larger males, however, the granules become fewer and are found only near the proximal part ventrally. In the largest males (20 mm or more—e.g. the holotype of *S. luteus*) the outer surface is smooth.

The extent of the short tomentum on the dorsal surface of the carapace is somewhat variable—in some specimens the lateral band is broad and extends inwards at two places more or less opposite the anterolateral emarginations.

The first pleopod of the holotype of *Speocarcinus luteus* agrees completely with the figure of *R. gracilipes* given by Serene (fig. 2C).

DISTRIBUTION: Gulf of Siam (Rathbun), Chinese Seas (Stimpson). Eastern Australia, from Moreton Bay to Port Jackson (McNeill, Serene, and present report).

Genus *Xenophthalmodes* Richters
***Xenophthalmodes dolichophallus* Tesch**

(Figs. 2D, 6C.)

Xenophthalmodes dolichophallus Tesch, 1918, pp. 216–7, pl. 14, figs. 1, 1a, 1b. Stephensen, 1945, pp. 178–9, figs. 47C, E.

Xenophthalmodes moebii: Barnard, 1950, pp. 297–9, figs. 56 a–c.

[non] *Xenophthalmodes moebii* Richters, 1880.

MORETON BAY MATERIAL: Male (10.5 mm), 1 mile W. of M3 red beacon, 2C, dredged 8 fms, 29.x.1962, W.S., Qd Mus. W2901. Four females (7.5–10 mm), 3 miles SW. of M3 red beacon, 2C, dredged, mud, 10.xi.1961, W.S., Aust. Mus. P15788. Female (8 mm), 3 miles W. of Shark Spit,

Moreton I., 2C, 12½ fms, sand with little mud, 5.x.1967, Z.D.U.Q., Qd Mus. W2902. Male (11 mm), W. of Shark Spit, Moreton I., 2D, dredged 15½ fms, muddy, 1.vi.1962, Z.D.U.Q., Qd Mus. W2815. Male (10 mm), 3¼ miles SE. of wreck off Mud I., 4C, 10 fms, sandy mud, 30.viii.1967, Z.D.U.Q., Qd Mus. W2903. Female (9.5 mm), 2 miles N. of Hope Banks, 4C, dredged, 10 fms, muddy sand, 1.vi.1962, W.S., Qd Mus. W2710.

The specimens agree well with Tesch's notes as to differences from *X. moebii* Richters. The tomentum covering the carapace is extremely short and the margins bear long hairs, the dorsal surface bears small crowded granules towards the margins laterally, the front is deeply notched, only a very small area of pigment is visible at the distal end of the eyestalk ventrally, the epistome is vertical and without a posterior ridge, and the longitudinal sulcus is shallow. The third maxillipeds are as described by Tesch—ischium broad, the merus anterolaterally rounded—but differ from his figure in that the greatest width of the ischium is midway along, at the angle, not across the distal margin. The carpus of the cheliped has a short spiniform projection at the inner angle as mentioned by Tesch. However, the chelae are weakly pubescent in the females, naked in the male, except proximally, and smooth in all specimens except for a granular ridge along the ventral and dorsal edges of the palm. The two males possess the long pleopods characteristic of this species. The male abdomen differs from Tesch's figure only in that the lateral margins of the second segment are rounded, not straight and divergent.

There is a single specimen labelled *X. moebii* (see fig. 2e) in the Australian Museum collections (male, 9.5 mm, Malabar coast, India, coll. "Investigator", exch. Indian Museum, May 1900, P2700) which was probably identified by Alcock. This agrees with the specimens from Moreton Bay which we refer to *X. dolichophallus* in the following features: carapace with long hairs laterally, otherwise with very short tomentum, surface laterally granulate; front bilobate anteriorly; ischium of third maxilliped wider than merus; cheliped with edges of the segments granulate and bearing long fringes of hairs; and dorsal and ventral edges of ambulatories bearing long fringes of hairs. The abdomen of the male is almost the same shape as in *X. dolichophallus* and the sternum around the edges of the abdominal fossa is obscurely granulate and pubescent. However, the lateral and anterior edges of the merus of the third maxilliped do form an obtuse angle at their junction; the carpus of the cheliped bears a short, sharp spine at the anteromedial angle; the chela is of a different shape, the palm being of about equal width throughout and longer than high with the outer surface bearing a broad band of small tubercles among thick tomentum and scattered hairs along the ventral edge, the band tapering to a thin line at the tip of the fixed finger, and with similar tubercles, tomentum and hairs on the dorsal edge of the palm and on the dorsal edge of the dactyl proximally; the sternites in front of the abdominal fossa are flat, not excavate, and the first pleopod is short and sinuous, curving inwards half way along and outwards apically. In all these features there is agreement with previous descriptions and figures of *X. moebii* (Alcock, 1900; Tesch, 1918).

Barnard (1950) figures a male specimen in which the pleopods are extremely long and straight. Barnard's material, according to his description, also agrees with *X. dolichophallus* but not *X. moebii* in the even curve of the merus of the third maxilliped

laterally, "angular" carpus of the cheliped, "sharp" edges of the chelae, excavation of the anterior sternites in front of the abdominal fossa, and the first segment of the abdomen extends laterally for only one-third of the width of the adjacent sternal plate (see Barnard, 1955, fig. 15e).

X. brachyphallus Barnard, 1955, from Inhambane (East Africa), differs from *X. dolichophallus* and *X. moebii* in having the outer surface of the palm of the chela margined with a broad band of hair, and the first pleopod of the male distally weakly expanded.

DISTRIBUTION: East coast of Java, west coast of Flores and south of Celebes (Tesch). Moreton Bay, Queensland (present report). ? Delagoa Bay, South Africa (Barnard).

Genus *Typhlocarcinops* Rathbun

Typhlocarcinops tonsurata sp. nov.

(Figs. 3, 6B.)

MORETON BAY MATERIAL: Holotype, male (8.8 mm), 8 miles E. of Scarborough, 2C, dredged on rising shallowing banks, 30 ft, fine sand, 10.xi.1961, W.S., Qd Mus. W2911.

DESCRIPTION: Carapace slightly shorter than wide (width 1.22 times length), widest midway along. Surface covered everywhere by very short tomentum which is particularly dense laterally; a fringe of long hairs laterally and of short hairs anteriorly; surface almost flat from side to side, strongly vaulted posterolaterally, strongly convex from front to back; front narrow (c. 0.22 carapace width, 0.53 fronto-orbital width), bilobate, projecting; anterolateral margins convex, bearing two shallow indentations, the first broad, the second narrow, defining a broad, weakly rounded lobe just forward of the widest part of the carapace; posterolateral margins weakly convergent; posterior margin weakly convex, bordered by a narrow, low ridge. Orbits well formed, filled by short, broad ($l/b = 1.25$), immovable eyestalks with small, rounded terminal cornea only partly visible.

Antennae extremely short, stout. Epistome not extremely short; weakly concave posteriorly, with a narrow ridge prominent medially; surface concave medially.

Sides of carapace, pterygostomian regions, third maxillipeds, sternum, and abdomen covered by short tomentum partly concealing small round granules except on ischium and central part of merus of third maxillipeds, central parts of sternites, and abdomen, which are smooth.

Third maxillipeds with ischium wider midway along than greatest width of merus, centrally with a prominent oblique groove; merus broader than long (1.2 times), very weakly excavate near medial margin, lateral and anterior margins almost forming a smooth arc, weakly angled at their junction; palp short, stout, fringed with long hairs.

Chelipeds short (1.5 times carapace width), robust, outer face of merus, carpus and chela margined by broad band of tomentum, edges with fringes of long hairs and small granules, inner face of all segments mostly naked, all naked areas smooth and porcelain

white. Merus trigonal. Carpus subcylindrical, minutely granular dorsally, particularly near inner angle. Palm of chela compressed, about as long as high, highest close to distal edge; fingers stout, with broad teeth along inner edge, dactyl crossing behind fixed finger when closed.

Ambulatory legs compressed, covered by tomentum, dorsal and ventral edges of all segments bearing fringes of long hairs. Dactyli of first legs longest, second and third subequal, fourth shortest.

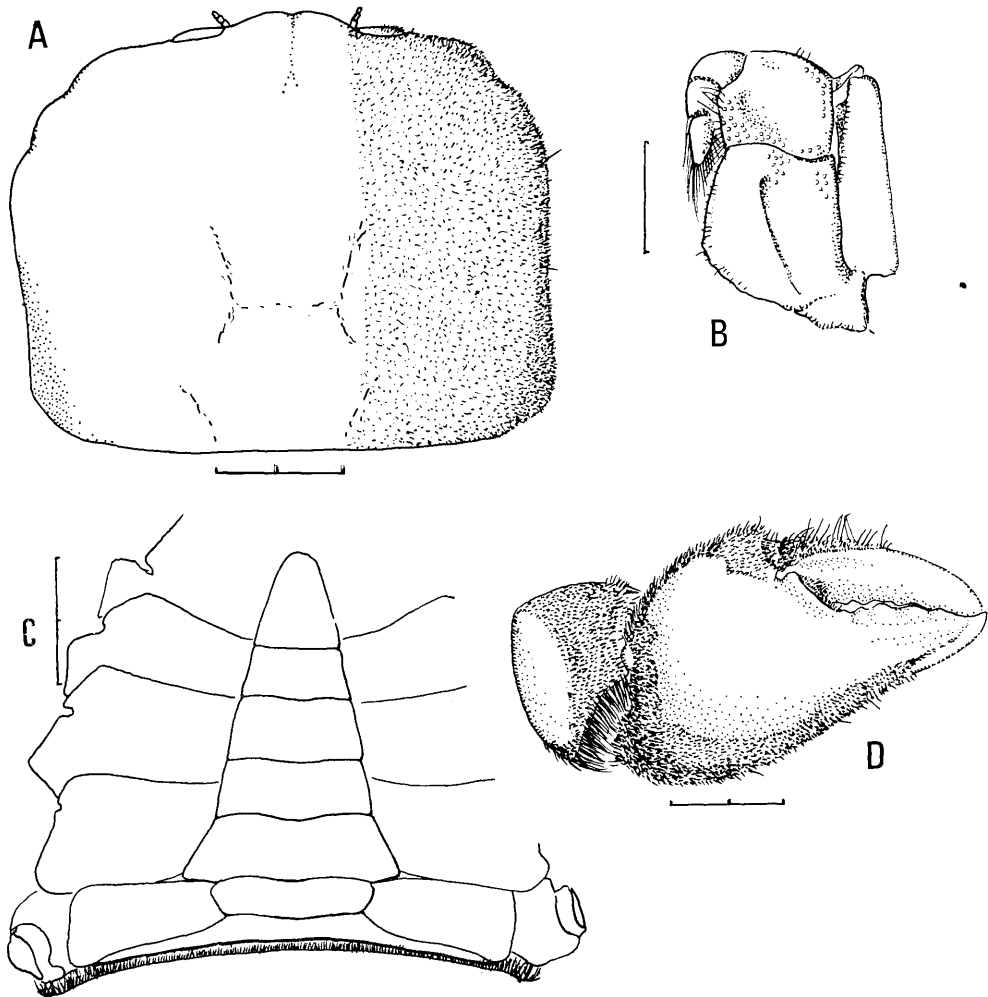


FIG. 3: *Typhlocarcinops tonsurata*, holotype. A, carapace; B, third maxilliped; C, male abdomen; D, chela.

Scale divisions 1 mm.

Abdomen of seven segments, widest at base of first segment which almost completely occupies the entire width between bases of last ambulatory legs; second segment much narrower; third segment widening abruptly, then tapering to fourth segment; fourth segment little narrower than second segment; abdomen evenly tapering from base of fourth segment to rounded tip of last segment which is almost as wide as long.

First pleopod sinuous, carrying two series of short to moderate bristles distally, the median terminal bristles being stouter than the laterals. (Distal half of right pleopod of holotype missing; left pleopod twice fractured.)

DISCUSSION: Tesch (1918, pp. 210-1) has discussed the close affinity of the genus *Typhlocarcinops* with *Typhlocarcinus* and disagrees with Rathbun's action in creating the sub-family *Typhlocarcinopsinae* for this genus. The justification for retaining this sub-family would rest solely in the very marked lateral production of the first abdominal segment of the males in *Typhlocarcinops* and Tesch has pointed out that a tendency for lateral production also exists, though to a lesser extent, in *Typhlocarcinus*. This tendency is most obvious in *T. villosus* Stimpson (see Serene, 1964, fig. 4B) and *T. rubidus* Alcock (see Serene, 1964, fig. 5B) but in neither of these does the first segment nearly occupy the entire breadth of the sternum. Of the species of *Typhlocarcinops*, *T. tonsurata* probably has the least produced first segment, but this in fact does very nearly occupy the entire breadth of the sternum. While there is thus insufficient reason to include *Typhlocarcinops* in a family separate from *Typhlocarcinus* there can be little doubt that these genera are in fact distinctly separable and that this present species belongs in *Typhlocarcinops*. *T. tonsurata* further differs from *Typhlocarcinus villosus* and *T. rubidus* in having a more projecting front and non-granulate, trilobate carapace margins, and in the shape and armature of the male first pleopod.

Serene (1964, p. 222) listed 7 species of *Typhlocarcinops*, described two new species, and described and figured a specimen which he doubtfully referred to *T. canaliculata* Rathbun. In view of the marked difference in carapace shape between his specimen and those of Rathbun, even when allowance is made for the fact that Rathbun's were juveniles, the total number of species in this genus, including *T. tonsurata*, is probably eleven.

These eleven species can be divided, on the basis of carapace shape, into two groups, those with broad carapace (b/l greater than 1.4) being *T. stephenseni* Serene, *T. canaliculata*: Serene (non Rathbun), *T. transversa* Tesch and *T. angustifrons* Rathbun. Of those with narrow carapaces (b/l less than 1.4), *T. canaliculata* Rathbun, *T. angustipes* Tesch, and *T. ocularia* Rathbun have the anterolateral margins entire and are thus separable from *T. marginata* Rathbun, *T. decrescens* Rathbun, *T. gallardoi* Serene, and *T. tonsurata*.

T. tonsurata is distinguished from *T. marginata* and *T. gallardoi* (see Serene, 1964, pp. 227-33, figs. 10, 11, pls. 20A, 20B) by its narrow, projecting front, the lack of conspicuous grooving on the carapace, the anterolateral margins which are not conspicuously granulate and are twice indented, and the lateral margins of the sixth segment of the male abdomen which are distinctly convergent distally.

Comparison with *T. decrescens* was made difficult by inaccuracies in published figures of this species. Sakai (1965, p. 172) mentions several discrepancies between Tesch's (1918) pl. 13 fig. 4 and the holotype, and there are also discrepancies between Sakai's own figures and the measurements given by Rathbun (1914, p. 151) for the holotype. We are most grateful to Henry B. Roberts of the United States National Museum for comparing the holotype of *T. decrescens* with Sakai's figures and with figures of *T. tonsurata*, for providing sketches of the holotype, and for the loan of a paratype, USNM122579. In the holotype and paratype the merus of the outer maxilliped is not as short and broad as in Sakai's fig. 22d and the outer angle is not strongly produced laterally; the front is produced well beyond the level of the inner angles of the orbits and the frontal width is half the fronto-orbital width which is 0.44-0.45 times the carapace width; the first segment of the male abdomen is shorter and broader, the remaining segments, especially the third, are much narrower than as depicted by Sakai (fig. 22c), and the deep median groove running back from the front in Sakai's pl. 84, fig. 5 is not present. Sakai's figures do agree with the type material in 1/b ratio and in the production of the posterolateral angles of the carapace. In the paratype, the shape of the male pleopod is as depicted by Sakai but the three distal spines of the lateral series are much longer, approximately twice the shaft thickness, and cross behind the curved tip.

T. tonsurata differs from *T. decrescens* in the following particulars:

- (1) The posterolateral margins of the carapace are not conspicuously produced.
- (2) The anterolateral margin of the carapace is more conspicuously lobate, its anterior third more transverse.
- (3) The eyestalks are shorter and broader ($1/b = 1.25$ in *T. tonsurata*, 1.60 in *T. decrescens* paratype).
- (4) The surface of the carapace is entirely covered with a very short tomentum.
- (5) The merus of the third maxilliped is broader than long (1.2 times) whereas in *T. decrescens* it is as broad as long.

Genus *Eucrate* de Haan

Eucrate sexdentata Haswell

Eucrate sexdentatus Haswell, 1881, p. 548; 1882, p. 86.

[non] *Pseudorhombilia vestita* (de Haan), var. *sexdentata*, Haswell [sic]: Miers, 1884, pp. 240-1, pl. 24B.

Eucrate sexdentata: Alcock, 1900, p. 301. Campbell, 1969, pp. 120-2, fig. 1.

MORETON BAY MATERIAL: Male (20 mm), $\frac{1}{2}$ mile SSW. of red beacon, Toorbul Pt., **1A**, dredged 4 fms, muddy, 29.x.1962, Z.D.U.Q., Aust. Mus. P15246. Male (6.5 mm), 1 mile off shore E. of Redcliffe water tower, **2A**, 15.xii.1964, Z.D.U.Q., Qd Mus. W2806. Male (15 mm), 3 miles NNE. of Pile Light, **3B**, 29.iv.1964, Z.D.U.Q., Qd Mus. W2808. Male (18 mm), 2 miles NE. of Pile Light, **3B**, 29.iv.1964, Z.D.U.Q., Qd Mus. W2817. Female (16 mm), $3\frac{1}{4}$ miles SW. of Shark Spit, **3C**, dredged 13 fms, mud, 23.ii.1962, Z.D.U.Q., Qd Mus. W2715. Female (ovig.) (16 mm), 3 miles ENE.

of Mud I., 3C, dredged 10 fms, 14.xii.1962, Aust. Mus. P15253. Female (15 mm) 2 miles N. of E. end of Mud I., 3C, 6½ fms, mud, 25.v.1967, Z.D.U.Q., Qd Mus. W2818. Female (12 mm), 4½ miles NW. of sand hills on Moreton I., 3D, 11–12 fms, 1.vi.1962, Z.D.U.Q., Qd Mus. W2726. Male (15 mm), 5 miles E. of north beacon, St. Helena I., 4C, dredged 11–12 fms, 13.xii.1962, Z.D.U.Q., Qd Mus. W2648. Female (20 mm), ½ mile E. of Wellington Pt., 5C, 5–6 fms, muddy sand, Z.D.U.Q., Aust. Mus. P15258. Female (23.5 mm), 1¼ miles SSE. of Goat I., 6D, 2½ fms, gritty mud, 12.x.1967, Z.D.U.Q., Qd Mus. W2909.

ADDITIONAL MATERIAL: Female (ovig.) (17.5 mm), off Jumpin Pin, SE. Qd, trawled 26 fms, late 1962, L. Wale, Qd Mus. W2812.

This species has been redescribed and figured by Campbell (1969).

DISTRIBUTION: Port Denison (Haswell, 1882), India (Alcock, 1900,) and Moreton B.

***Eucrate dorsalis* (White)**

Cancer (Galene) dorsalis White, 1848, p. 144, pl. Annulosa 6.

Eucrate dorsalis: McCulloch, 1909, p. 314. Campbell, 1969, pp. 133–5, figs. 2, 6.

MORETON BAY MATERIAL: Female (54 mm), 1 mile SW. of Mud I., 5B, trawled 4–5 fms, 16.ii.1966, Z.D.U.Q., Qd Mus. W2717. Female (ovig.) (51 mm), 8 miles E. of Scarborough, 3B, trawled 4½ fms, sandy, 10.xi.1961, Z.D.U.Q., Qd Mus. W2647.

Male (31 mm), Sandgate, Moreton B., M. Ward, Aust. Mus. P7914. Three males (51–63 mm), Moreton B., 24.v.1917, A. Fooks, Qd Mus. W76. Male (53.5 mm), Cleveland, Moreton B., 10.xii.1932, A. Spence, Qd Mus. W414. Male (16 mm), Hayes Inlet, Moreton B., 27.v.1941, W. Duus, Qd Mus. W1257. Male (15 mm), Mud I., Moreton B., 15.x.1941, V. F. Collin, Qd Mus. W1430. Female (19 mm), Mud I., Moreton B., 28.i.1942, V. F. Collin, Qd Mus. W1465. Female (27 mm), Mud I., Moreton B., 1.ii.1942, V. F. Collin, Qd Mus. W1472. Female (42 mm), trawled off Otter Rock beacon, 6.iii.1967, L. Woodland, Qd Mus. W2661. Male (18.5 mm), Mud I., Moreton B., 12.x.1942, V. F. Collin, Qd Mus. W3032. Male (38 mm), Mud I., Moreton B., 26.v.1944, V. F. Collin, Qd Mus. W3033.

ADDITIONAL MATERIAL: Male (44 mm), Observation I., Gulf of Carpentaria, N.Qd, W. Paradise, Aust. Mus. P6793.

This species has been redescribed and figured by Campbell (1969).

DISTRIBUTION: Queensland coast from Gulf of Carpentaria to Moreton B.

Genus ***Ommatocarcinus*** White

Ommatocarcinus macgillivrayi White

(Figs. 4, 6D.)

Ommatocarcinus Macgillivrayi White, 1852, pp. 393–4, pl. 5, fig. 1.

Ommatocarcinus macgillivrayi: Sakai, 1934, p. 314, fig. 22; 1939, p. 564, pl. 102, fig. 5; 1965, p. 170, pl. 84, fig. 3.

Ommatocarcinus sp.: Yokoya, 1933, pp. 198–9, fig. 65.

[non] *Ommatocarcinus macgillivrayi*: Miers, 1886, pp. 247–8. Chilton and Bennett, 1929, pp. 757–8. Bennett, 1964, pp. 74–5, figs. 79–83, 135. (= *O. huttoni* Filhol).

MORETON BAY MATERIAL: Four males (56–61 mm), Woody Pt., 3A, 4.vi.1926, J. Askew, Qd Mus. W3039. Male (59 mm), Woody Pt., 3A, 16.xii.1941, N. Adams, Qd Mus. W1445.

The present specimens agree well with White's (1852) figure of this species, but differ markedly from illustrations of Japanese specimens (Yokoya, 1933; Sakai 1934, 1965) in the length of the chelipeds. In Yokoya's 14 mm specimen the chelipeds nearly equal the carapace width, in Sakai's 32mm specimen they are 1.3 times as long, and in our 56 mm specimen they are 2.5 times as long. An equivalent elongation of the chelipeds with growth is mentioned in the New Zealand species by Bennett (1964). The palps of the third maxillipeds as figured by Yokoya appear too small but in other respects—the obtuse transverse ridge across the carapace, the anteriorly widening buccal area, the length of the eye-stalks, and the fine spinulation of the ambulatory meri—the Japanese specimens agree well with the present specimens, and there is no reason to consider them specifically distinct as was suggested by Bennett (1964, p. 74).

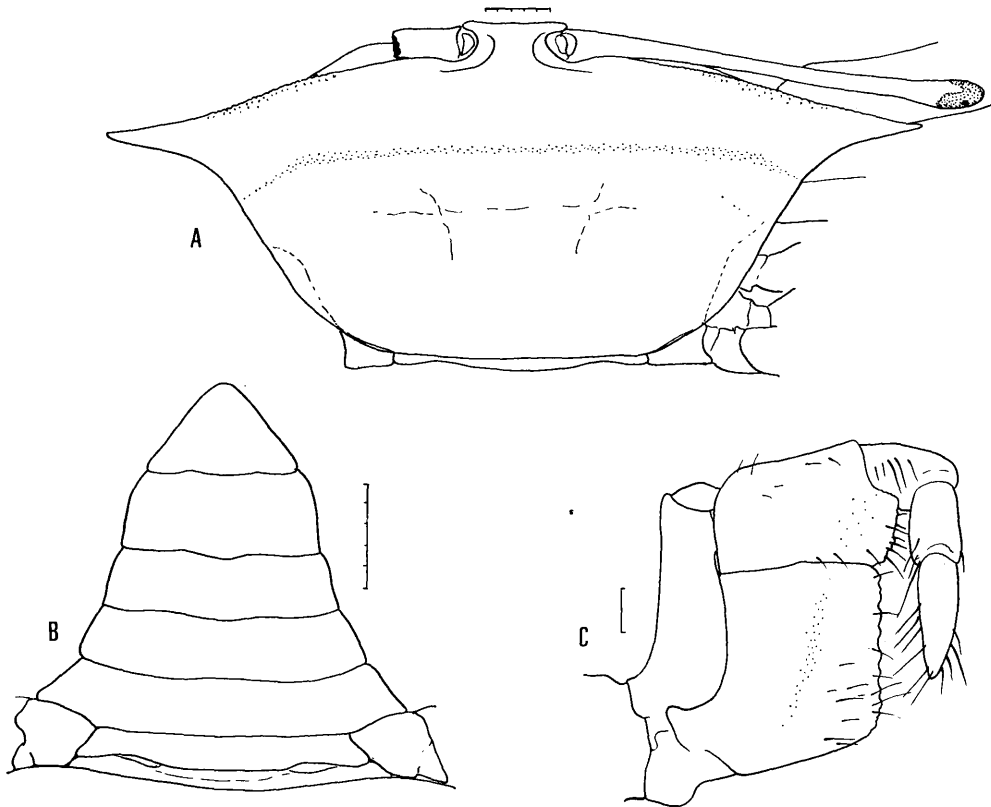


FIG. 4: *Ommatocarcinus macgillivrayi*, male 61 mm, Qd Mus. W3039. A, carapace; B, male abdomen; C, third maxilliped.

Scale divisions 1 mm.

This species, while quite close to the New Zealand *O. huttoni*, differs from it in the following particulars:

- (1) The eye-stalks of the adults are longer, so that the exorbital spine does not reach to the base of the cornea.
- (2) There is a distinct, obtuse, transverse ridge running across the carapace on the anterior third.
- (3) The male abdomen is broader, and composed of seven distinctly separate segments.
- (4) The lateral borders of the buccal area are subparallel, not narrowing anteriorly.
- (5) The merus of the ambulatory legs is less distinctly spinose, with the subdistal spinule very small.
- (6) The orbital margins are less arcuate.
- (7) The lateral carapace spine is more slender.
- (8) The carpus of the cheliped bears a distinct spine on its inner angle.

Neither Chilton and Bennett nor Bennett mention the strong milled ridge which runs below, and parallel to, the suborbital border and which, together with the short ridge on the base of the merus of the cheliped, forms a stridulatory mechanism in the Australian species. It is quite possible that this was overlooked and that it is, in fact, present in *O. huttoni*.

DISTRIBUTION: Queensland from Port Curtis (type locality, White, 1852) and Moreton Bay; Japan (Yokoya, 1933; Sakai, 1934, 1965).

Family PINNOTHERIDAE

Genus *Xenophthalmus* White

Xenophthalmus pinnotheroides White

(Figs. 5, 6E.)

Xenophthalmus pinnotheroides White, 1846, p. 178, pl. 2, fig. 2. Adams and White, 1848, p. 63, pl. 12, figs. 2, 3a. H. Milne Edwards, 1853, p. 221. Stimpson, 1858, p. 107. Sluiter, 1881, p. 162. Henderson, 1893, p. 394. Rathbun, 1910, p. 338, fig. 22. Tesch, 1918, pp. 272-4. Shen, 1937, pp. 301-4, fig. 11a-g; 1948, pp. 113-4, fig. 4. Stephensen, 1945, pp. 186-7, fig. 54.

Xenophthalmus pinnoteroides: Alcock, 1900, pp. 332-3.

MORETON BAY MATERIAL: Female (12.5 mm), $\frac{3}{4}$ mile W. of Toorbul Pt. beacon, **1A**, 3 fms, gritty sandy mud, 14.viii.1967, W.S., Qd Mus. W2858. Female (17 mm), 1 mile S. of Bribie beacon, **1A**, 3 fms, clean fine sand, 14.viii.1967, W.S., Qd Mus. W2853. Female (14.5 mm), 1 mile SE. of Skirmish Pt., **1B**, 2 fms, sand ripple, 14.viii.1967, W.S., Qd Mus. W2856. Male (9 mm), $5\frac{1}{2}$ -6 miles ENE. of Scarborough, **1B**, dredged $2\frac{1}{2}$ fms, 6.vii.1962, W.S., Qd Mus. W2908. Male (10 mm), 1 mile SE. of Redcliffe Jetty, **2A**, $3\frac{1}{2}$ fms, mud with shell and grit, 15.xii.1964, Z.D.U.Q., Qd Mus. W2804. Three males, two females (9-17.5 mm), 1 mile offshore E. of Redcliffe water tower, **2A**, 3 fms, mud

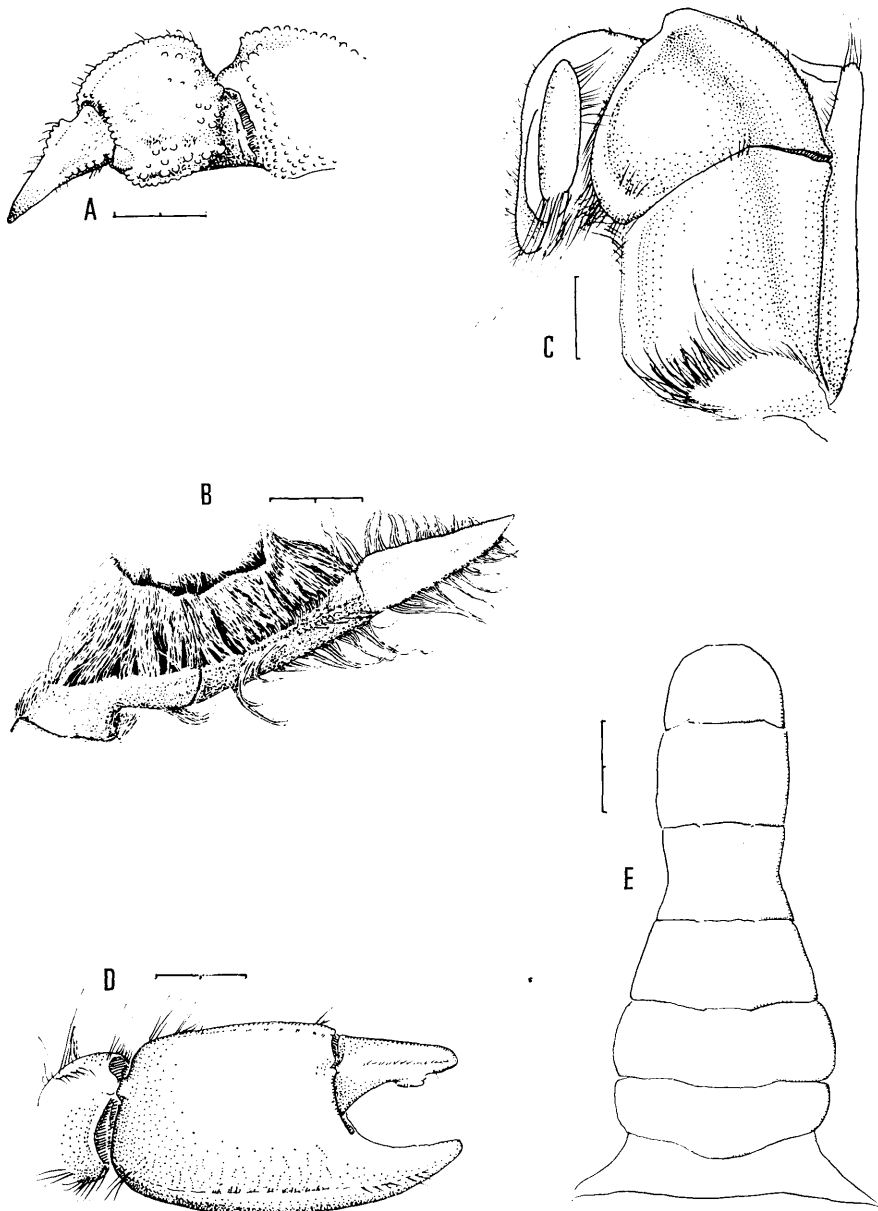


FIG. 5: *Xenophthalmus pinnotheroides*, male 16 mm, Qd Mus. W2906. A, dactyl and propodus of right first ambulatory leg; B, last three segments of right second ambulatory leg; C, third maxilliped; D, chela; E, male abdomen.

Scale divisions 1 mm.

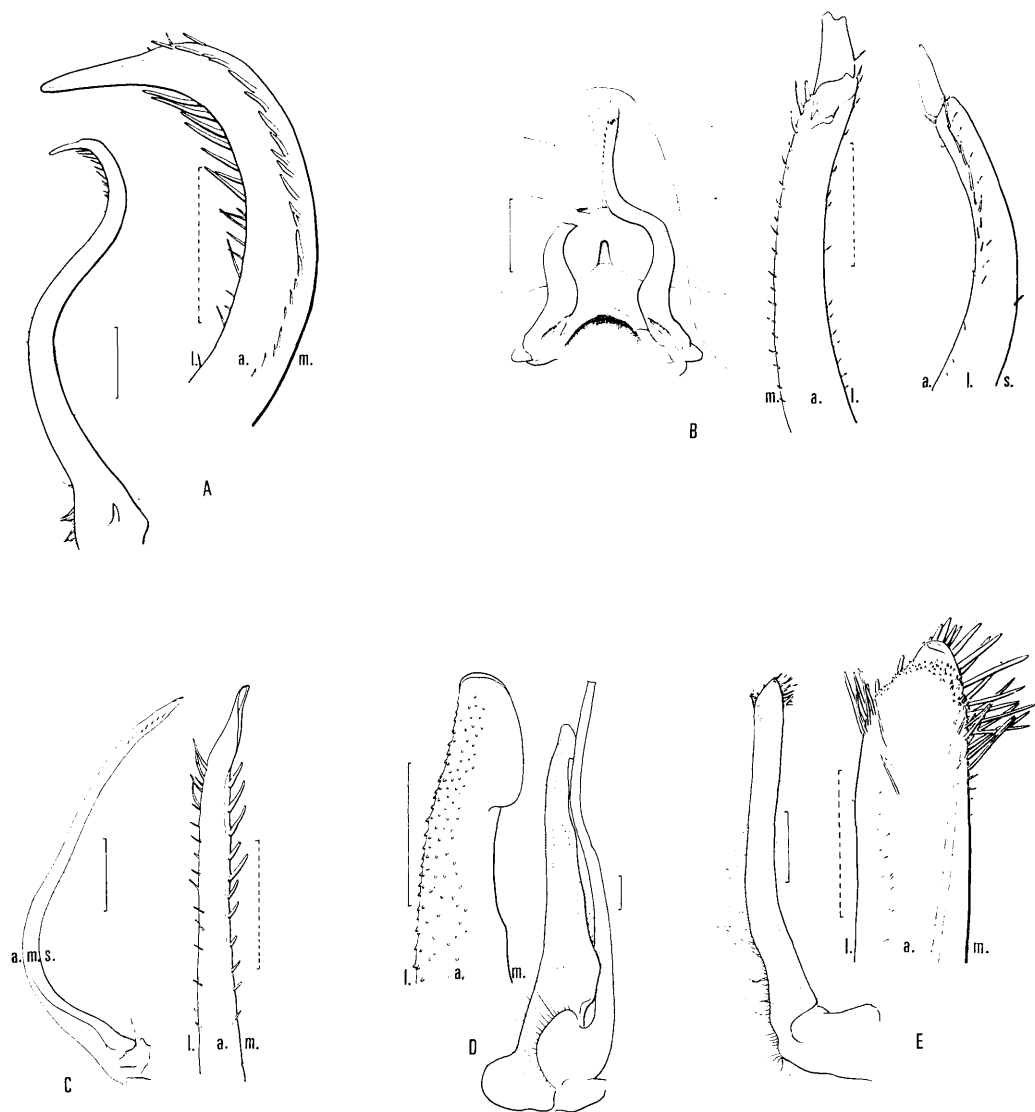


FIG. 6: Male first pleopods of A, *Rhizopa gracilipes*, Qd Mus. W1475; B, *Typhlocarcinops tonsurata*, holotype; C, *Xenophthalmodes dolichophallus*, Qd Mus. W2815; D, *Ommatocarcinus macgillivrayi*, Qd Mus. W3039; E, *Xenophthalmus pinnotheroides*, Qd Mus. W2905.

a = abdominal, l = lateral,
m = medial, s = sternal faces.

Scale lines 1 mm and 0.5 mm (broken line).

and shell, 15.xii.1964, Z.D.U.Q., Qd Mus. W2801, W2809. Four males, four females (ovig.) (11–16 mm, smallest ovig. female 11 mm), 200 yds S. of Scarborough blinker, **2A**, dredged 3 fms, 29.x.1962, W.S., Aust. Mus. P15789. Male, five females (6.5–10 mm), 100 yds NW. of Scarborough blinker, **2A**, dredged 3½ fms, sandy grit, 29.x.1962, W.S., Qd Mus. W2907. Five males, ten females (9–23 mm), ¼ mile NE. of Old Pile Light, **3B**, 15.v.1967, Z.D.U.Q., Qd Mus. W2814. Male (10 mm), female (15 mm), ½ mile N. of Mud I., **3C**, dredged 3 fms, mud, 19.iv.1961, Z.D.U.Q., Qd Mus. W2716. Two males, two females (12.5–16 mm), ½ mile E. of St. Helena I., S. beacon in line with middle of Green I., **4C**, dredged 4 fms, 13.xii.1962, W.S., Qd Mus. W2906. Male (15.5 mm), S. end of St. Helena I. in line with Nazareth House, **4C**, dredged 5½–6 fms, 3.xii.1962, W.S., Aust. Mus. P15790. Two males, female (5.5–8 mm), 2 miles NNW. of Wellington Pt., **5B**, dredged 4 fms, sandy mud, 12.ii.1968, Z.D.U.Q., Qd Mus. W2962. Male (6.5 mm), 1 mile NE. of Hanlon Light, **5D**, dredged 3½ fms, muddy sand, 12.ii.1968, Z.D.U.Q., Qd Mus. W2960. Seven males, four females (6.5–8 mm), 1 mile, ENE. of Cleveland Light, **6C**, dredged 6½ fms, gritty sand, 12.ii.1968, Z.D.U.Q., Qd Mus. W2961. Ten males, four females (11–15 mm), 2¼ miles SW. of Garden I., **7C**, 1½ fms, sandy mud, 13.x.1967 Z.D.U.Q., Qd Mus. W2904. Male (12.5), two females (12, 12.5 mm), ½ mile SE. of Snipe I., **7C**, 3 fms, muddy sand, 13.x.1967, Z.D.U.Q., Qd Mus. W2905.

Additional records of specimens which were identified but not retained by the collecting party: Six, 2 miles ESE. of Beachmere, **1A**, 2 fms, shelly mud, 6.vi.1967, W.S. Four, ½ mile ENE. of Toorbul Pt. red buoy, **1B**, 3½ fms, muddy sand, 13.vi.1967, R. Maloney. One, 1¼ miles N. of North Reef beacon, **2A**, 3¼ fms, mud with shell, 6.vi.1967, W.S. Twelve, ¾ mile NNE. of Cribb I., **4A**, 2 fms, mud with shell, 15.v.1967, W.S. Six, ¾ mile NNE. of Serpentine Ck., **4A**, 2 fms, mud with shell, 15.v.1967, W.S.

Two males, female (5.6–16.3 mm), between Peel I. and Cleveland, old collection, Aust. Mus. P11442.

The specimens agree well with Tesch's detailed description, except that he describes the ischium and merus of the third maxillipeds as having a faint longitudinal groove laterally—in our specimens the groove is very deep. In addition, the chelae in the largest males are stout and the palms are widest distally. The specimens examined by Tesch and by Rathbun were smaller than the largest in the present series. The abdomen in adult females is very broad and subovate as illustrated by Adams and White.

DISTRIBUTION: Gulf of Siam (Rathbun, 1910); "eastern seas" (Adams and White, 1848); east coasts of Java and Sumbawa (Tesch, 1918); Rameswaram, India (Henderson, 1893); Philippine Islands (White, 1846; Milne Edwards, 1853); Hong Kong (Stimpson, 1858); Tandjong Priok, Java (Sluiter, 1881).

Genus *Pinnotheres* Latreille *Pinnotheres spinidactylus* Gordon

(Figs. 7, 8.)

Pinnotheres spinidactylus Gordon, 1936, pp. 169–71, figs. 1a, 2a–e (not 3:52 mm male, not figs. 1b, c.)

[?] *Pinnotheres modiolicola* Bürger, 1895, p. 370, pl. 9, fig. 9, pl. 10, fig. 9. Tesch, 1918, p. 253 (in key).

MORETON BAY MATERIAL: Female (6 mm) from *Modiolus* sp., ½ mile W. of "House" on Macleay I., **7D**, 3½ fms, muddy sand with shell, 13.x.1967, Z.D.U.Q., Qd Mus. W2910. Male (3.1 mm), female (7.2 mm) from *Modiolus* sp., ¼ mile NW. of Pat's Pt., **6D**, dredged 5 fms, gritty mud, 13.x.1967, Z.D.U.Q., Qd Mus. W3038, W3037 respectively.

DESCRIPTION OF FEMALE

CARAPACE: Approximately 1.15–1.2 times as broad as long, smooth and convex; front considerably advanced beyond anterior border, obscurely bilobed; shoulders distinct but rounded; posterior border straight or slightly concave; eyes visible in dorsal aspect, subcircular and with small subterminal triangular or subcircular pigmented area in frontal view.

EXTERNAL MAXILLIPEDS: Dactyl arising one third to half way along propodus, reaching just short of blunt apex of propodus.

CHELIPED: Almost as long as third walking leg and much more massive. Merus, measured along outer margin *c.* twice as long as wide; carpus abruptly bent inwards and wider than proximal end of palm; dactyl as long as maximum height of palm, 0.75 dorsal length of palm; palm 1.5 times length of dactyl.

TABLE 1
RELATIVE LENGTHS OF LEG SEGMENTS OF FEMALE *P. spinidactylus*

—	Specimen	Left legs			Right legs		
		2	3	4	2	3	4
Relative lengths of dactyls	W2910	—	—	—	1.00	1.09	1.47
	W3037	1.00	1.41	1.81	1.00	1.15	1.84
<u>Propodus 1.</u> <u>dactyl 1.</u>	W3037	1.93	1.55	1.00	1.84	1.74	1.00

WALKING LEGS: First two subequal, third longest, fourth shortest; right third leg shorter than left; third left dactyl *c.* $\frac{1}{3}$ longer than second; fourth dactyl equal to propodus in length. Spinulation of inner margin of dactyls variable and asymmetric *; first dactyl without spinules; second dactyl with 6–4 spinules on both sides of W3037, 10 on right side and left dactyl missing on W2910; third dactyl with 7–10 spinules on right side of both specimens, no spines on left side of W3037, left dactyl missing on W2910; fourth dactyl with 5–8 long subterminal spines and a series of *c.* 20 spinules on both sides of W2910, 2 spinules on right side and none on left side of W3037.

* These spines are minute and require critical microscopy for their detection on the entire specimen; immersion in glycerine and substage illumination are helpful, but correct orientation of the dactyl to view the spines in profile is still necessary.

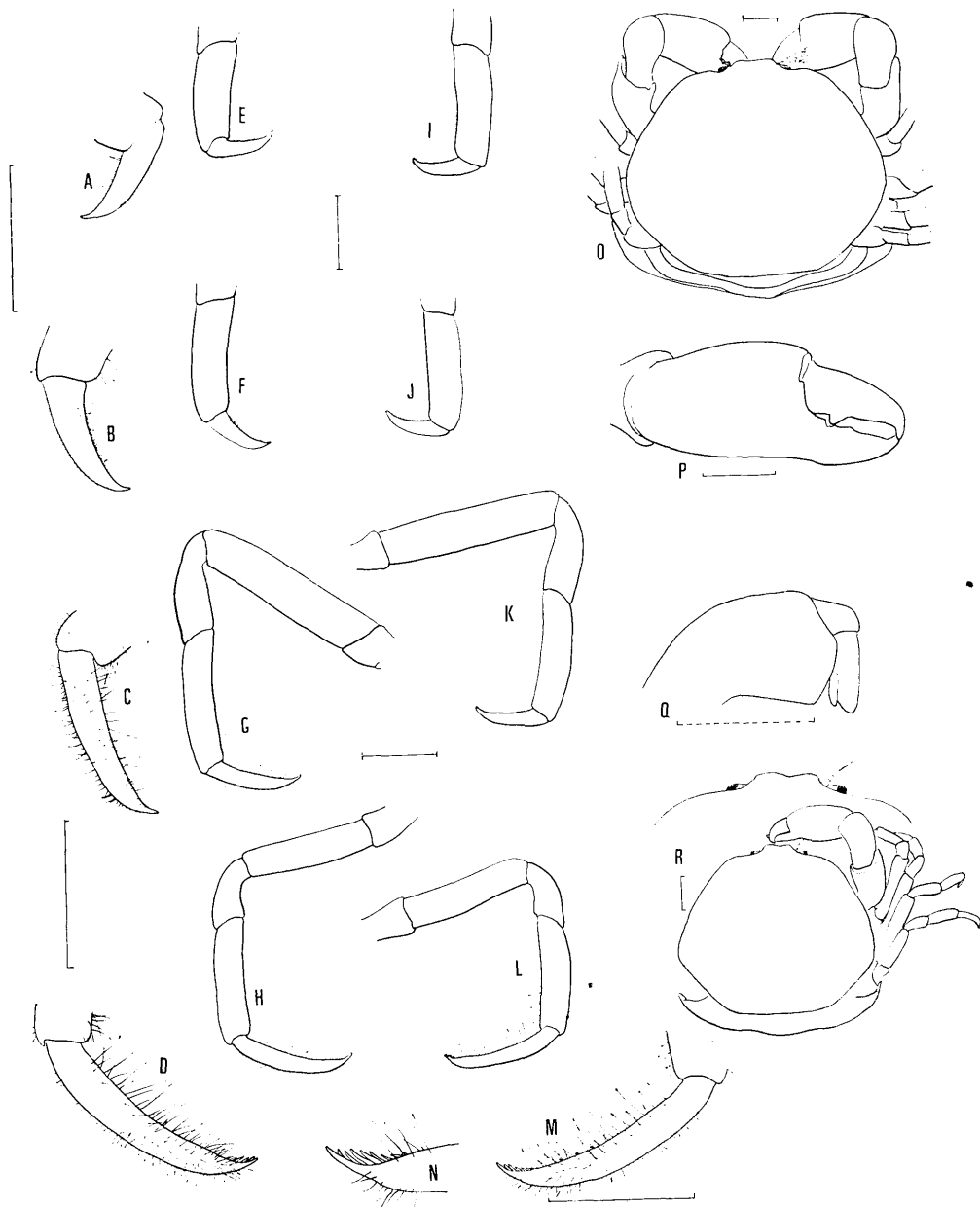


FIG. 7: *Pinnotheres spinidactylus*, female. A-Q, Qd Mus. W3037. A-D, dactyli of first to fourth left ambulatory legs respectively, A in anterior view, B-D in dorsal view; E-F, dactyl and propodus of first and second left legs respectively; G-H, third and fourth left legs respectively; I-J, dactyl and propodus of first and second right legs respectively; K-L, third and fourth right legs respectively; M, N, dactyl of fourth right leg; O, carapace; P, chela; Q, third maxilliped.

R, carapace of Qd Mus. W2910, with front enlarged.

Scale lines 1 mm and 0.5 mm (broken line).

DESCRIPTION OF MALE

CARAPACE: Little broader than long (1.05 times); front considerably produced beyond anterior border, bilobate; shoulders distinct but rounded, separated from orbit by *c.* half frontal width; posterior border straight; eyes visible in dorsal view, orbits small.

EXTERNAL MAXILLIPEDS: Similar to those of female.

CHELIPEDS: Propodus height half total length, slightly greater than length of dactyl; tip of dactyl markedly hooked.

WALKING LEGS: Second and third legs with dense fringes of long setae on ventral border of propodus and running from upper surface of carpus to, and along dorsal border of propodus; dactyls subequal; first to fourth propodi in ratio 1:1.15:1.25:0.85.

MALE ABDOMEN: Much broader than in other species of this genus (see fig. 8B). The male pleopods are undeveloped and this broadened abdomen is probably due to immaturity.

MALE PLEOPODS: Immature, two pairs of biramous appendages.

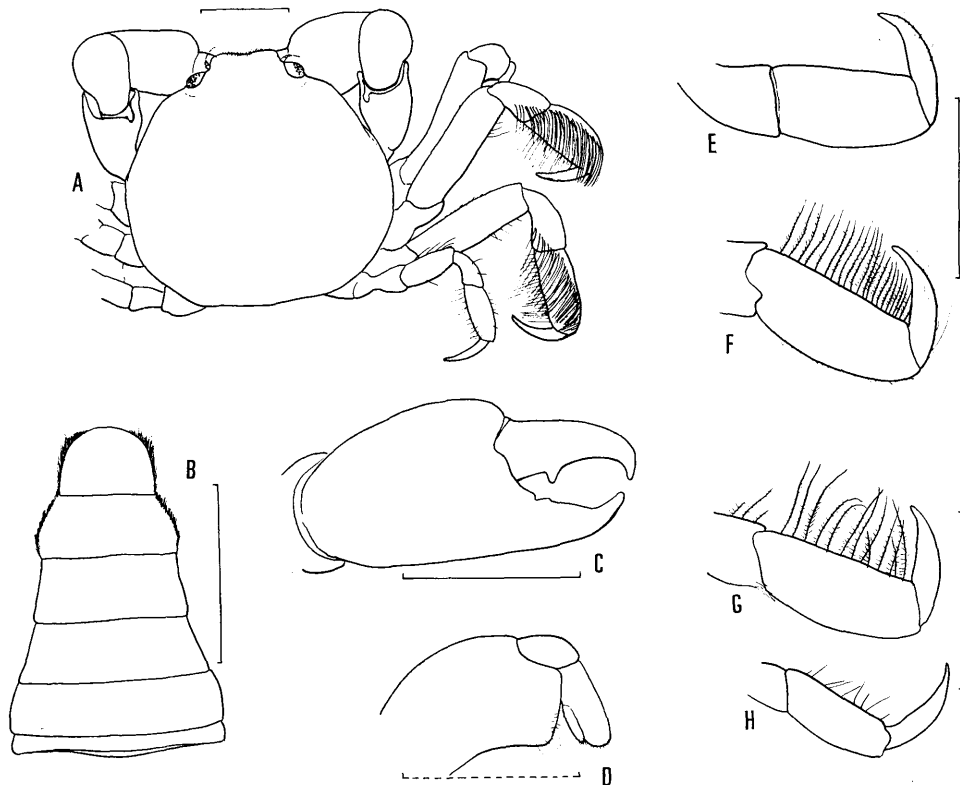


FIG. 8: *Pinnotheres spinidactylus*, male, Qd Mus. W3038. A, carapace; B, abdomen; C, chela; D, third maxilliped, E-H, first to fourth right ambulatory legs respectively, in ventral view. Scale lines 1 mm and 0.5 mm (broken line).

DISCUSSION (FEMALE)

The asymmetry of the ambulatory legs in this genus has been commented on by Gordon (1936, p. 164) and it is unfortunate that this asymmetry was not considered by Tesch (1918) in the construction of his key to the species. As relative length of dactyls is one of the most used characters, this key is unreliable as each side of the one specimen can key out to a different species. This is the case with the present specimens.

At couplet 21 the left side, which has the longer third dactyl, through couplets 30, 37, 38, 41, 42 reaches "*P. similis* and *P. alcocki*". Gordon notes that reaching a name in Tesch's key is not equivalent to reaching an identification, and presents a key which discriminates between *P. similis*, *P. alcocki*, *P. latissimus* and three new species, *P. spinidactylus*, *P. tivelae*, and *P. winckworthi*. All six species appear closely related and their separation in the key depends on detailed multi-character couplets. In using this key for the identification of the present specimens *P. latissimus* and *P. winckworthi* can be eliminated as the third dactyl in those species is longer than the fourth. Beyond this point although these specimens undoubtedly belong to this group (dactyl of external maxilliped styliform, inserted at inner margin of propodus; dactyls of third and fourth legs on side with longest third dactyl longer than those of first and second legs) they cannot be fitted within the framework of the key, because of their possession of the following characteristics:

- (1) Setae on dorsal margin of fourth dactyl *.
- (2) Fourth dactyl equal in length to propodus.
- (3) Fourth dactyl armed with 5-6 short to moderate spines near claw.
- (4) Ratio of second propodus to dactyl 1.93: 1.
- (5) Front advanced and distinct from carapace.
- (6) Ratio of second to fourth dactyl 1: 1.8.
- (7) Ratio of fourth to third dactyl at most 4: 3.
- (8) Dactyl of chela *circa* four-fifths dorsal border of palm.
- (9) Propodus of third maxilliped not contracted distally.

Although it would appear that the description of the present specimens as a new species would be justified, the probable existence of an already considerable number of synonyms within the genus made it more desirable that they should be forced, if possible within the conceivable variability of an existing nominate species even if only as a temporary measure.

The spinulation of the ventral margins of the dactyls, in particular the strong subterminal series on the fourth dactyl, the shape of the carapace and of the bilobate front, and the host bivalve (*Modiolus* sp.) agreed remarkably well with *P. spinidactylus*. The key characters which prevented this identification were features 2, 4, and 6, all of

* The ambiguity of the first character of Gordon's couplets IA, IB, has been resolved after examination of her figures of the species involved as "setae on dorsal margin of fourth dactyl: no setae on dorsal margin of fourth dactyl".

which are based on the ratios of lengths of segments of the ambulatory legs, which are quite variable and open to individual error in measurement. Because of this, because the magnitudes of the differences are not great (0.8–0.9 vs 1.0; 1.40–1.66 vs 1.9, 1.4–1.65 vs 1.8 respectively), and because the specimens agree well with Gordon's description (the format of which is used in the present description) this material is identified as *P. spinidactylus*.

If the right side of the specimen is used in following Tesch's key, this follows through couplets 21, 24, 26, 27, 29 to *P. modiolicolus* Bürger. This species is remarkably similar to *P. spinidactylus*, the only apparent differences being:

- (1) The front is less produced in Bürger's figure. This varies considerably with the angle of view and the slight difference could well be due to this.
- (2) The carapace is relatively longer in Bürger's specimen. Again, the difference, considering the difficulties that must have existed in measuring a small, soft specimen are not considerable.
- (3) The walking legs appear much more slender in Bürger's figure.

Opposed to this, such leg proportions as are available, the shape of the carapace, and the coincidence of the host suggest that these two species might be synonymous, but no firm conclusion can be reached from the meagre information contained in Bürger's brief description and rough figure.

DISCUSSION (MALE)

The sexual dimorphism in this genus is quite considerable and difficulties must inevitably be experienced by the taxonomist in associating males with the correct females. With her females of *P. spinidactylus* Gordon (1936, p. 171) had three males which appeared to belong to two distinct species. She referred the smallest specimen to *P. spinidactylus*, the others to an unidentified species. The reasons for this choice are not clear, but one criterion was probably the ratio of the lengths of the second, third, and fourth dactyls which were 1 : 1.40 : 1.33 in the small specimen, 1 : 1 : 1 in the others. In her female *P. spinidactylus* this ratio was 1 : 1.04–1.33 : 1.40–1.65. A second criterion could have been the setation of the second and third legs. Shen (1932) associated males and females in three species, of which one had no dense fringing of these legs in either sex, the other two had this setation in both sexes. Gordon refers to Shen's paper and perhaps relied heavily on this feature in associating her unfringed male with the unfringed females. Sakai (1965) however, describes and figures both sexes of *P. pholadis* and in this species only the male bears these dense fringes of setae.

The male in the present series which was taken from the same shell as W3037 agrees closely with the brief notes given by Gordon on her two unreferred males. The second and third legs are fringed with setae; the dactyl of the external maxilliped is similar to that of *P. gordonii* (see Shen, 1932, p. 152), although the abdomen is much broader in this juvenile specimen; the distance between the fourth legs equals the fronto-orbital width; the carapace width approximates the length; and the dactyls of the ambulatory

legs are subequal. It seems possible that Gordon underestimated the extent of the sexual dimorphism in this species and that, of her three males, the two larger actually belonged to *P. spinidactylus*.

DISTRIBUTION: Singapore (Gordon, 1936), ? Philippines (Bürger, 1895), and Moreton B. (present report).

ACKNOWLEDGEMENTS

We are very grateful to Prof. W. Stephenson for allowing us to examine the material collected by the Zoology Department of the University of Queensland, and to Dr. Ray Manning and Dr. Henry B. Roberts of the Smithsonian Institution, Washington, for so carefully comparing our descriptions and figures of *T. tonsurata* with the types of *Typhlocarcinops angustifrons* and *T. decrescens* respectively.

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