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THE GENUS *EUCRATE* (CRUSTACEA: GONEPLACIDAE) IN EASTERN AUSTRALIA AND THE INDO-WEST PACIFIC

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ABSTRACT

Five species are recorded from the Queensland coast; *Eucrate sexdentata* Haswell and *E. affinis* Haswell are redescribed, *E. australiensis* (Miers) being considered a synonym of the latter; *E. affinis:* Alcock is regarded as a synonym of *E. tripunctata* sp. nov.; *E. haswelli* sp. nov. is described from a single specimen similar to *E. transversa;* and smaller specimens of *E. dorsalis* White are shown to differ markedly from published figures and descriptions, which are based on large specimens. *E. crenata* de Haan is described and figured. A tentative key to nine Indo-West Pacific species is included.

While carrying out routine identifications for a faunal list of the sublittoral crabs of Moreton Bay (Campbell and Stephenson in MS.; Griffin and Campbell, 1969) it was inevitable that some specimens should require more thorough investigation. Three specimens of *Eucrate dorsalis*, readily identifiable from published figures, nevertheless initiated a comparison with additional material of this genus in the Queensland Museum and the Australian Museum. The presence of an undescribed species among this material showed the need for a more detailed study of the genus. Five species are here described from Australia, and a specimen of *E. crenata* from Japan is described and figured for comparative purposes.

All drawings have been made with the aid of a camera lucida. Those of the male abdomens are a composite of several drawings made perpendicular to the surface to eliminate paralax.

Genus **Eucrate** de Haan, 1835

TYPE SPECIES: *Cancer* (*Eucrate*) *crenata* de Haan, 1835.

DIAGNOSIS: See Alcock, 1900, pp. 298–9. To this description can be added two features which are common to at least the six species examined:—

(1) The front is transversely sulcate.

(2) The male pleopod carries a terminal armature of numerous small spinules, many of which are bifid.

A considerable number of nominate species, subspecies and " varieties " have been proposed for this genus and almost as many different attempts have been made to synonymise these in a multiplicity of combinations. The problem is perpetuated partly because of the inadequacies of many published descriptions and figures and perhaps partly because of the considerable growth polymorphism which appears to exist in some species (see below, *E. dorsalis*) and which demands for its investigation a larger range of specimens than has been available in many cases. A fuller study of this growth polymorphism may result in a reduction of the number of valid species in this genus, but at the present time it seems necessary to recognise nine in the Indo-West Pacific.

The most recent comprehensive treatment of this genus is that of Tesch (1918). Tesch failed to recognise *E. hamiltoni* McCulloch as a synonym of *E. dorsalis* White, to recognise *E. sexdentata* as belonging to this genus, and to appreciate the distinctness of two other Australian species which he synonymised with *E. sulcatifrons* (Stimpson). The following key to the Indo–West Pacific species is proposed as a tentative replacement for that given by Tesch (1918, p. 158).

KEY TO THE INDO–WEST PACIFIC SPECIES OF EUCRATE

(Species in **bold face** are described in this paper; in the case of other species a reference is given to a recent description.)

1. Anterolateral margins of carapace without teeth, with or without low rounded lobes. (Carapace width greater than 35 mm; carapace with anterior speckling and usually a single central dorsal spot).......... .... **E. dorsalis** White

Anterolateral margins with distinct teeth.......................... 2

2 (1). Only three anterolateral teeth (including the external orbital angle); carapace with *c.* 20 large regular spots on its anterior two thirds........ .... **E. sexdentata** Haswell

Four anterolateral teeth, the fourth possibly small but always distinct...... 3

3 (2). Carapace with short but very distinct ridges mesiad to, but separated from, third and fourth anterolateral teeth; a short beaded posterolateral ridge .... **E. affinis** Haswell

Carapace without very distinct ridges.............................. 4

4 (3). Second and third anterolateral teeth of similar shape and size, both well developed... 5

Third anterolateral tooth much more acute, more prominent, or much more raised than the second tooth, which may have a longer outer margin 8

5 (4). Carapace width less than 25 mm.................................... 6

Carapace width greater than 25 mm.................................. 7

6 (5). Median longitudinal groove deep, dividing on the gastric region; carapace dark reddish-brown with distinct pale margin anteriorly and laterally .... *E. sulcatifrons* (Stimpson)
Hong Kong, Japan; ?Timor, Celebes, NW. New Guinea. (See Stimpson, 1907, pp. 90–1; Sakai, 1965, p. 169, pl. 83, fig. 3.; this paper, p. 126)

Median longitudinal groove shallow carapace with 2–4 dorsal spots or a single irregular blotch... 7

7 (6, 5). Carpus of cheliped with only a narrow fringe of hair distally on its upper border; propodus of last leg broad, 1/w = 2·0–2·4; carapace with one central and two lateral spots which are sometimes coalesced to form an irregular blotch.......................... **E. tripunctata** sp. nov.

Carpus of cheliped with a broad patch of hair distally on its outer surface; propodus of last leg 1/w = 2·6–2·8; carapace without a central spot .... **E. crenata** de Haan
Japan, Hong Kong, ?Red Sea.

8 (4). Carapace broad, carapace width more than 1·30 times carapace length; fronto-orbital width greater than carapace length.................... 9

Carapace width less than 1·30 times carapace length; fronto-orbital width less than carapace length....................................... 10

9 (8). Second anterolateral tooth distinct.................. **E. haswelli** sp. nov.

Second anterolateral tooth nearly obsolete...... *E. transversa* (Stimpson)
Hong Kong. (See Stimpson, 1907, p. 95)

10 (8). Frontal notch minute or absent; cheliped with patch of hair distally on outer face of carpus; no large central spot on carapace.......... .... *E. dentata* (Stimpson)
Hong Kong, Palk Str. (See Stimpson, 1907, pp. 94–5; Chhapgar, 1957, pp. 437–8, pl. 11, figs. j, k. 1; this paper, p. 135.)

Frontal notch small but distinct; cheliped with only a narrow fringe of hair distally; carapace usually with central reddish spot (carapace width *c.* 1·5 times frontal width; second anterolateral tooth not markedly less conspicuous than first)........................ **E. dorsalis** White

The brevity of many of the existing descriptions and the lack of illustrations of some features have made it impossible to give complete synonymies at this time.

Eucrate sexdentata Haswell

(Fig. 1.)

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

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

Eucrate sexdentata Haswell: Alcock, 1900, p. 301.

MATERIAL EXAMINED

Queensland Museum: Four males (6·5–18 mm), four females (12–23·5 mm), Moreton B., W2648, W2715, W2726, W2806, W2808, W2817, W2818, W2909. Ovig. female (17·5 mm) off Jumpin Pin, SE. Qd, W2812.

Australian Museum: Male (20 mm), female (20 mm), ovig. female (16 mm), Moreton B., P15246, P15258, P15253. Male (23·5 mm), 12–15 miles NNE. of Cape Moreton, 80–100 fms, D. Harris, 1965.

DESCRIPTION

CARAPACE: Broader than long (1·10–1·20 times); surface microscopically granulate and punctate, without ridges, with the regions not defined; median frontal groove not discernable. Frontal width half fronto-orbital width; front with two broad square-cut lobes, their anterior margins straight, transverse, and sulcate. Anterolateral margins with three teeth including external orbital angle; first two broad, rounded, well separated from third which is slightly more dorsal, very acute, forwardly projecting, and forming broadest part of carapace.

BASAL ANTENNAL JOINT: Antero-external angle produced to meet front so that flagellum is excluded from orbit; frontal margin of projection much less than orbital margin.

CHELIPED: Merus granulate ventrally; with single prominent, rounded spine dorsally. Carpus with prominent flattened conical spine on inner angle and tuft of hairs distally on outer face. Propodus smooth and rounded dorsally, with longitudinal carina on ventral edge of outer surface extending back from tip of fixed finger to proximal third of chela.

AMBULATORY LEGS: Long, third distinctly longer than twice carapace width. Propodus of last leg 3·6 to 4·2 times as long as broad.

MALE ABDOMEN: First, second, and third segments expanded laterally to meet coxae of last legs.

MALE PLEOPOD: Curved and tapering throughout length; terminal armature with some spinules bifid; tip slightly flared.

COLOUR: Pale cream with purple-pink spots on the dorsal surface of the carapace disposed as in fig. 2B, or with two additional posterior spots. Upper surfaces of carpus, propodus, and dactyl of chelipeds sometimes with fainter pink blotches which may coalesce leaving cream spots between a purplish network.

DISTRIBUTION: Port Denison (type locality, Haswell, 1881); India (Alcock, 1900); Moreton B.

DISCUSSION

Haswell's brief description is sufficient to confidently assign the present specimens to this species, but it was not sufficiently detailed to prevent subsequent conjecture as to the relationships of the species.

Miers (1884, pp. 240–1) described specimens from the Arafura Sea under the name "*Pseudorhombilia vestita* (de Haan), var. *sexdentata*, Haswell". He doubtfully synonymised *Eucrate sexdentatus* Haswell, but suggested that these might be distinct

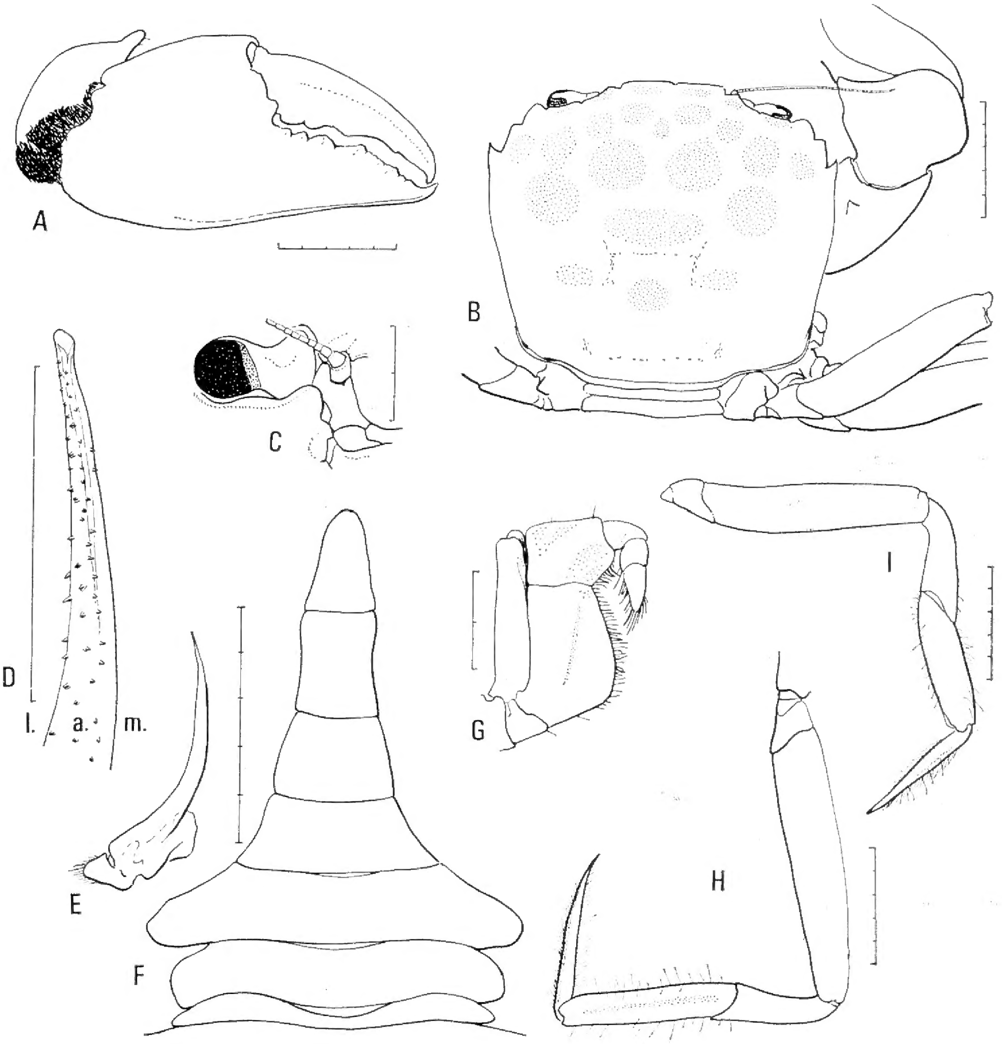

FIG. 1: *Eucrate sexdentata.* A, C–F: male, Qd Mus. W2817. A, chela; C, basal antennal joint; D, E, male pleopod (l. = lateral, a. = abdominal, m. = median faces); F, male abdomen. B, G–I: female Qd Mus., W2818. B, carapace; G, third maxilliped; H, third right ambulatory leg; I, last right ambulatory leg.

Scale divisions 1 mm.

and proposed the name *Pseudorhombilia haswelli* to be used if this should be proved so. These two species are, in fact, quite distinct. Miers's specimens differ from *E. sexdentata* in that the carapace is pubescent, the typical pinkish spots are not present on the carapace, the front is entire, the basal antennal joint is not produced to meet the front, and the second and third abdominal segments do not meet the bases of the fifth legs.

Rathbun (1915, p. 146) designated *P. haswelli* Miers as type species of a new genus *Homoioplax*, in the subfamily Prionoplacinae, distinguished by having a male abdomen with the first and second segments, *but not the third*, covering the entire breadth of the sternum.

Tesch (1918, pp. 190–3, pl. 10, fig. 1) described and figured material which he referred to *H. haswelli* (Miers), and suggested (p. 158, footnote) that *E. sexdentata* Haswell should also belong to the genus *Homoioplax*. This suggestion was apparently based on the erroneous assumption that the male abdomen of *E. sexdentata* is similar to that of *H. haswelli*. The third segment of the abdomen of *E. sexdentata* is, in fact, fully expanded laterally to meet the bases of the last legs and this species is correctly placed in the genus *Eucrate*, subfamily Carcinoplacinae.

Eucrate affinis Haswell

(Figs. 2, 3.)

Eucrate affinis Haswell, 1881, p. 547; 1882, p. 86. Stebbing, 1921, p. 458, pl. 15.
Pseudorhombilia sulcatifrons (Stimpson), var. *australiensis* Miers, 1884, pp. 242–3, pl. 24, fig. C.
Eucrate sulcatifrons (Stimpson): Barnard, 1950, pp. 295–6, fig. 54d, e.
[non] *Pilumnoplax sulcatifrons* Stimpson, 1858, p. 93; 1907, p. 90.
[non] *Eucrate sulcatifrons* (Stimpson): Sakai, 1965, p. 169, pl. 83, fig. 3.
[non] *Eucrate affinis* Haswell: de Man, 1887, pp. 89–93, pl. 5, figs. 5–7. (= *E. tripunctata*)
[non] *Eucrate crenata* var. *affinis* Haswell: Alcock, 1900, pp. 300–1. (= *E. tripunctata*)

Material Examined

Australian Museum: Male (8·7 mm), female (12·4 mm), Holborn I., off Port Denison, Qd, P2972, dry preservation, syntypes of *E. affinis* Haswell. The male is here designated lectotype, the female becomes a paralectotype.

Description

Carapace: Broader than long (1·29, 1·32 times); regions not defined; median frontal groove shallow, but distinct in both specimens, dividing on gastric region; shallow concave depression behind orbits extending laterally to first and second anterolateral teeth, forward to antennal notches and across the carapace well back on

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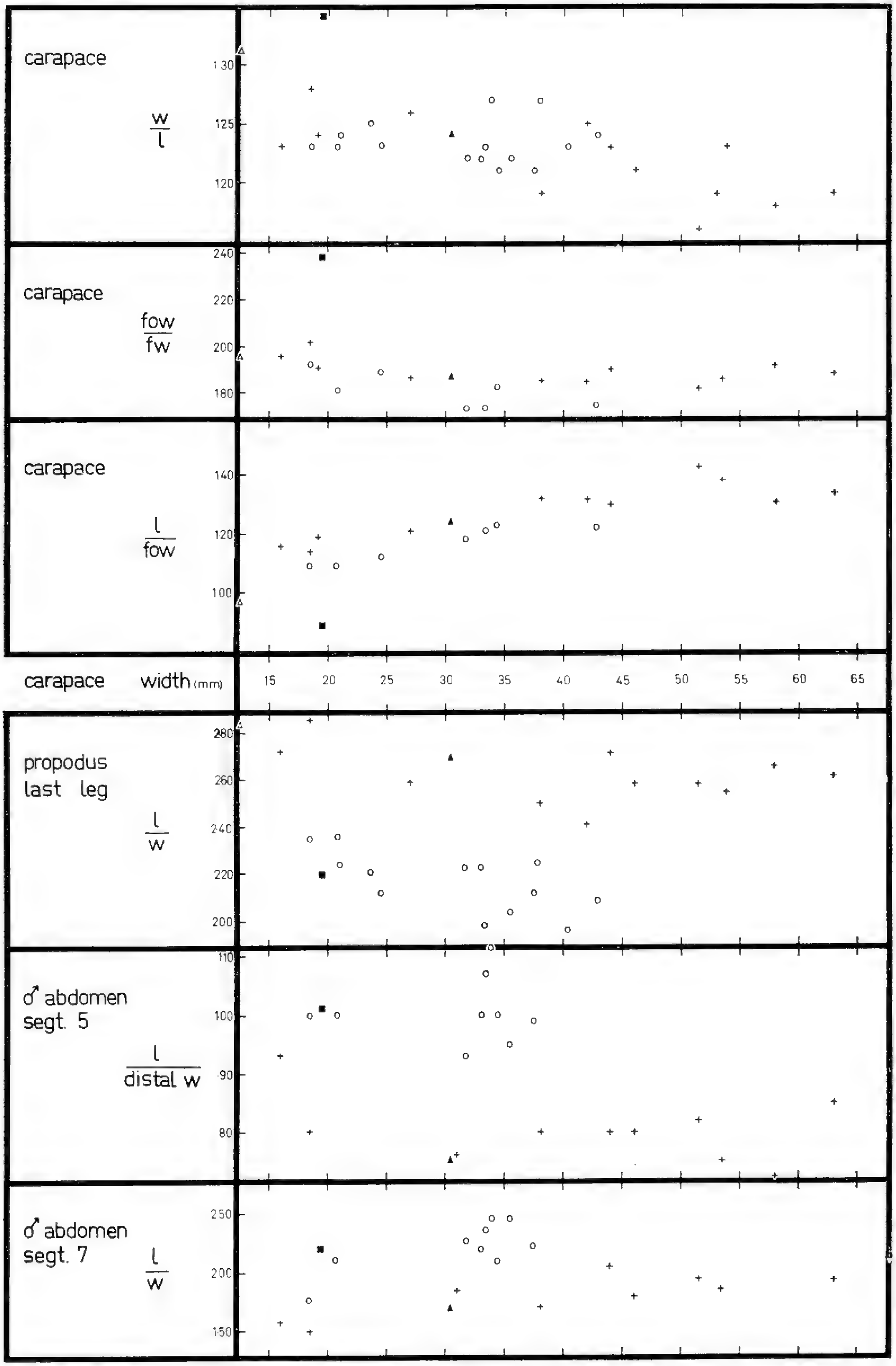
Fig. 2: Variation in proportion of six features with carapace width. Each point represents a single specimen. w. = width; l. = length; fow. = fronto-orbital width; fw. = frontal width. △ = *E. affinis;* O = *E. tripunctata;* ■ = *E. haswelli;* + = *E. dorsalis;* ▲ = *E. crenata.*


carapace
w/l
130
125
120
carapace
fow/fw
240
220
200
180
carapace
l/fow
140
120
100
carapace width (mm)
15
20
25
30
35
40
45
50
55
60
65
propodus last leg
l/w
280
260
240
220
200
♂ abdomen segt. 5
l/distal w
110
100
90
80
♂ abdomen segt. 7
l/w
250
200
150

the post-frontal region; low rounded epigastric prominences barely discernable. Fronto-orbital width 1·97, 1·96 times frontal width; front with two broad square-cut lobes, their anterior margins straight, transverse, and sulcate. Infra-orbital margin well defined by a raised rim which ends medially as a rounded tooth which is separated from the prominent inner sub-orbital tooth by a deep sinus. Anterolateral margins with four teeth including the external orbital angle; the third the largest, acute, prominent, and distinctly raised above the second; the fourth the smallest; the first rounded with a faint dorsal carina; the second more acute with a more distinct dorsal carina. Mesiad to the third tooth, but separated from it by a deep groove there is a very distinct, short, almost tooth-like ridge; mesiad to the fourth tooth there is a longer but slightly less distinct carina separated from the fourth tooth by a broader, shallower groove. Posterolateral corners of carapace with distinct, irregularly granulate ridge running almost parallel with posterolateral borders for short distance in male, longer in larger female.

BASAL ANTENNAL JOINT: With antero-external angle produced to meet front so that flagellum is excluded from orbit; frontal margin of projection much shorter than orbital margin.

CHELIPED: Upper border of merus with strong subdistal spine. Intermediate lobe between subdistal spine and prominence for upper carpal articular condyle large, tooth-like, intermediate in size between subdistal spine and prominence when viewed in profile sighting across bases of maxillipeds. Inner angle of carpus with low short median carina ending in spine; few scattered hairs between this spine and upper articulation with propodus, dense patch of long hairs between upper and lower articulations and covering distal quarter of outer face of carpus. Propodus smooth and rounded; with deep longitudinal groove near ventral edge of outer face, extending back from near tip of finger for half length of chela.

AMBULATORY LEGS: Of moderate length, third twice carapace length. Propodus of last leg (only right last leg of female available) with length 2·83 times width.

MALE ABDOMEN: First, second, and third segments expanded laterally to meet coxae of last legs; third and fourth segments rapidly tapering to base of fifth; length of fifth segment less than width of distal margin (0·82 times); [sixth segment obscured by mounting medium;] terminal segment with rounded tip, length 1·9 times width.

MALE PLEOPOD: Not available for examination.

COLOUR: After prolonged preservation bleached to uniform pale cream.

DISTRIBUTION: Port Denison, Qd (type locality, Haswell, 1881); Port Molle (Miers, 1884).

DISCUSSION

The most distinctive and characteristic feature of this species is probably the presence of the short strong ridges at the bases of the third and fourth anterolateral teeth. These are well shown in the South African specimens of Stebbing (1921, pl. 15) and Barnard (1950, fig. 54d) and there is little doubt that these are conspecific with Haswell's type

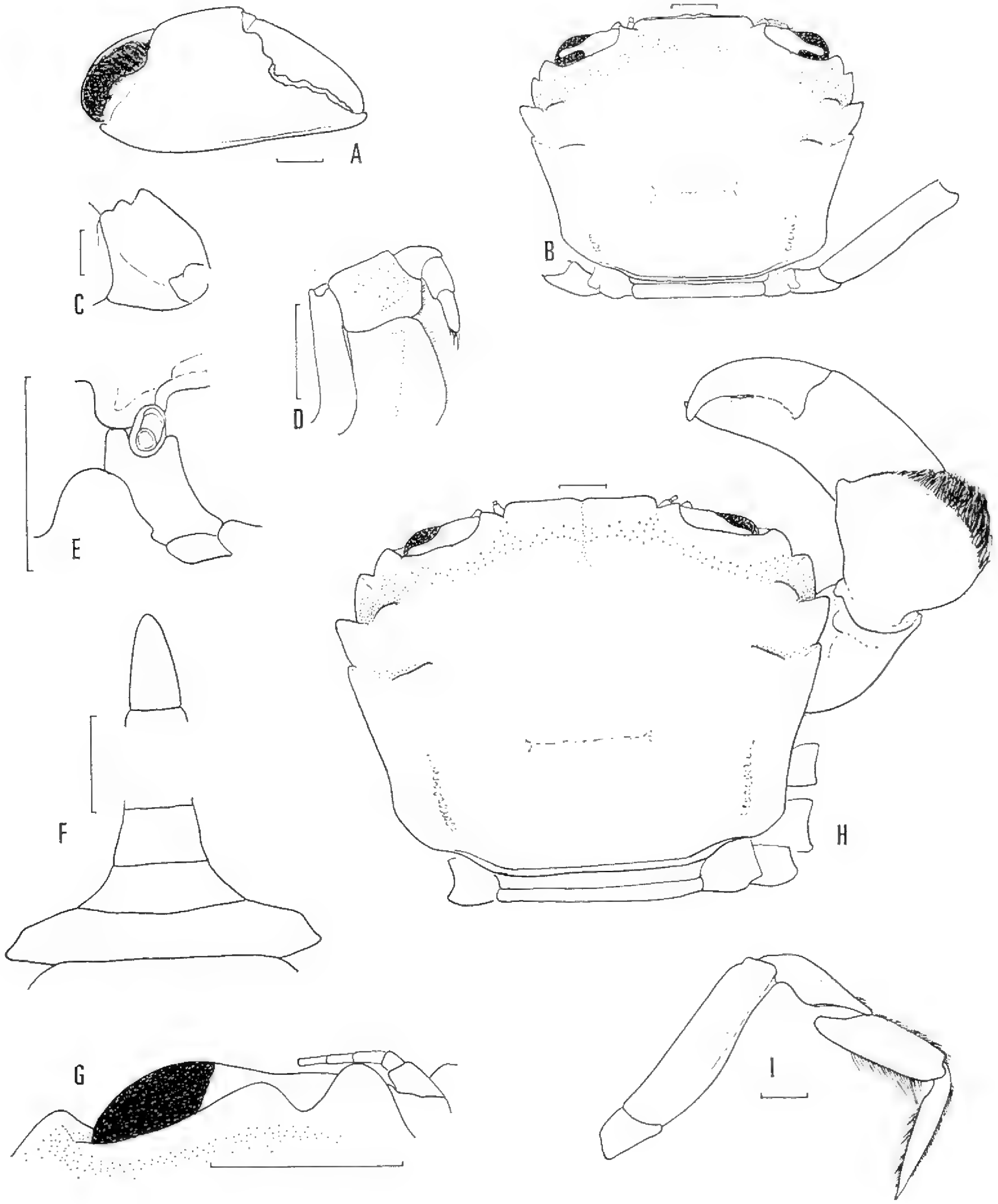


FIG. 3: *Eucrate affinis*. A–G: lectotype, male, Aust. Mus. P2972. A, chela; B, carapace; C, merus of cheliped (see text); D, third maxilliped; E, basal antennal joint; F, male abdomen (sixth segment obscured by mounting medium); G, suborbital rim.

H, I: paralectotype, female, Aust. Mus. P2972. H, carapace; I, last right ambulatory leg.

Scale divisions 1 mm.

material. It should be noted that the carapace as illustrated by Barnard is relatively narrower than in the type material although the proportions of Stebbing's illustrated specimen compare more favourably.

Miers described *Pseudorhombilia sulcatifrons* var *australiensis* from an 8 mm male. Photographs of the holotype, a dried specimen in good condition at the British Museum, have been received from Mr. R. W. Ingle and these show the following inaccuracies in Miers's figure and description. (*a*) The front of the holotype is not entire, but has a faint median notch. (*b*) The basal antennal joint is in contact with the front. (*c*) The third anterolateral teeth are larger and more projecting than is shown in Miers's figure, the first teeth are more rounded, and the second are slightly smaller. (*d*) The dactyli, particularly those of the last legs, are not as slender as shown in the figure and the propodi do not taper strongly distally.

Although Miers's holotype does not appear to have the outer face of the carpus of the cheliped hirsute and the strongly granular posterolateral ridges are not present in the photograph, it can be referred to the present species with some confidence because of the following features. (*a*) Ridges mesiad to the third and fourth anterolateral teeth are shown in the photographs and were mentioned by Miers. (*b*) All ratios shown in fig. 2 for *E. affinis* are in very close agreement with those taken from the photograph of the holotype. (*c*) The projection of the basal antennal joint is long and slender, agreeing well with fig. 3E. (*d*) The suborbital crest as figured by Miers is similar to that of the present species (fig. 3G). (*e*) Haswell's specimens and Miers's were collected from localities only 45 miles apart (Port Denison and Port Molle respectively).

No distinct carapace ridges are mentioned by Stimpson in his description of "*Pilumnoplax*" *sulcatifrons* and it is not probable that he would have failed to describe them had they been present. There seems little justification for synonymising *E. affinis* and *E. sulcatifrons*. The "slight longitudinal ridge or angle on each side above and parallel with the posterolateral margin" that Stimpson mentions could well be only the break in curvature that is found in most species of this genus—it is significant that Stimpson did not mention any granulation or beading of this posterolateral ridge, also characteristic of *E. affinis*.

E. SULCATIFRONS: The absence of type material, the incompleteness of the original description, and the loss of Stimpson's subsequently prepared figures have enabled any material which proved difficult to identify, and any surplus nominate species, to be referred to *E. sulcatifrons*. The deep median longitudinal groove to which Stimpson (1907, p. 90) refers, an unusual feature for this genus, provides a distinguishing character. Sakai (1965, pl. 33, fig. 3) has illustrated a specimen which he refers to *E. sulcatifrons* and his illustration shows this deep median groove. His description (Japanese Part, p. 73) mentions that this species is smaller than *E. crenata*, has a marked concavity posterior to the orbit, a well developed inner orbital spine, four anterolateral teeth which are more acute than those of *E. crenata*, the hand of the cheliped is much enlarged, and the colour is variable but many specimens have paler carapace margins. It is not possible to refer with certainty descriptions that mention neither the deep median groove nor the colouration (see Sakai), but the material described by Tesch (1918, pp. 158–60) does not carry the distinct lateral carapace ridges of *E. affinis* and it seems possible that his material has been correctly referred to *E. sulcatifrons*.

Pseudozius (*Platyozius*) *laevis* Borradaile, as illustrated by Rathbun (1906, pl. 11, fig. 7) bears little resemblance to this species. The Hawaiian "*E. sulcatifrons*" as illustrated and described by Edmondson (1962) differs quite markedly from *E. sulcatifrons*, and indeed from all other species of *Eucrate*, in having the front divided by a broad shallow depression in place of the usual small distinct notch. The Hawaiian material could well represent a tenth species of this genus which could be separated from the others in the key by the form of the frontal notch.

Tozzetti (1877) described and illustrated a specimen from Yokohama which he identified as *Pilumnoplax sulcatifrons*. This specimen is here referred to *E. crenata* (see p. 136).

Eucrate tripunctata sp. nov.

(Figs. 2, 4.)

Eucrate affinis, Haswell: de Man, 1887, pp. 89–93, pl. 5, figs. 5–7.
Eucrate crenata var. *affinis*, Haswell: Alcock, 1900, pp. 300–1.
[non] *Eucrate affinis* Haswell, 1881, p. 547; 1882, p. 86.

Material Examined

Queensland Museum: Ten males (8–35 mm), nine females (21–40·5 mm), Moreton B. (Mud I., Woody Pt., dredged), W385, W1070, W1190, W1214, W1496, W1514, W3029, W3030, W3034, W3035.

Australian Museum: Male (*c.* 34 mm), Magazine I., Pt. Denison, in burrow in muddy sandbank, P6990; male (35 mm), Sandgate, Moreton B., P7914; male (12·5 mm), Masthead I., G5884.

Holotype: Male (33·3 mm), Mud I., Moreton B., 26. V. 1964, V. F. Collin, Qd Mus. W3034 (part).

Description

Carapace: Broader than long (1·20–1·28 times, see fig. 2); surface microscopically punctate; regions not defined; median frontal groove very shallow or barely discernable; concave depression behind orbits extending laterally to second anterolateral tooth, forward to antennal notches and across post-frontal region as a shallow concavity bordered posteriorly by faintly indicated post-frontal lobes. Fronto-orbital width 1·7–1·95 times frontal width (see fig. 2); front with two broad square-cut lobes, their anterior margins straight, transverse, and sulcate. Infra-orbital margin well defined by a raised rim ending abruptly laterally, and with a small tooth medially which is similar in shape to, and separated by a deep concavity from, the much larger inner suborbital tooth. Anterolateral margins with four teeth including external orbital angle, all of similar shape, fourth smallest, first three subequal; a short low ridge running postero-mesiad from the fourth tooth. Posterolateral margins rounded and only vaguely defined.

Basal Antennal Joint: Antero-external angle produced to meet front so that flagellum is excluded from orbit; frontal margin of projection almost equal to orbital margin.

CHELIPED: Upper border of merus usually with small sharp granular spine in middle of length, always with strong subdistal spine. Intermediate lobe between subdistal spine and prominence for upper carpal articular condyle subequal to articular prominence when viewed in profile sighting across base of the maxillipeds. Carpus with strong median spine and band of hairs between this and upper articulation with propodus. Propodus smooth and rounded, with longitudinal groove near ventral edge of outer surface extending back from near tip of fixed finger for half length of chela.

AMBULATORY LEGS: Of moderate length, third less than twice carapace length in larger specimens, twice or slightly more than twice in specimen of under 20 mm cw. Propodus of last leg broad, length 1·9–2·4 times width (see fig. 2).

MALE ABDOMEN: First, second, and third segments expanded laterally to meet coxae of last legs; third and fourth segments rapidly tapering to base of fifth; length of fifth segment equal to (0·9–1·12 times) width of distal margin; sixth segment with concave or sinuous, subparallel sides; terminal segment long, slender, pointed (length 1·75–2·5 times width, see fig. 2).

MALE PLEOPOD: Moderately long, quite distinctly extending past point where first sternal groove meets abdomen. Maximum curvature in proximal third followed by straight, slender, tapering shank gently curving in distal sixth; terminal armature with some spinules bifid; tip rounded.

COLOUR: After alcohol preservation pale cream with three large reddish spots on carapace, a broadly oval median spot of variable extent, sometimes coalescing with the two smaller lateral spots. These spots are usually discrete and rounded but in some specimens are in the form of irregular blotches.

DISTRIBUTION: Mergui Archipelego (de Man, 1887; Alcock, 1900); Moreton B.

DISCUSSION

de Man (1887) described specimens from the Mergui Archipelago as *E. affinis* Haswell. His description and figure are not entirely in agreement, but the restriction of the patch of hair on the upper border of the wrist of the cheliped, the proportions of the propodus of the last leg, and the subequal anterolateral teeth place these specimens in the present species. Although de Man refers to two transverse ridge-like elevations near the third and fourth teeth these are not described as strongly developed and the illustration shows the usual low elevations of *E. tripunctata*. While de Man's description and figure of "*E. affinis*" can be referred to this species with certainty those of other authors present some difficulties although Alcock (1900) provides a special case in that his description is based on the same specimen as that of de Man.

Although close to *E. crenata*, the present species is distinguished by the features provided in the key by the proportions of the fifth and seventh segments of the male abdomen (see fig. 2), by the shape of the orbital projection on the basal antennal joint,

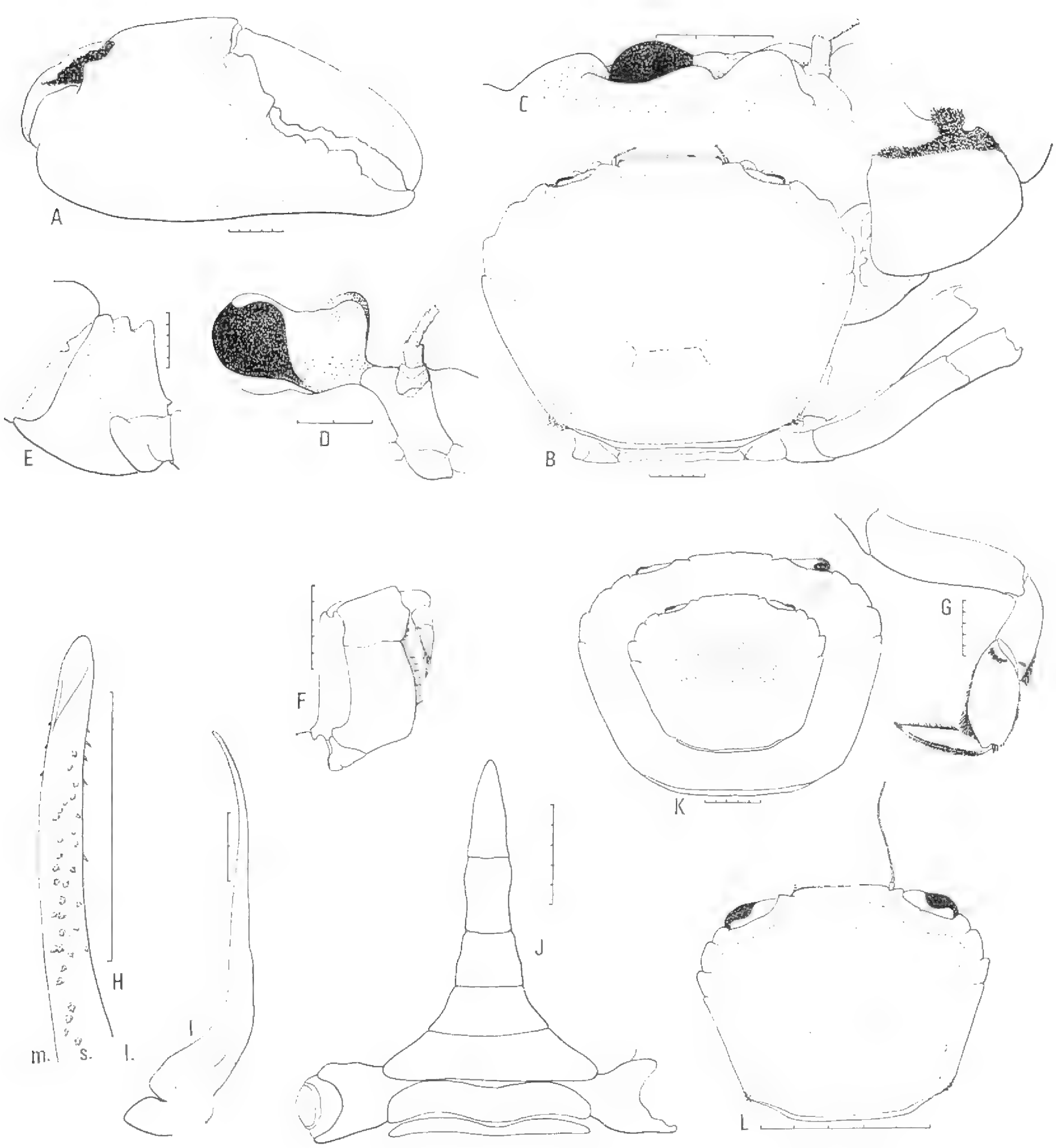


FIG. 4: *Eucrate tripunctata.* A–J: holotype, 33·3 mm male, Qd Mus. W3034 (part). A, chela; B, carapace; C, suborbital rim; D, basal antennal joint; E, merus of cheliped, (see text); F, third maxilliped; G, last right ambulatory leg; H, I, male pleopod (m. = median, s. = sternal, l. = lateral faces); J, male abdomen.

K: carapaces of 15 mm male and 27 mm female, Qd Mus. W3034 (part).

L: carapace of 8 mm male, Qd Mus. W3034 (part).

Scale divisions 1 mm.

by the suborbital ridge, and by the shape of the male pleopods. The apparent overlap of the two species in the Indian region does not permit *E. tripunctata* to be regarded as a subspecies of *E. crenata*.

Eucrate haswelli sp. nov.

(Figs. 2, 5.)

MATERIAL EXAMINED

Holotype: Male, 19·5 mm, Port Denison, Qd, between tide marks, E. H. Rainford, Australian Museum P6991.

DESCRIPTION

CARAPACE: Much broader than long (1·34 times); surface microscopically punctate; regions not defined; median frontal groove very shallow, dividing on gastric region; very shallow concave depression behind orbits extending laterally to second anterolateral teeth, forward to antennal notches. Fronto-orbital width 2·38 times frontal width; front with two broad square-cut lobes, their anterior margins straight, transverse, and sulcate. Infra-orbital margin well defined by a raised rim which ends medially with a rounded lobe well separated by a broad concavity from the larger inner suborbital tooth. Anterolateral margins with four teeth including the external orbital angle, third much the largest, fourth smallest, first large, rounded, and with distinct ventral carina running to meet suborbital ridge.

BASAL ANTENNAL JOINT: Antero-external angle produced to meet front so that flagellum is excluded from orbit; frontal margin of projection approximately equal to orbital margin.

CHELIPED: Upper border of merus with single sharp granular spine in middle of length, and strong subdistal spine. Intermediate lobe between subdistal spine and prominence for upper carpal articular condyle subequal to articular prominence when viewed in profile sighting across base of maxillipeds. Inner angle of carpus with strong short median carina ending in spine; few scattered hairs between this spine and upper articulation with propodus, dense patch of long hairs between upper and lower articulations and covering distal fifth of outer face of carpus. Propodus smooth and rounded, with deep longitudinal groove marking distinct ridge near ventral edge of outer surface, extending back from tip of fixed finger for half length of chela.

AMBULATORY LEGS: Of moderate length, third twice carapace length. Propodus of last leg broad, length 2·2 times width.

MALE ABDOMEN: First, second, and third segments expanded laterally to meet coxae of last legs; third and fourth segments rapidly tapering to base of fifth; length of fifth segment equal to width of distal margin; sixth segment with sinuous, subparallel sides; terminal segment triangular, length 2·3 times width.

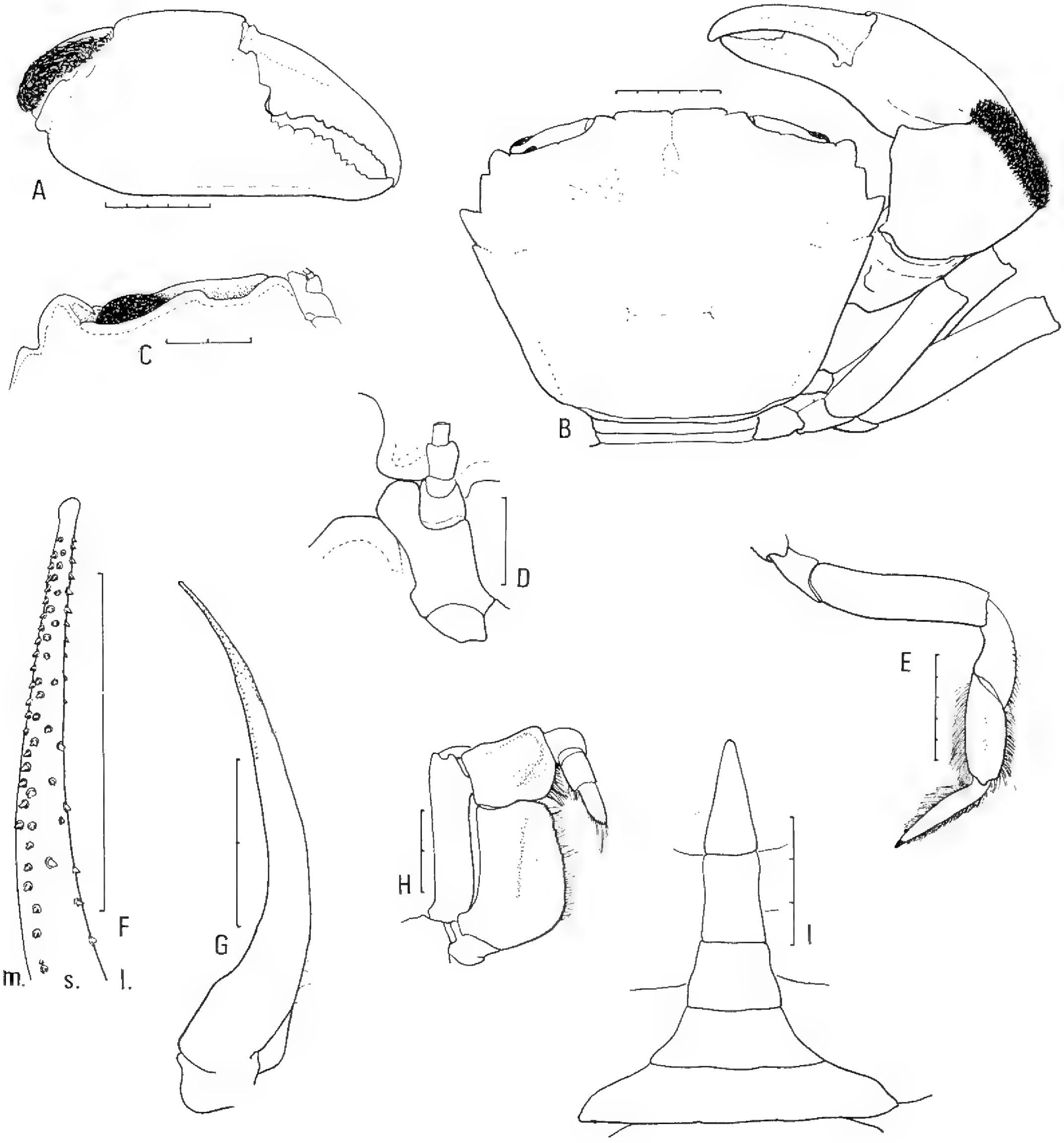


FIG. 5: *Eucrate haswelli.* Holotype, male, Aust. Mus. P6991. A, chela; B, carapace; C, suborbital rim; D, basal antennal joint; E, last right ambulatory leg; F, G, male pleopod (m. = median, s. = sternal, l. = lateral faces); H, third maxilliped; I, male abdomen.

Scale divisions 1 mm.

MALE PLEOPOD: Of moderate length, not extending past point where first sternal groove meets abdomen. Curved, with thick tapering shank and flared tip; some terminal spinules bifid.

COLOUR: After prolonged alcohol preservation bleached to uniform pale cream.

DISTRIBUTION: Port Denison, mid east Queensland.

DISCUSSION

This species shows some agreement with Stimpson's (1907, p. 95) description of *Heteroplax* [=*Eucrate*] *transversa*. This brief description is composed largely of comparisons with his *E. dentata* so that some of the supposed agreements are based on inference, the lack of a statement to the contrary being taken as adequate grounds to assume that *E. transversa* shared a certain feature with *E. dentata*. On this basis, the significant points of agreement are as follows:—

(1) The carapace is little broader than the fronto-orbital width.
(2) The anterolateral and posterolateral regions are nearly continuous, the former very short.
(3) The outer orbital angle is prominent.
(4) The ocular peduncles are long.
(5) There is a tuft of pubescence on the outer surface of the carpus of the cheliped.
(6) The carapace is very broad.

These features suggest a very close relationship between the present specimen and that of Stimpson, and together serve to distinguish both from other species of *Eucrate*. Opposed to this there are the following points of disagreement:—

(1) The carapace of *E. transversa* is much broader (cw 1·46 x cl) than in the present specimen (cw 1·34 x cl).
(2) The second anterolateral tooth of *E. transversa* is almost obsolete. In *E. haswelli* this tooth is very distinct, much larger than the fourth.
(3) The median frontal notch of *E. transversa* is presumed, by inference, to be absent as in *E. dentata*. In *E. haswelli* it is quite distinct.

In spite of the many points of agreement these differences cannot at present be reconciled. Until the discovery of specimens that can be referred unquestionably to Stimpson's description of *E. transversa* indicates that the variability of this species is adequate to encompass these differences, it seems necessary to regard the present specimen as belonging to a species distinct from *E. transversa*. Haswell described two species of *Eucrate* but both were subsequently considered junior synonyms of established species. They have been reinstated in this paper and it is fitting that his name should be used for this species.

Eucrate dorsalis (White)

(Figs. 2, 6.)

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

Eucrate hamiltoni McCulloch, 1908, pp. 58–9, pl. 12, figs. 1, 1a. Tesch, 1918, p. 158 (in key).

Eucrate dorsalis White: McCulloch, 1909, p. 314.

MATERIAL EXAMINED

Queensland Museum: Eight males (16–63 mm), four females (19–54 mm), Moreton B. (Cleveland, Hayes Inlet, Mud I, Otter Rock, trawled, 4–5 fms), W76, W414, W1257, W1430, W1465, W1472, W2661, W2717, W3031, W3032, W3033.

Australian Museum: Male, 31 mm, Moreton B., P7914; male, 44 mm, Gulf of Carpentaria, P6793; five males (29–47 mm), eight females (18–50 mm), Gulf of Carpentaria.

DESCRIPTION

CARAPACE: Broader than long (1·16 to 1·28 times, see fig. 2); surface microscopically punctate; regions not defined; median frontal groove imperceptable; concave depression behind orbits extending laterally to second anterolateral teeth, forward to antennal notches, and across post-frontal region as a very shallow concavity. Fronto-orbital width 1·80–2·05 times frontal width (see fig. 2); front with two broad square-cut lobes, their anterior margins straight or slightly concave, transverse, and sulcate. Infra-orbital margin defined by a slightly raised rim which ends medially with a low, rounded, very obtuse lobe separated by a shallow concavity from the larger, more acute inner suborbital tooth. Anterolateral margins with four teeth including external orbital angle. In smaller specimens the very acute third tooth is much the more prominent, the second has the longest outer margin, the fourth is the smallest, sometimes only demarcated by a fine groove. With increase in carapace width the teeth are much reduced (see fig. 6K), becoming gradually indistinguishable (see McCulloch, pl. 12, fig. 1.) in large specimens.

BASAL ANTENNAL JOINT: Antero-external angle produced to meet front so that flagellum is excluded from orbit; frontal margin of projection shorter than orbital margin.

CHELIPED: Upper border of merus usually with one or two small sharp granular spines in middle of length, always with strong subdistal spine. Intermediate lobe between subdistal spine and prominence for upper carpal articular condyle poorly developed or absent, always much smaller than articular prominence when viewed in profile, sighting across base of maxillipeds. Carpus with strong median spine, and narrow band of hairs between this and upper articulation with propodus, sometimes carried right to lower articulation, but only as narrow fringing band (covering less than one seventh of outer face). Propodus smooth and rounded, with longitudinal groove near ventral edge of outer surface extending back from tip of fixed finger for half length of chela.

AMBULATORY LEGS: Of moderate length, third ambulatory less than twice carapace length. Propodus of last leg moderately slender, length 2·4–2·9 times width (see fig. 2).

MALE ABDOMEN: First, second, and third segments expanded laterally to meet coxae of last legs; third and fourth segments rapidly tapering to base of fifth; length of fifth segment less than (0·75–0·85 times) width of distal margin; sixth segment with concave subparallel sides; terminal segment triangular, length 1·5 to 2·0 times width (see fig. 2).

MALE PLEOPOD: Of moderate length, not distinctly extending past point where first sternal groove meets abdomen. Curved and tapering throughout length; tip rounded; some terminal spinules bifid.

COLOUR: After alcohol preservation pale cream, usually with single large reddish central spot on carapace, reddish speckling anterior to this extending on to pterygostome and maxillipeds and on upper surfaces of chelipeds; central spot sometimes paler, or replaced by a complete or incomplete ring of close-set speckles with or without more sparsely distributed speckles inside this ring.

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

DISCUSSION

Large specimens of this species are quite distinctive, having greatly reduced anterolateral teeth, very large chelae, and a characteristic colour pattern. Smaller specimens (*c.* 10–40 mm) differ quite markedly from these in having strongly developed teeth, the third being markedly prominent.

These small specimens of *E. dorsalis* show some similarity to Stimpson's (1907) description of *E. dentata*, but differ most notably in the ratio of the carapace width to the fronto-orbital width. According to Stimpson the carapace width is a little greater whereas in *E. dorsalis* it is *c.* 1·5 times. *E. dorsalis* further differs in having no frontal notch, a tuft of pubescence on the outer surface of the wrist, and in the colouration which is given as " Carapax gray or brown, whitish posteriorly, and with a transverse narrow white band behind the eyes. The frontal region and feet punctate with red. The species presents little or no variation in colour." Stimpson states that *E. dentata* is found in considerable numbers near Hong Kong so that the absence of large specimens similar to *E. dorsalis* is a further argument for not synonymising the two.

Chhapgar (1957, pp. 437–8, pl. 11, figs. j, k, l) refers eight specimens from Bombay to *E. dentata*. In these specimens the frontal notch is present, but almost obsolete (as was also reported by Alcock, 1900, p. 301 in his two specimens from Palk Str. and Hong Kong) and the second, as well as the fourth, anterolateral tooth is quite inconspicuous. Chhapgar's figure also differs from Stimpson's description in that the fronto-orbital width appears markedly less than the carapace width, and the colouration of his specimens is "bright yellow with minute red spots scattered throughout. One of the specimens has two black squarish patches on the outer sides of the gastric region." Chhapgar's material differs from *E. dorsalis* in the absence of any indication of a central patch on the carapace; in the extent of the pubescence on the wrist of the cheliped, which covers about one third of the outer surface; in the second anterolateral tooth being inconspicuous; and in the abrupt curve at the distal quarter of the male pleopod.

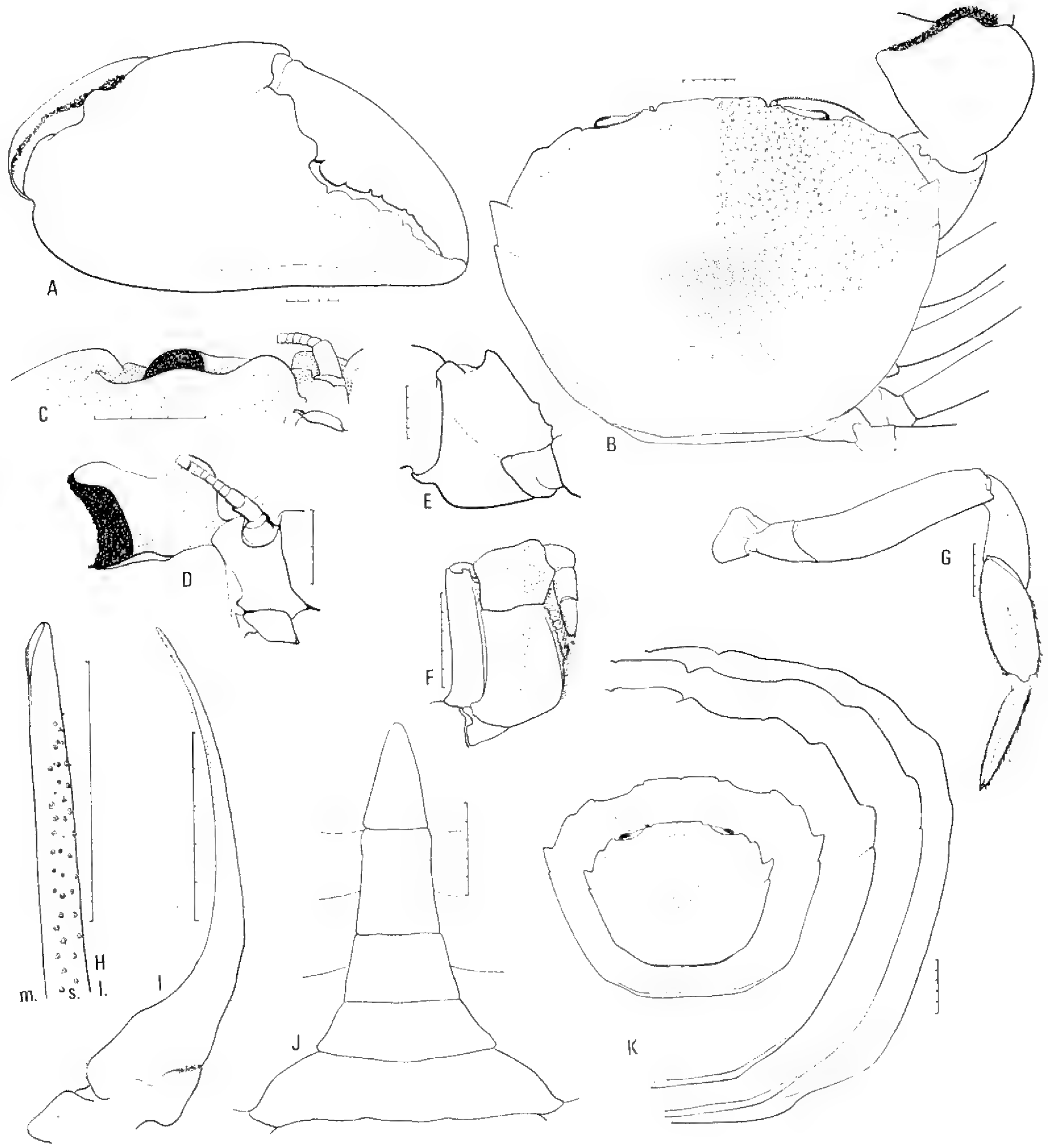


FIG. 6: *Eucrate dorsalis*. A–G: female, Qd Mus. W2661. A, chela; B, carapace; C, suborbital rim; D, basal antennal joint; E, merus of cheliped (see text); F, third maxilliped; G, last right ambulatory leg.

H–J: male, Qd Mus. W1430. H, I, male pleopod (m. = median, s. = sternal, l. = lateral faces); J, male abdomen.

K: carapace outlines of Qd Mus. W1519 (male, 18·5 mm); W1472 (female, 27·0 mm); W1430 (male, 46·1 mm); W2717 (female, 53·9 mm); W414 (male, 53·5 mm).

Scale divisions 1 mm.

Eucrate crenata de Haan

(Figs. 2, 7.)

Cancer (*Eucrate*) *crenatus* de Haan, 1835, p. 51, pl. 15, fig. 1.

Pilumnoplax sulcatifrons Stimpson: Tozzetti, 1877, pp. 102–6, pl. 7, figs. 2 a–e.

[non] *Pilumnoplax sulcatifrons* Stimpson, 1858, p. 93.

Eucrate crenata de Haan: Alcock, 1900, p. 300. Shen, 1932, pp. 114–7, pl. 5, fig. 2. Sakai, 1939, p. 562, pl. 102, fig. 1; 1965, pp. 186–9, pl. 83, fig. 4.

Although *E. crenata* does not occur in Australia a specimen from Japan in the Australian Museum collections has been used to give description and figures comparable with those of the Australian species.

MATERIAL EXAMINED

Australian Museum: Male, 30·5 mm, Japan, P720.

DESCRIPTION

CARAPACE: Broader than long (1·24 times); surface microscopically punctate; regions not defined; median frontal groove very shallow, barely discernable; a shallow concave depression behind orbits extending laterally to second anterolateral tooth, forward to deep antennal notches and across post-frontal region as a very shallow concavity. Fronto-orbital width 1·87 times frontal width; front with two broad square-cut lobes, their anterior margins transverse and sulcate. Infra-orbital margin defined by a slightly raised rim which ends medially in a rounded lobe well separated from the much larger inner suborbital tooth. Both inner suborbital tooth and terminal lobe have smaller subsidiary lobes lateral to them. Anterolateral margins short, curving (ratio of distance between last teeth and fronto-orbital width 1·55 : 1); with four teeth including external orbital angle all of similar shape, fourth smallest, first three subequal; a short low ridge running postero-mesiad from the fourth tooth. Posterolateral margins without distinct ridge.

BASAL ANTENNAL JOINT: Antero-external angle produced to meet front; frontal margin of projection distinctly shorter than orbital margin.

CHELIPED: Upper border of merus with small spine in middle of length and strong subdistal spine. Intermediate lobe between subdistal spine and prominence for upper carpal articular condyle subequal to articular prominence when viewed in profile sighting across base of maxillipeds. Inner angle of carpus with short median carina ending in low proximal lobe and prominent distal spine. Tapering band of hairs running from this spine to upper articular condyle and expanding to cover one third outer surface of carpus. Propodus smooth and rounded with raised longitudinal ridge near ventral edge of outer surface extending back for half length of chela.

AMBULATORY LEGS: Of moderate length, third ambulatory 1·8 times carapace length. Propodus of last leg moderately slender, length 2·7 times width.

MALE ABDOMEN: First, second, and third segments expanded laterally to meet coxae of last legs; third and fourth segments rapidly tapering to base of fifth; length of fifth segment much less than (0·75 times) width of distal margin; terminal segment triangular, length 1·7 times width.

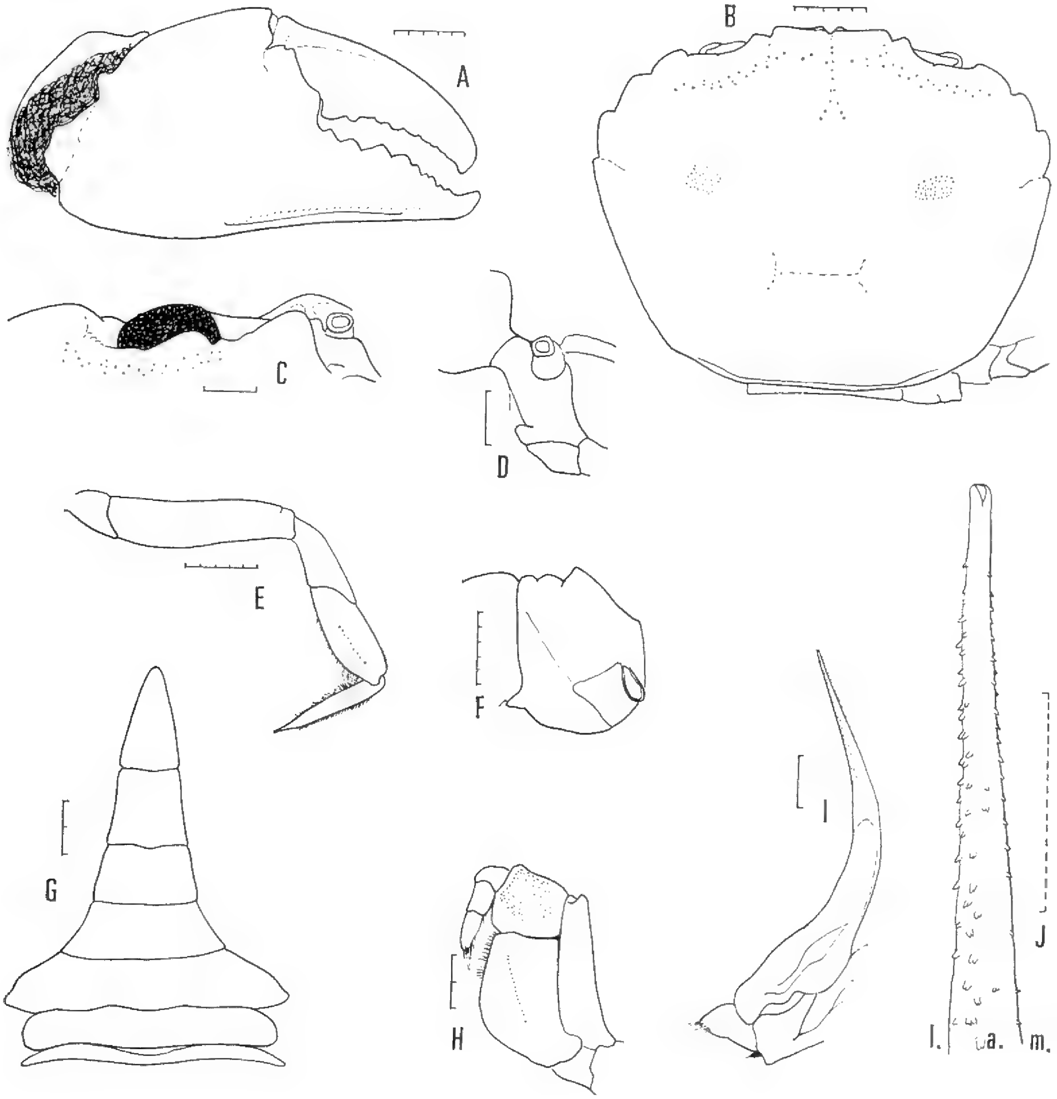


FIG. 7: *Eucrate crenata*. Aust. Mus. P720. A, chela; B, carapace; C, suborbital rim; D, basal antennal joint; E, last right ambulatory leg; F, merus of cheliped (see text); G, male abdomen; H, third maxilliped; I, J, male pleopod (l. = lateral, a. = abdominal, m. = median faces).

Scale divisions 1 mm, or 0·5 mm (broken line).

MALE PLEOPOD: Curved in proximal two thirds with straight, evenly tapering, horny tip; some terminal spinules bifid.

COLOUR: Very faded but with two smallish spots still evident mesiad to fourth anterolateral teeth.

DISTRIBUTION: Japan (type locality, de Haan, 1835; Sakai, 1939; 1965); China (Shen, 1932); to India (Alcock, 1900).

DISCUSSION

It has often been suggested that *E. sulcatifrons* could represent a juvenile form of *E. crenata*, but the case for their distinctness is substantiated by Sakai's discovery of *E. sulcatifrons* in Japan and his recognition of it as a species distinct from *E. crenata.*

E. crenata appears closest to *E. tripunctata* and differences between the two are discussed under that species.

Alcock's description is not complete enough to provide, in itself, a definite record of this species from India but his reference to de Haan and Tozzetti in the synonymy increase the probability that his identification was correct.

Tozzetti's (1877) specimen from Yokohama agrees well in all respects with *E. crenata*, the short curving anterolateral margins, the proportions of the fifth and seventh segments of the male abdomen, and the extent of the hairy patch on the outer surface of the carpus of the cheliped being particularly significant.

DISCUSSION

In spite of the key given above it is to be expected that identification of some specimens of this genus will still prove difficult. The extensive growth polymorphism demonstrated in some species but only suspected in others, the probability of considerable geographical variation, and even the possibility of short term temporal variation in such things as colour patterns, are some of the expected complications. More attention must be paid to such features as male pleopods, suborbital margins, and basal antennal joints as, although the orbital lobes of the latter do shorten with increasing size of specimen, all three can provide useful information. Further information is needed on variability of material throughout the Indo-West Pacific and it is hoped that the present paper might provide a starting point for these investigations.

ACKNOWLEDGEMENTS

I am grateful to Professor W. Stephenson, University of Queensland, whose collected material provided the initial stimulus for this paper, to Mr. R. W. Ingle of the British Museum for providing notes, figures and photographs of the holotype of *E. australiensis* (Miers), and most especially to Dr. D. J. G. Griffin for assistance with material from the Australian Museum, for stimulating general discussion, and for useful specific criticisms.

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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 dolicophallus* (= *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

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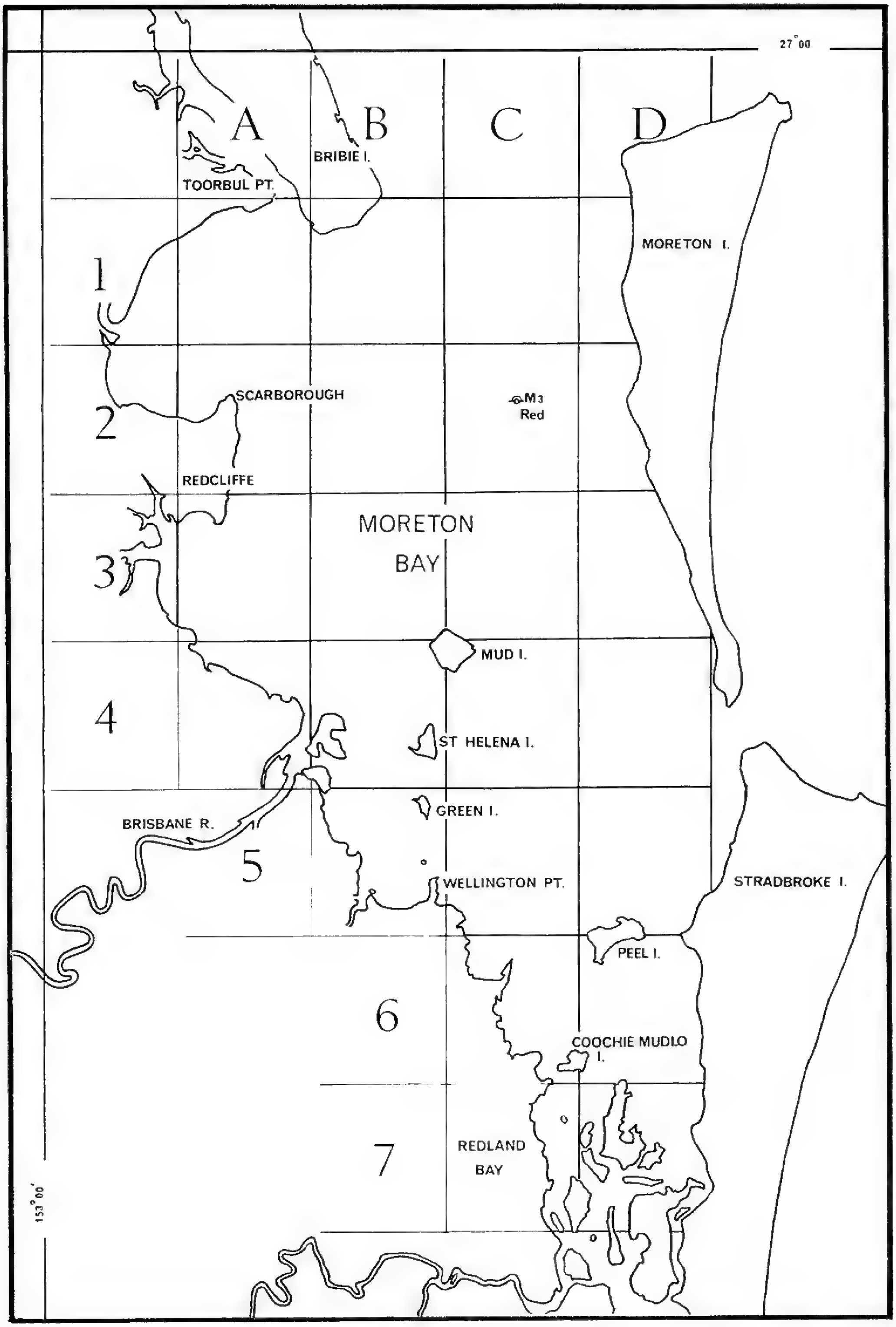
FIG. 1: Moreton Bay, showing arbitrary grid reference (based on intervals of 0° 05′ lat. and long.) used to group localities.


27°00
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A
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1
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6
7
BRIBIE I.
TOORBUL PT.
MORETON I.
SCARBOROUGH
M3
Red
REDCLIFFE
MORETON
BAY
MUD I.
ST HELENA I.
GREEN I.
BRISBANE R.
WELLINGTON PT.
STRADBROKE I.
PEEL I.
COOCHIE MUDLO I.
REDLAND
BAY

and terminal. The merus of the third maxillipeds 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.

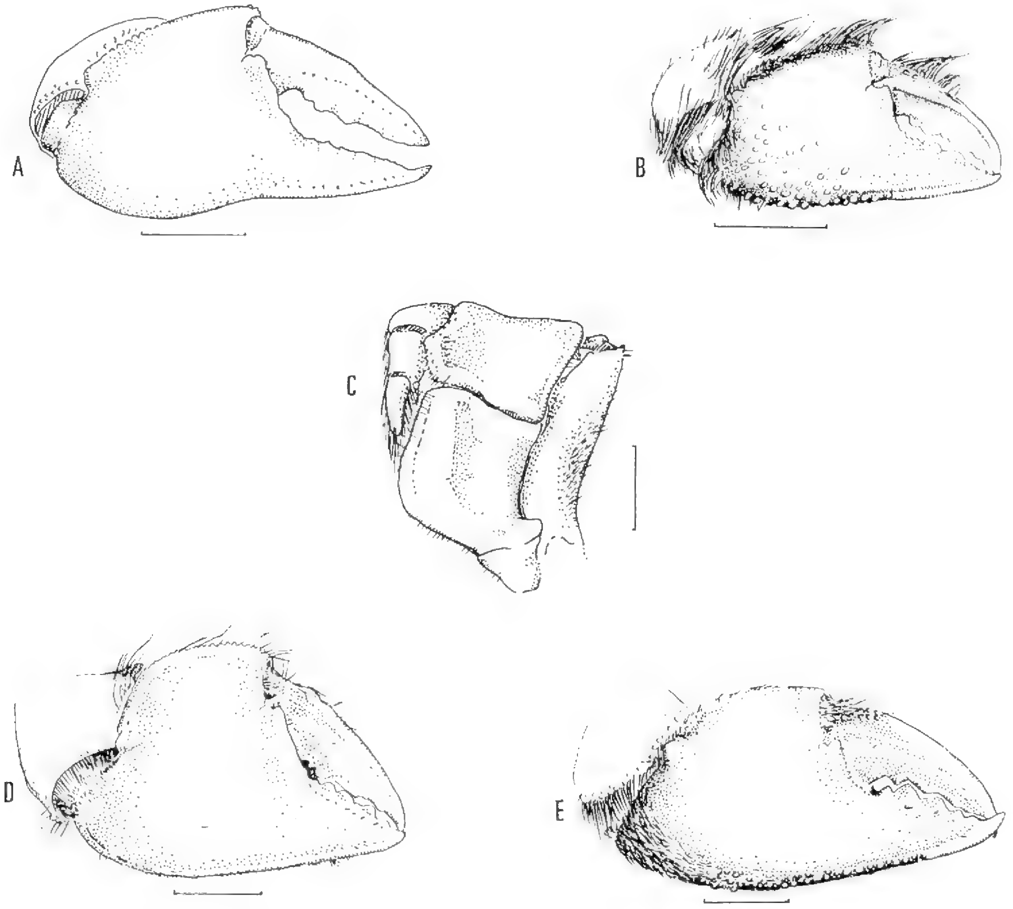

FIG. 2: A–C, *Rhizopa gracilipes*. A, chela of male, 21 mm, Aust. Mus. P4489; B, chela of female, Aust. Mus. P12338; C, third maxilliped, male 21 mm, Aust. Mus. P4489.

D, *Xenophthalmodes dolicophallus*, 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), 3¾ 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.

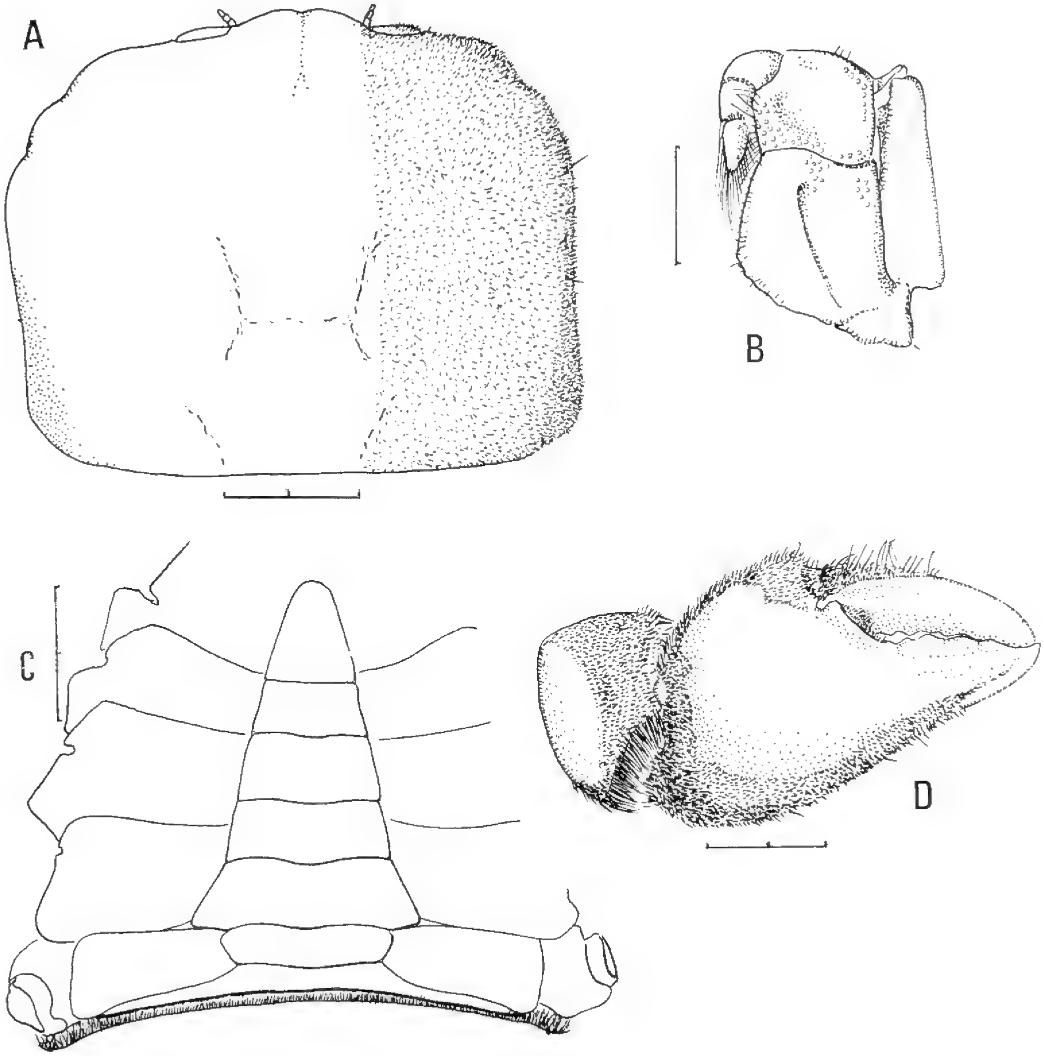

FIG. 3: *Typhlocarcinops tonsurata*, holotype. A, carapace; B, third maxilliped; C, male abdomen; D, chela.

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 tendancy for lateral production also exists, though to a lesser extent, in *Typhlocarcinus*. This tendancy 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 l/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 (l/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), ½ 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), 3¼ 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), 1¾ 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. Paradice, 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).

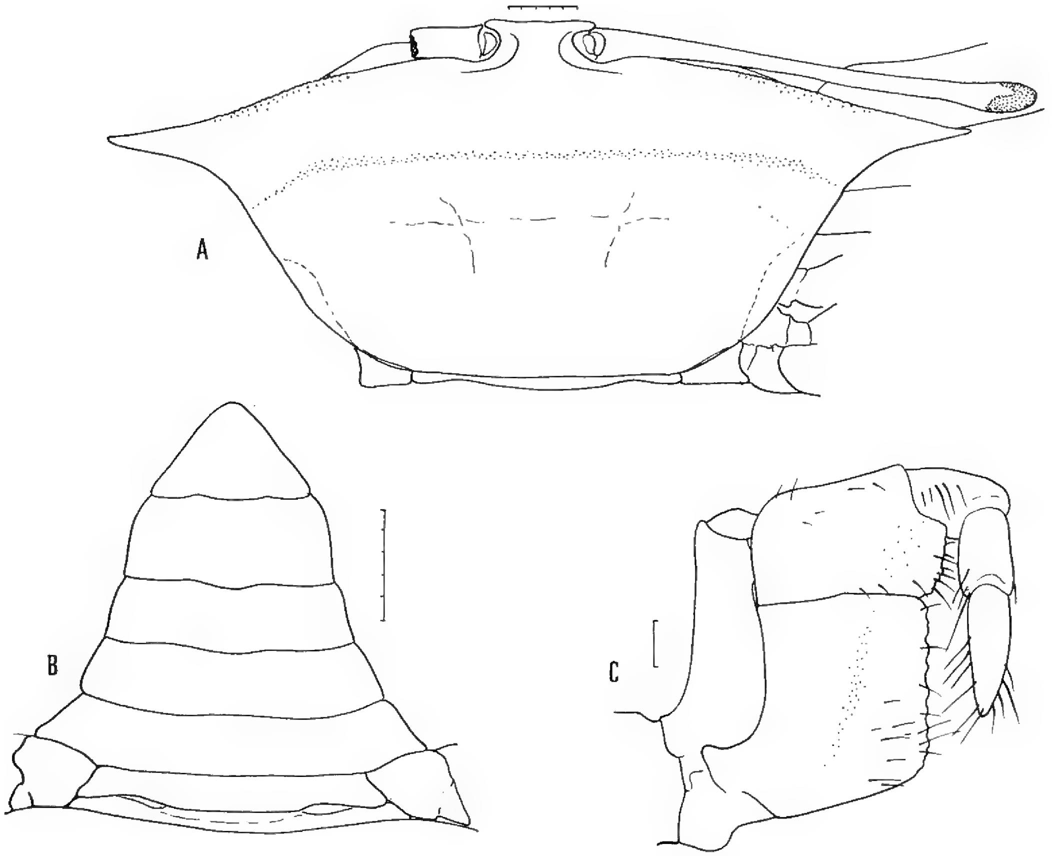

FIG. 4: *Ommatocarcinus macgillivrayi*, male 61 mm, Qd Mus. W3039. A, carapace; B, male abdomen; C, third maxilliped.

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), ¾ 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), 5½–6 miles ENE. of Scarborough, **1B,** dredged 2½ fms, 6.vii.1962, W.S., Qd Mus. W2908. Male (10 mm), 1 mile SE. of Redcliffe Jetty, **2A,** 3½ 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

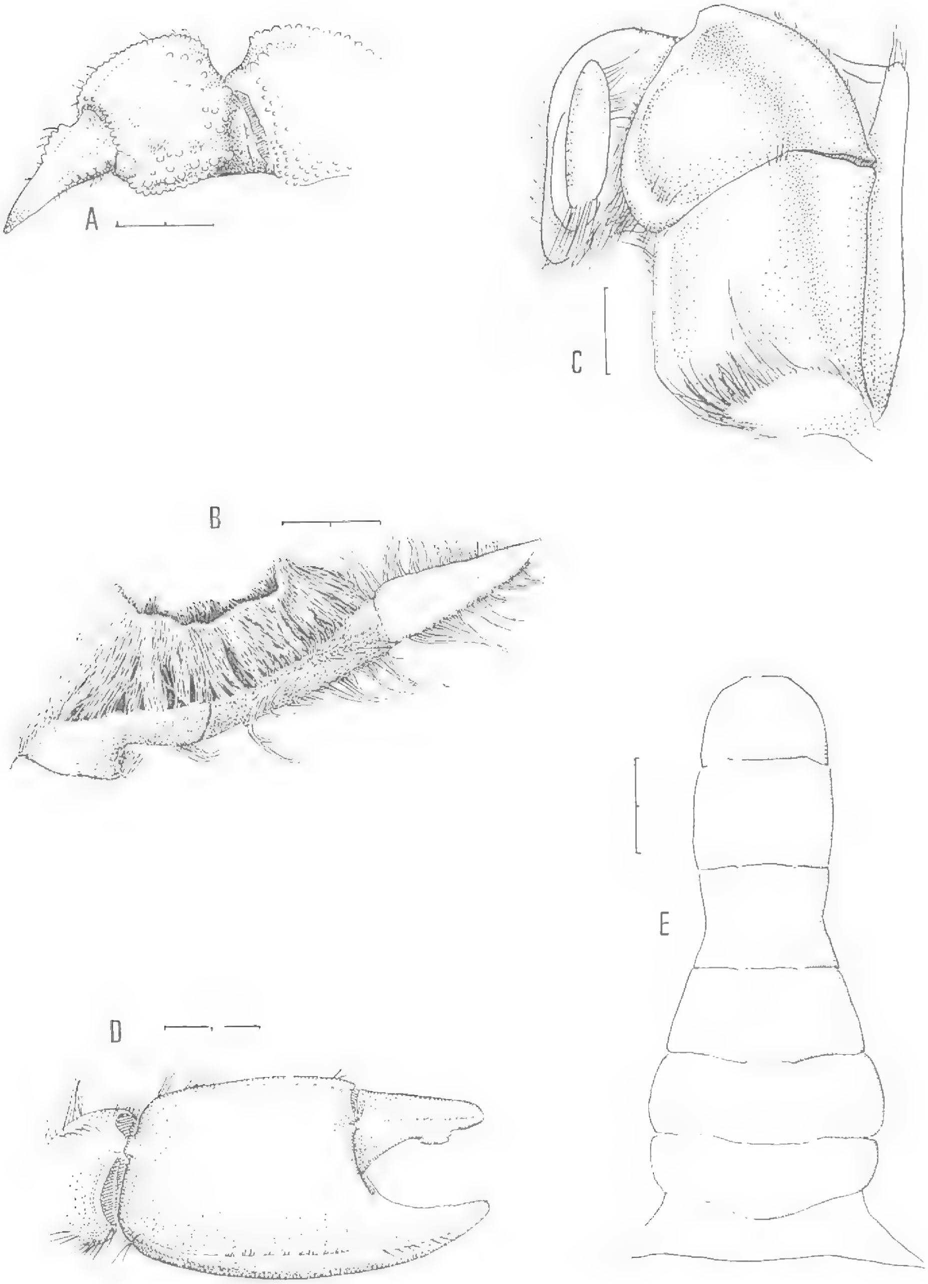

FIG. 5: *Xenophthalmus pinnotheroides*, male 16 mm, Qd Mus. W2906. A, dactyl and propodus of right first ambulatory leg; B, last three segments of right second ambulatory leg; C, third maxilliped; D, chela; E, male abdomen.

Scale divisions 1 mm.

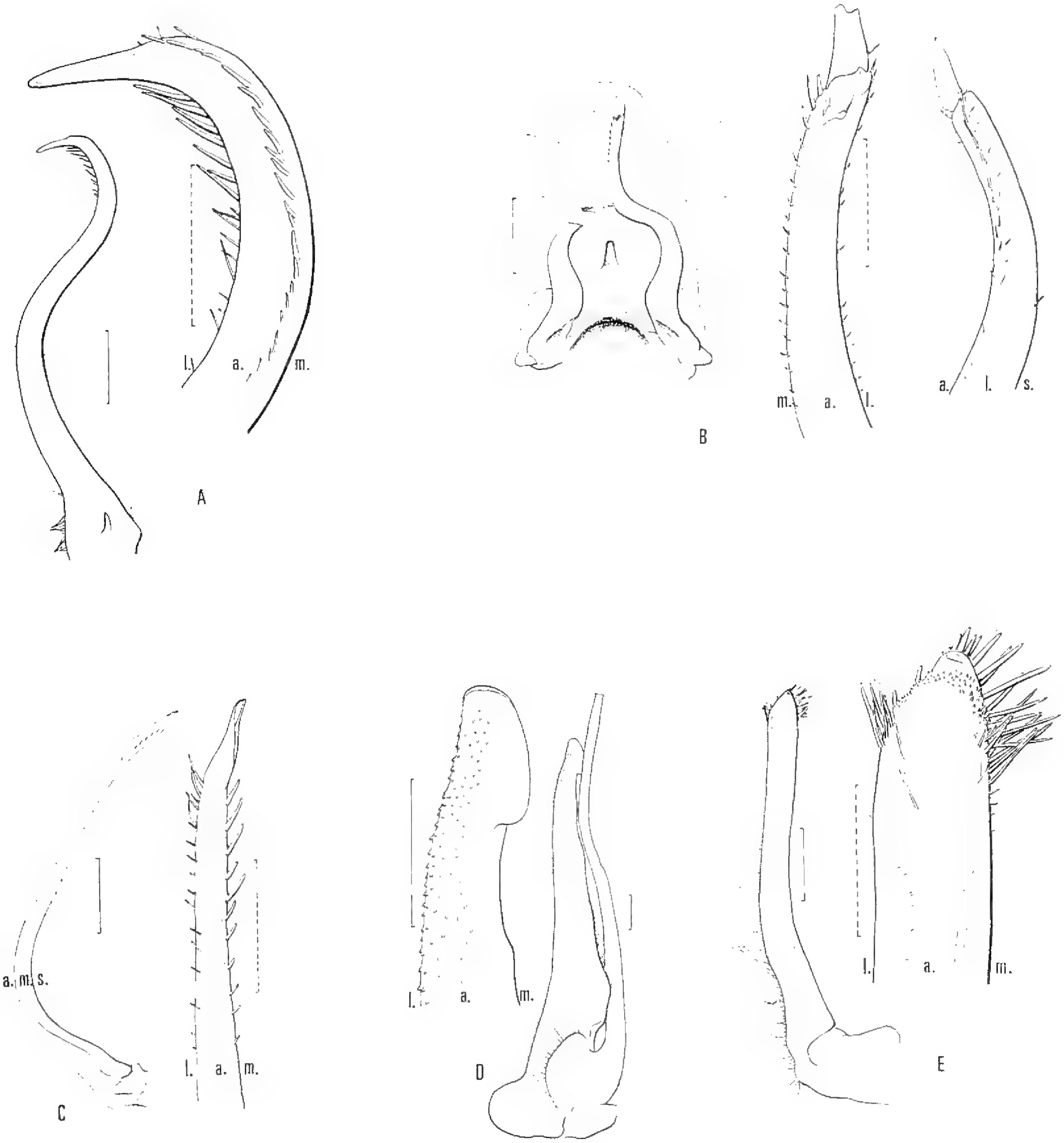

FIG. 6: Male first pleopods of A, *Rhizopa gracilipes*, Qd Mus. W1475; B, *Typhlocarcinops tonsurata*, holotype; C, *Xenophthalmodes dolicophallus*, Qd Mus. W2815; D, *Ommatocarcinus macgillivrayi*, Qd Mus. W3039; E, *Xenophthalmus pinnotheroides*, Qd Mus. W2905.

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), ⅓ 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: Dacytl 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
$\frac{\text{Propodus l.}}{\text{dactyl l.}}$	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.

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* 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.

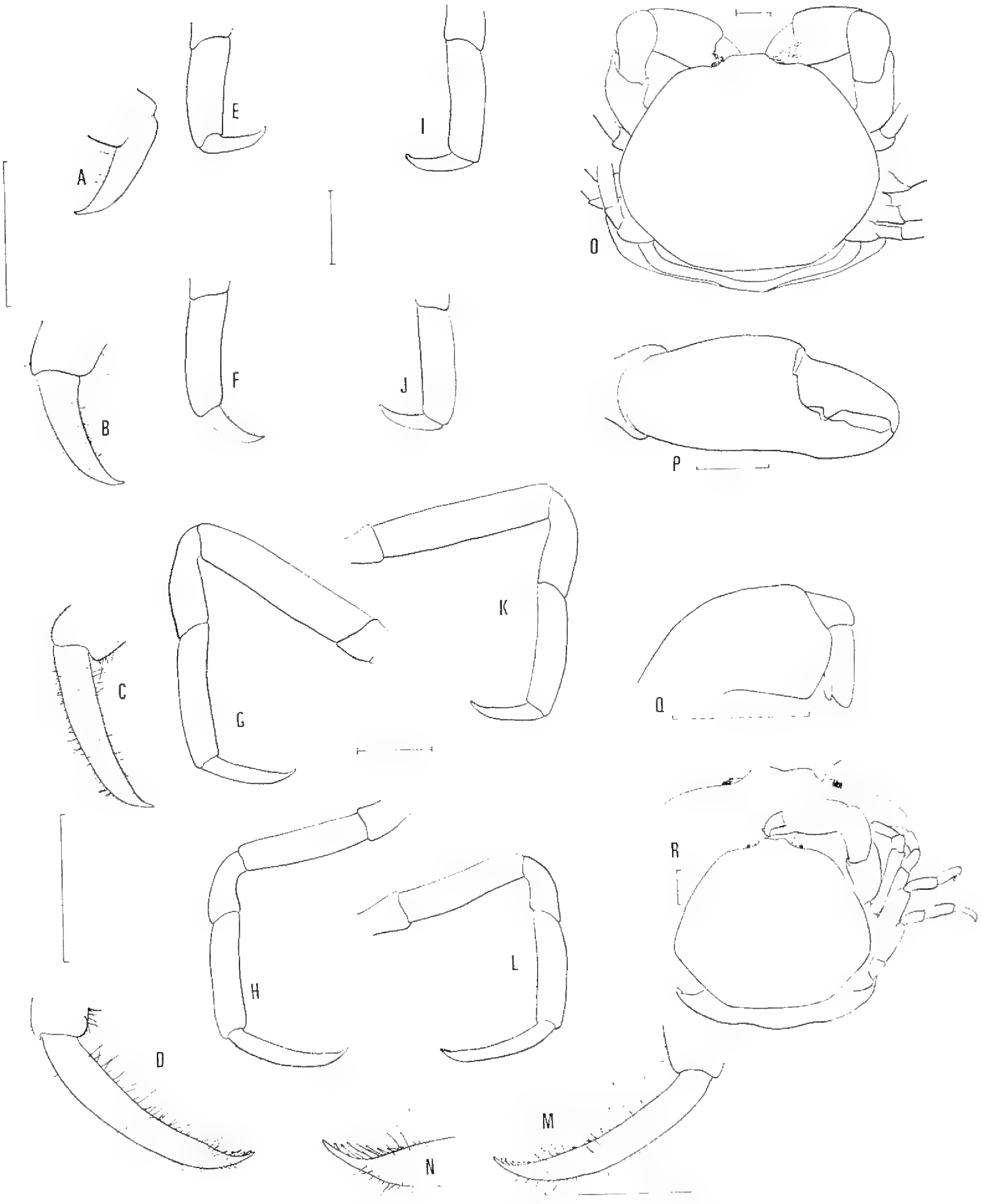

FIG. 7: *Pinnotheres spinidactylus*, female. A–Q, Qd Mus. W3037. A–D, dactyli of first to fourth left ambulatory legs respectively, A in anterior view, B–D in dorsal view; E–F, dactyl and propodus of first and second left legs respectively; G–H, third and fourth left legs respectively; I–J, dactyl and 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.

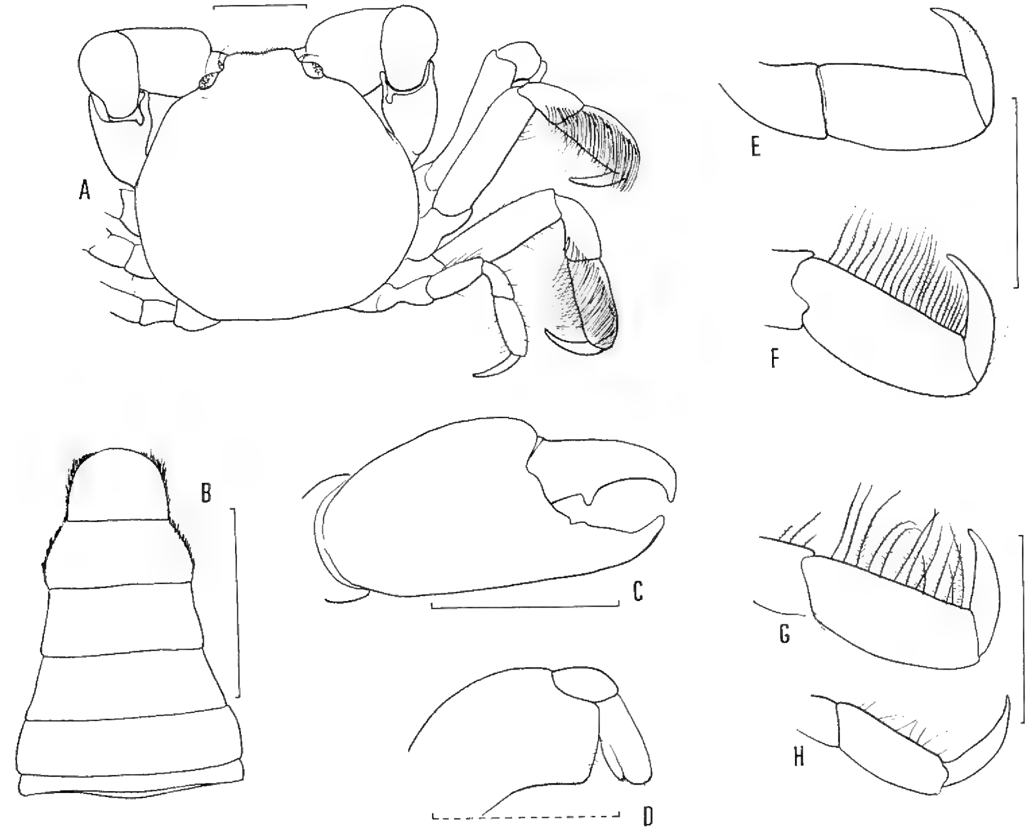

FIG. 8: *Pinnotheres spinidactylus*, male, Qd Mus. W3038. A, carapace; B, abdomen; C, chela· D, third maxilliped, E–H, first to fourth right ambulatory legs respectively, in ventral view. Scale lines 1 mm and 0·5 mm (broken line).

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 remarkedly well with *P. spinidactylus*. The key characters which prevented this identification were features 2, 4, and 6, all of

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* 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 remarkedly 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. gordoni* (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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STUDIES OF QUEENSLAND TETRANYCHIDAE (ACARINA: PROSTIGMATA)

6. A NEW GENUS AND FIVE NEW SPECIES OF SPIDER MITES FROM NATIVE PLANTS

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ABSTRACT

Drepanonychus hapsis gen. nov., sp. nov., *Eotetranychus pronus* sp. nov., *E. pseudomori* sp. nov., *Schizotetranychus russeus* sp. nov., and *S. sagatus* sp. nov., are described. All five mites feed on Queensland native plants.

The tribal placement of the new genus *Drepanonychus* is discussed and a key given to genera of the tribe Eurytetranychini, family Tetranychidae.

The two species of *Schizotetranychus* are the first in this genus to be recorded from Australia.

This paper is one of a series describing the spider mites (Tetranychidae) of Queensland, Australia. The first five parts were published in the Queensland Journal of Agricultural and Animal Sciences **23**: 569–72 (1966), **24**: 201–5 (1967), and **25**: 57–67, 69–72, 73–5 (1968).

Genus **Drepanonychus** nov.

DEFINITION

Empodium on each leg of males and females consisting only of a long slender curved claw more than half as long as the tenant hairs of the padlike true claws; tarsus I of both males and females with two pairs of " associated " setae distally, one pair dorsal, one pair ventro-lateral, but unlike typical duplex setae in that the distal sensory member is short and curved and only slightly longer than the proximal tactile member; tarsus II without paired setae of this kind; legs long and slender, the foreleg of the male nearly twice as long as the body not including the palpi; three pairs of dorsal propodosomal setae, ten pairs of hysterosomal setae, and two pairs of para-anal setae present.

The generic type species is designated as *Drepanonychus hapsis* sp. nov. The generic name is derived from the Greek *drepane*, *drepan—onyx*, *onych—*, referring to the shape of the empodial claw, and is of masculine gender.

Drepanonychus hapsis sp. nov.

MATERIAL EXAMINED

HOLOTYPE: Female, (525 μ long to tip of palpi, 330 μ wide), Kilkivan (5·4 miles west of Kilkivan township by the road to Tansey), on *Eucalyptus melanophloia* F. Muell. (silver-leaf ironbark), J. J. Davis, 29.ix.65, in Hoyer's medium, Qd Mus. W2794.

ALLOTYPE: Male (465 μ long to tip of palpi, 270 μ wide), same data as holotype, in Hoyer's medium, Qd Mus. W2795.

PARATYPES: Male mounted laterally in Hoyer's medium Qd Mus. W2796, same data as holotype except collected 17.ii.66. Six females three males collected 11.xii.64; one female two males, collected 29.ix.65; three females two males collected 17.ii.66; otherwise same data as holotype, in Hoyer's and Heinze P.V.A. media, in collection of Queensland Department of Primary Industries. Mounted paratype females range from 450 μ to 540 μ long to tip of palpi and from 300 μ to 375 μ wide, males 405 μ to 480 μ and 240 μ to 300 μ.

DESCRIPTION

FEMALE: (Fig. 1A). Body broadly oval, slightly wider in front, somewhat flattened, reddish-brown in life, the hysterosoma filled with brown oval granules evident in mounted specimens; stylophore evenly rounded in front; dorsal striae dotted, mostly transverse, but irregularly anastamosing in the median propodosomal region (fig. 2A); dorsal setae moderately stout, evenly tapering, pointed, and conspicuously pubescent; dorso-central hysterosomal setae and inner sacral setae much shorter than the other dorsal setae, the dorso-centrals being only about one-third as long as the dorso-lateral hysterosomal setae, and very much shorter than the intervals between successive setae; the longitudinal interval between dorso-central setae II and III longer than the intervals between dorso-central setae I and II and between dorso-central III and the inner sacral setae; posterior para-anal (post-anal) setae present, short and slender; peritreme variable, but with a slightly expanded chamber at the tip, bent or weakly hooked (fig. 2B); palpus with terminal sensillum nearly five times as long as wide, thin walled and tapering, and slightly proximal to this are two slightly shorter, slender, stiff, rod-like sensilla and a spindle-shaped sensillum with cross-striated walls (fig. 2C); legs long and slender, only slightly shorter than the body not including the palpi; tarsus I with a pair of setae dorsally and well towards the distal end of the segment, perhaps comparable with duplex setae but differing in that the distal sensory component is short and curved, the proximal tactile member almost as long; latero-ventrally and distally on tarsus I is a second similar pair of setae; proximal to these two pairs of " associated " setae are six tactile setae and a sensory seta; tarsus II without anything resembling duplex setae, but distally on the dorsal side of this segment is a stout spindle-shaped and curved seta with thin cross-striated walls; tarsi II, III and IV each with a single curved sensory seta proximally and dorsally; tibia I with nine tactile setae and distally a curved sensory seta; tibiae II, III, and IV with nine, eight, and nine tactile setae respectively; tactile setae on all legs are short, stout, and pointed, while the sensory setae are short and curved; on each leg the empodium consists only of a simple claw, rather sharply curved and sickle shaped,

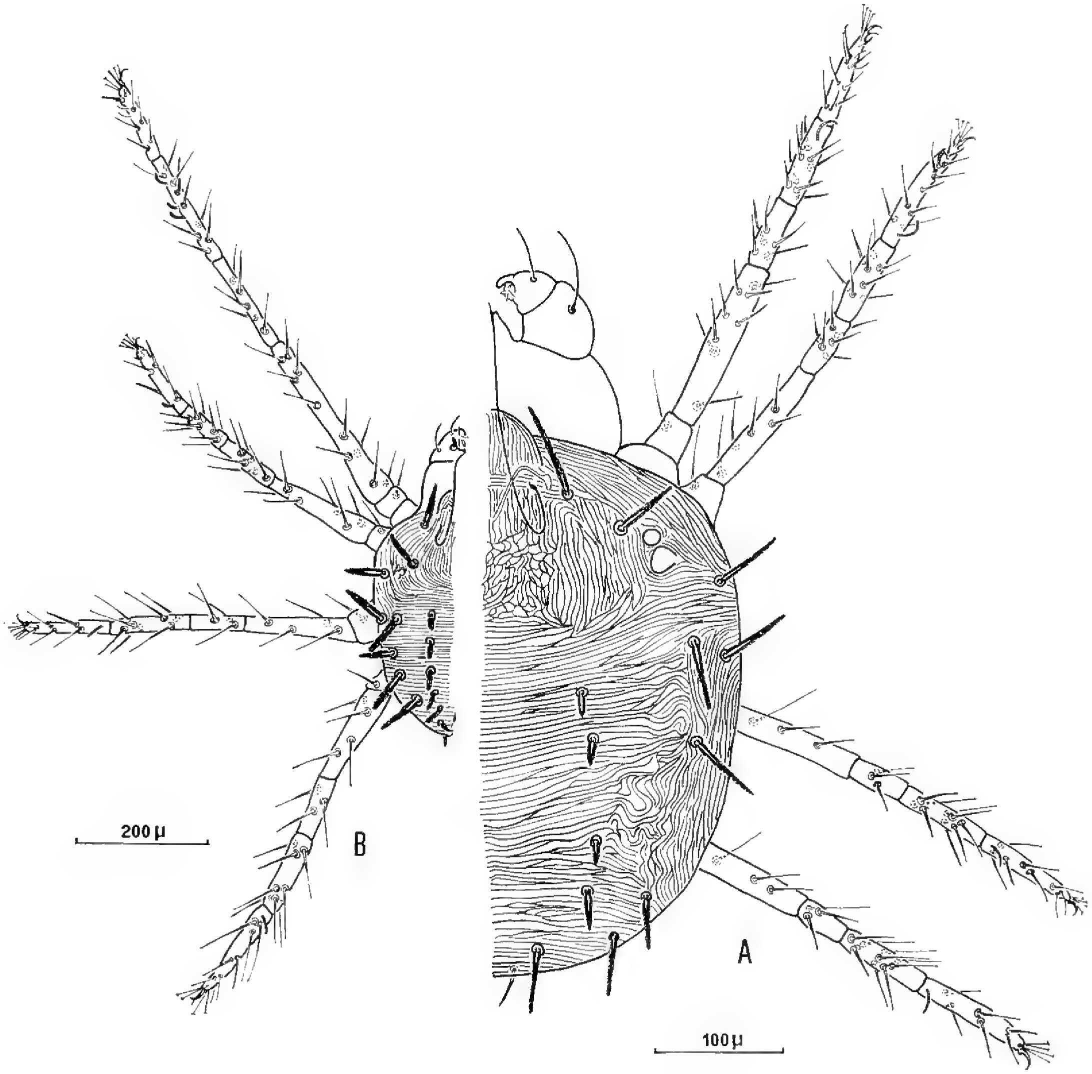


FIG. 1: *Drepanonychus hapsis*. A, female; B, male.

long and slender—more than half as long as the tenant hairs arising from the pad-like true claws. Eggs are round, yellow-green to amber, flattened above, radially striated and about 150 μ in diameter.

MALE: (Fig. 1B). Body elongate oval, slightly pointed caudad; peritreme variable, bent at tip (figs. 2D, E); palpus with terminal sensillum about three times as long as wide and apparently bifid at the tip, and slightly proximal to this are two long slender rods—much longer than the terminal sensillum—and a spindle-shaped cross-striated sensillum (fig. 2F); legs all longer than the body, leg I being nearly twice as long as the body not including the palpi; tarsi I and II (figs. 2G, H) with arrangement of distal setae similar to that previously described for the female, tarsus I with six or seven tactile setae and two short curved sensory setae proximal to the two pairs of "associated" setae; tibia I with nine tactile and three short curved sensory setae; tarsi II, III and IV each with a short curved sensory seta proximally; tibiae II, III and IV each with eight tactile setae; empodia on all legs similar to those of the female; aedeagus stout, in sheath, bent upwards then back in a gentle sigmoid curve, bluntly pointed at the tip (fig. 2I).

HABITAT

This species occurs on the (morphologically) upper surface of the leaves of the host plant and at the type locality is fairly common but not abundant, on trees covered in dust by the roadside. Webbing is practically absent and the small colonies of mites so far observed have caused no significant damage to the host plant.

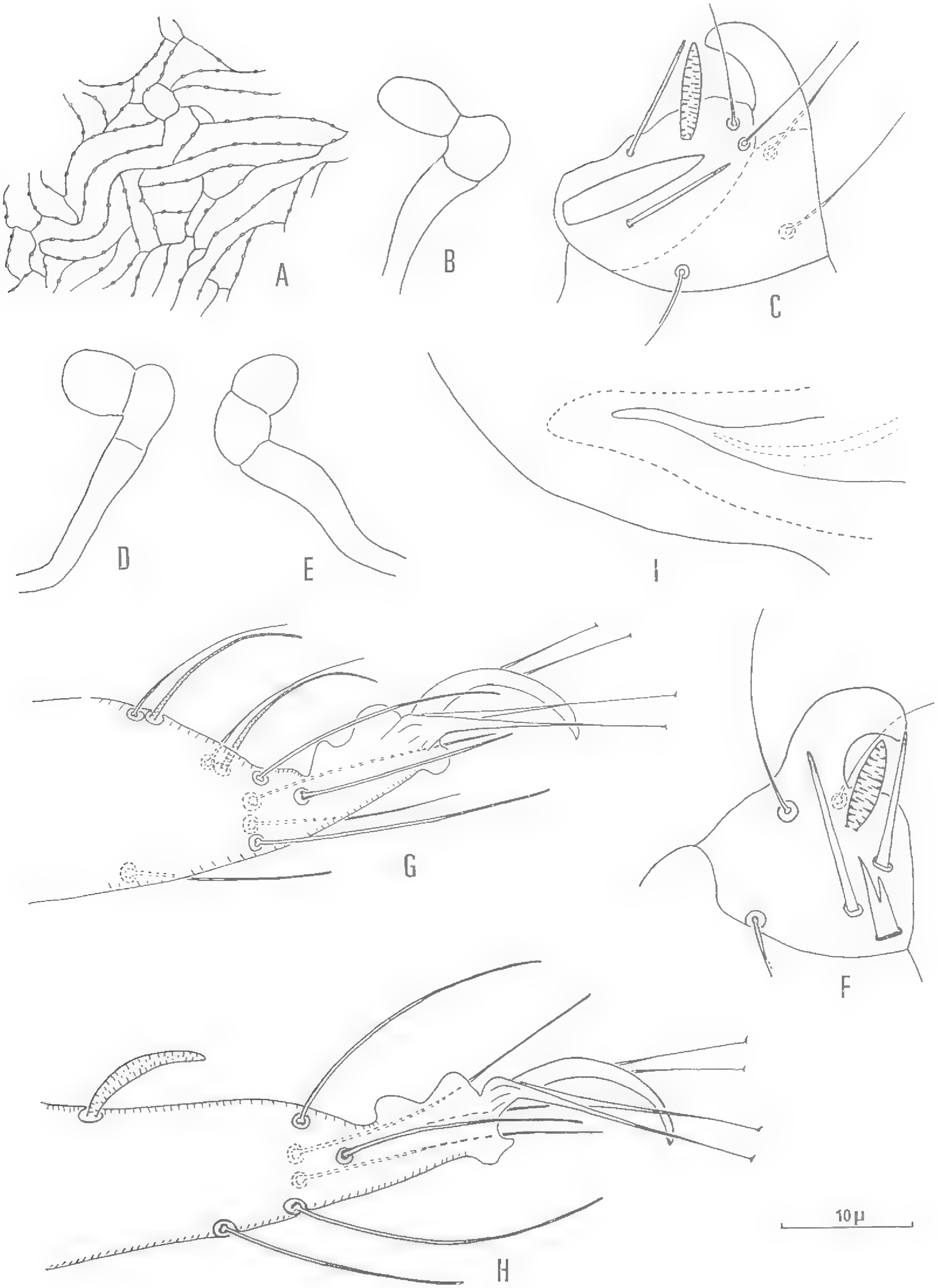
COMMENTS

The specific name of the generic type refers to the form of the dorsal propodosomal striae.

The genus *Drepanonychus* is proposed for this single species which is apparently related to mites of the tribe Eurytetranychini because, in common with these, it lacks the typical " duplex " setae characteristic of all other tribes of the family Tetranychidae (Pritchard and Baker, 1955).

Eurytetranychine species are either entirely without anything resembling duplex setae, or they may have on tarsi I and II pairs of setae which seem to be comparable to duplex setae but differ in being rather less closely associated and especially in having the distal sensory seta of the pair scarcely longer than the proximal tactile seta. Two pairs of setae of this kind are found on tarsus I of *Drepanonychus hapsis* and none on tarsus II. For this reason *Drepanonychus* is placed in the tribe Eurytetranychini.

FIG. 2: *Drepanonychus hapsis*. A, female, propodosomal striae; B, female, distal end of peritreme; C, female, palpus, terminal segment; D, E, male, distal end of peritreme; F, male, palpus, terminal segment; G, male, distal end tarsus I; H, male, distal end tarsus II; I, male, aedeagus.


A
B
C
D
E
I
G
F
H
10 μ

Drepanonychus is readily distinguished from *Eurytetranychus* Oudemans, 1931 and *Eutetranychus* Banks, 1917 by the long empodial claw, the empodium being only a tiny uncinate projection in *Eurytetranychus* and to all appearances absent in *Eutetranychus.*

Drepanonychus resembles the monotypic genus *Synonychus* Miller, 1966. *D. hapsis* differs from *S. eucalypti* in having much longer and differently proportioned legs, a relatively longer and more slender empodial claw, and in having two pairs of "associated" setae on tarsus I. *D. hapsis*, moreover, has peculiarly anastamosing dorsal striae on the propodosoma, while lacking, caudo-laterad of the first dorso-lateral hysterosomal seta, the " pore " common to *S. eucalypti* and species of *Eutetranychus.*

Drepanonychus also resembles the monotypic genus *Anatetranychus* established by Womersley (1940) for *Anatetranychus hakea* described from females only, on *Hakea* sp. Claremont, Western Australia. *D. hapsis* is similar to *A. hakea* in the proportions of the palpi and legs and particularly in the shape of the empodium. Womersley's description is deficient, however, in a number of important particulars—for example it is not clear whether or not *A. hakea* has duplex setae on tarsi I and II. The only material available is a type slide in the South Australian Museum, but the specimen is too fragmentary to be of any use. Attempts to obtain topotype material have been unsuccessful. The determination of the relationship between *Drepanonychus* and *Anatetranychus* must await discovery of topotype material of *A. hakea.*

Anatetranychus hakea was placed by Pritchard and Baker (1955) in *Neotetranychus* Trägårdh, 1915. Wainstein (1960) considered that *Anatetranychus* is a valid genus—a view which is shared by the present author—but its relationships must remain uncertain until topotype material is established. Miller (1966) also was of this opinion when establishing the genus *Synonychus.* It might eventually be found that either *Synonychus* or *Drepanonychus* is synonymous with *Anatetranychus.*

Tuttle and Baker (1968) placed *Anatetranychus* in the tribe Tetranychini and included in this genus two Arizona species with " normal " duplex setae, apparently because these species resemble *A. hakea* in the form of the empodium. This is in some agreement with the action of Pritchard and Baker (1955) in placing *A. hakea* in *Neotetranychus.* Relationships with *Synonychus* and *Drepanonychus*, however, have now been indicated and it is just as possible that a more suitable position for *Anatetranychus* is in the Eurytetranychini. It is also possible that as more Tetranychid mites are described, the tribal grouping will be replaced by a more natural classification.

KEY TO GENERA OF TRIBE EURYTETRANYCHINI RECK

Tetranychid mites lacking the duplex setae of tarsi I and II characteristic of other tribes of the family; empodium either apparently absent or simply claw-like.

This key does not include *Aponychus* Rimando, 1966. This genus, erected for two species from the Philippine Islands, was placed in Eurytetranychini by Tuttle and Baker

(1968) but its true affinities are uncertain and it was placed in a new sub-family by Rimando. Species of *Aponychus* resemble those of *Eutetranychus* by having the empodium reduced to a rudimentary knob.

1. Empodium rudimentary, rounded, and to all appearances absent .... *Eutetranychus* Banks
   Empodial claw present 2

2 (1). Empodial claw small—a minute uncinate projection .... *Eurytetranychus* Oudemans
   Empodial claw well developed, at least about half as long as the tenant hairs of the true claws 3

3 (2). Tarsus I without pairs of " associated " setae; legs short, about half as long as the body not including the palpi; empodial claw stout, about half as long as the tenant hairs of the true claw...... *Synonychus* Miller
   Tarsus I with two pairs of " associated " setae with some resemblance to true duplex setae, but with the proximal tactile member of the pair as strongly developed as distal sensory member; legs long, nearly as long as the body not including the palpi, with the forelegs of the male nearly twice as long; empodial claw long and slender, more than half as long as the tenant hairs of the true claw.......... *Drepanonychus* gen. nov.

Tribe TETRANYCHINI Reck

Genus **Eotetranychus** Oudemans

Eotetranychus pronus sp. nov.

MATERIAL EXAMINED

HOLOTYPE: Male (300 μ long to tip of palpi, 135 μ wide), Skyring Ck near Pomona, on *Ficus coronata* Spin. (a sandpaper-fig), J. J. Davis, 7.ii.66, in Hoyer's medium, Qd Mus. W2828.

ALLOTYPE: Female (375 μ long to tip of palpi, 195 μ wide), same data as holotype, in Hoyer's medium, Qd Mus. W2829.

PARATYPES: Four males, three females, same data as holotype. Three males, six females, Blackfellow Ck near Ridgewood on *Ficus* sp., J. J. Davis, 10.iii.65. Male, Kondallila National Park near Montville on *Ficus* sp., J. J. Davis, 15.i.66. All paratypes in Hoyer's and Heinze P.V.A. media in collection of Queensland Department of Primary Industries. Mounted paratype females range from 360 μ to 375 μ long to tip of palpi and 165 μ to 195 μ wide, males from 300 μ to 330 μ and 135 μ to 165 μ.

DESCRIPTION

FEMALE: Body in life yellow-green, with dark spots laterally including a prominent dark spot towards the caudal end on each side. Dorsal setae moderately slender, conspicuously pubescent, evenly tapering; dorso-central setae each about twice as long as the interval to the base of the seta next behind; stylophore evenly rounded in front, about one and one half times as long as wide; peritreme distally, a slightly expanded straight bulb (fig. 3A); striae transverse on dorsal hysterosoma including those regions between the third dorso-central setae and between the inner sacral setae; dorsal integumentary lobes small, semi-circular, separated at the base, each slightly dense at the tip and with an inconspicuous basal spot (fig. 3B); a few scattered irregular lobes ventrally between the posterior pair of ventral hysterosomal setae, but ventral striae mostly without lobes; striae transverse on the genital flap and in the region anterior to the genital flap; terminal sensillum of palpus strongly developed, a little over three times as long as wide (fig. 3C); empodia each with three pairs of proximoventral hairs, the proximal pair the strongest; tarsus I with two pairs of duplex setae closely approximated, five tactile setae and one sensory seta proximal to the duplex setae, nine tactile setae and one sensory seta on tibia I (fig. 3D); eight tactile setae on tibia II (fig. 3E); tibiae III and IV with six and seven tactile setae respectively.

Eggs are globular and pearly white, changing to amber when eye spots appear. They are found singly in the webbing, not fixed to the leaf surface, and have a long dorsal stipe. Egg diameter is about 112 μ, stipe length 42 μ.

MALE: Terminal sensillum of palpus reduced and conical (fig. 3F); peritreme straight distally, ending in a slightly expanded simple bulb (fig. 3G); empodium I with middle pair of hairs strongly developed, spur-like, the dorsal and ventral pairs of hairs comparatively weak (fig. 3H); tarsus I with four tactile and two or three sensory setae proximal to the duplex setae, tibia I with nine tactile and four sensory setae (fig. 3I); tibia II with eight tactile setae (fig. 3J); tibia III with six tactile setae; tibia IV with six or seven tactile setae; empodia II–IV each with three pairs of proximoventral hairs; aedeagus with shaft tapering, slender, and almost straight, then bent ventrad distally and with a small terminal enlargement bearing a slight anterior angulation and a larger posterior angulation—this distal knob about one fifth as long as the dorsal margin of the main shaft (fig. 3K).

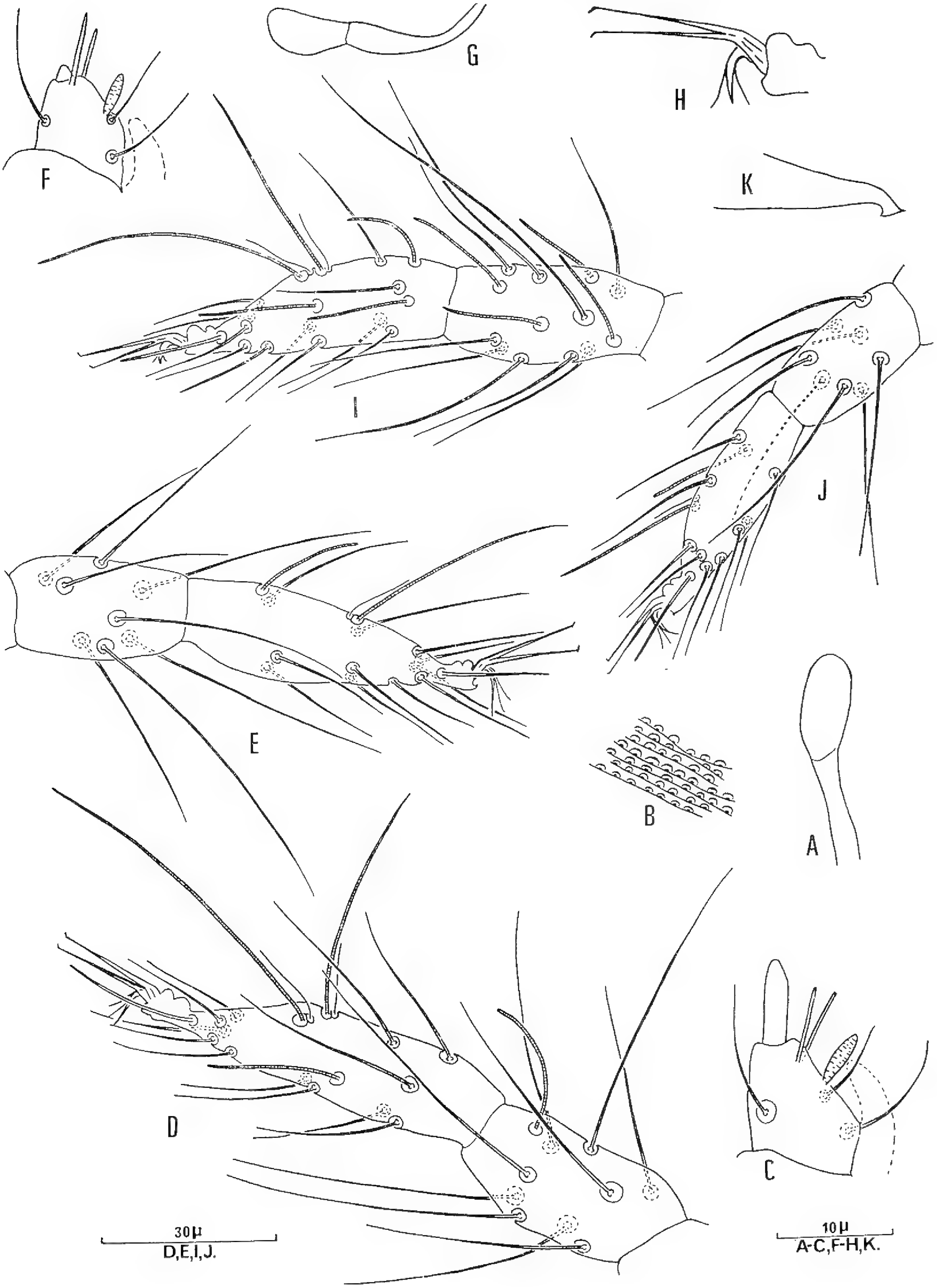
HABITAT

Colonies of *E. pronus* occur on the thickly haired under-surfaces of the leaves of the host plant. Webbing is sparse to moderate and the feeding of the mites causes the leaves to be lightly speckled.

COMMENTS

The specific name refers to the shape of the aedeagus. The aedeagus of *Eotetranychus pronus* is of the general type found in *E. perplexus* (McGregor, 1950), *E. edi* Meyer, 1964, *E. mastichi* De Leon, 1957, and *E. vaughni* Baker and Pritchard, 1962, but the species most closely resembles *E. cernuus* Baker and Pritchard, 1960.

FIG. 3: *Eotetranychus pronus*. A, female, distal end of peritreme; B, female, dorsal integumentary lobes; C, female, palpus, terminal segment; D, female, tibia and tarsus I; E, female, tibia and tarsus II; F, male, palpus, terminal segment; G, male, distal end of peritreme; H, male, distal appendages of tarsus I; I, male, tibia and tarsus I; J, male, tibia and tarsus II; K, male, aedeagus.


F
G
H
K
I
J
E
B
A
D
C
30μ
D,E,I,J.
10μ
A-C,F-H,K.

E. pronus and *E. cernuus* indeed seem to be very closely related, but on the basis of the material presently available they can be distinguished morphologically as males or females. A tabular comparison between the two follows:

	E. cernuus	*E. pronus*
Male: tactile setae tibia II	seven	eight
Female: tactile setae proximal to duplex setae, tarsus I	four	five
Female: ratio length/breadth terminal sensillum of palpus	2 : 1	3 : 1
Host plant	*Anona chrysophylla*	*Ficus coronata*, *Ficus* sp.
Distribution	Congo	S. Qld.

Baker and Pritchard (1960, p. 473) in the key to species stated that there were eight tactile setae on tibia II of male *E. cernuus*, but the description (p. 478) and the relevant figure both indicate seven tactile setae so placed and there is no mention of any variability.

E. friedmanni described recently from Madagascar on several species of host plants (Gutierrez, 1968) resembles *E. pronus* and differs from *E. cernuus* in having eight tactile setae on tibia II of males. This species differs from *E. pronus* however in having four tactile setae and two sensory setae—rather than five tactile and one sensory—proximal to the duplex setae on tarsus I of females, and in the proportionately stouter terminal sensillum of the female palpus.

Eotetranychus pseudomori sp. nov.

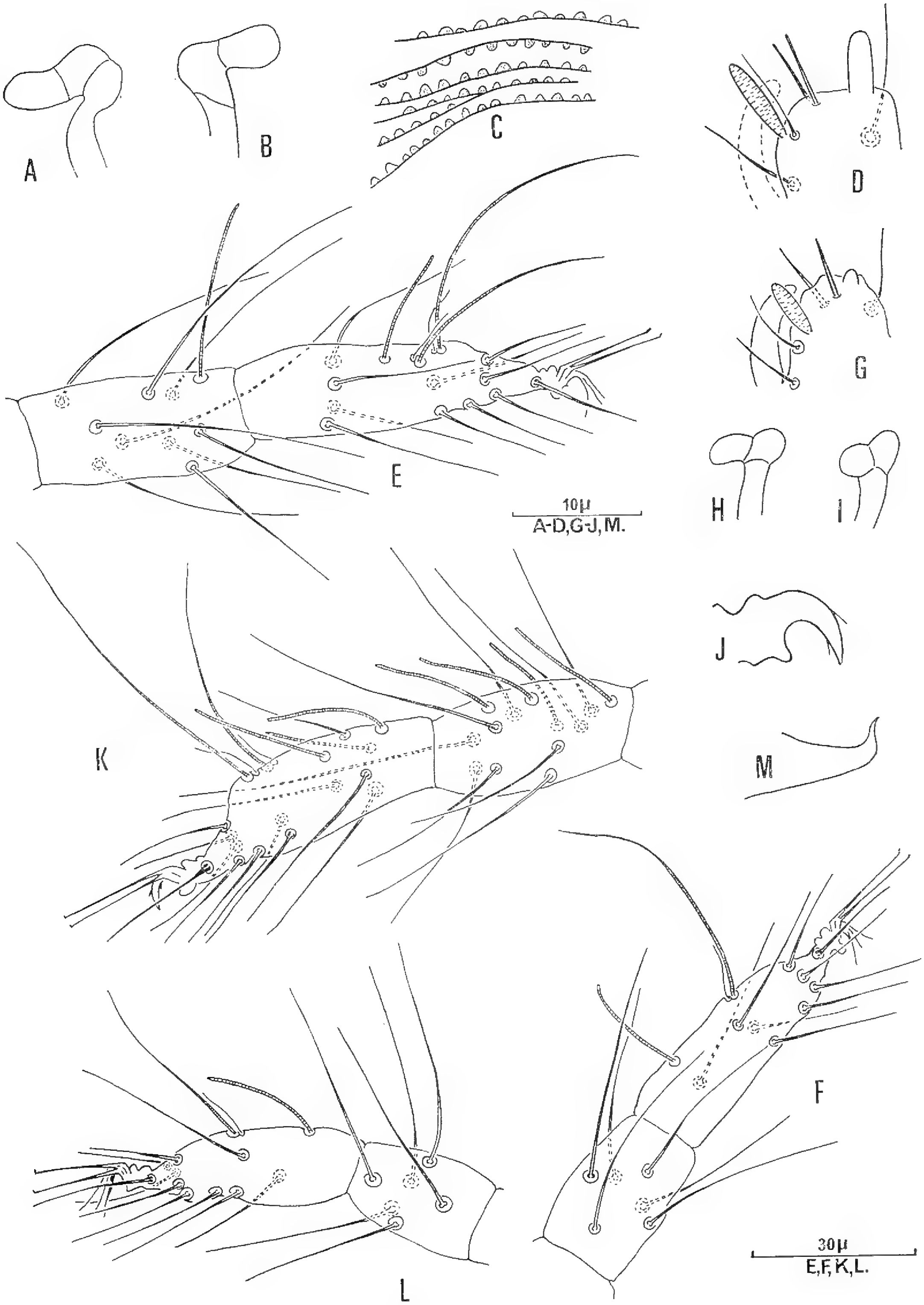
MATERIAL EXAMINED

HOLOTYPE: Male (275 μ long to tip of palpi, 135 μ wide), Lower Wonga, at junction of Woonga Ck and Widgee Ck, about twelve miles north-west of Gympie, on *Pseudomorus brunoniana* (Endl.) F. Muell. (a whalebone tree), J. J. Davis, 10.iii.67, in Hoyer's medium, Qd Mus. W2792.

ALLOTYPE: Female (435 μ long to tip of palpi, 270 μ wide), same data as holotype but collected 10.iii.65, in Hoyer's medium, Qd Mus. W2793.

PARATYPES: Two males, five females, same data as holotype. Five males, six females same data as allotype. All paratypes in Hoyer's and Heinze P.V.A. media, in collection of Queensland Department of Primary Industries. Mounted paratype females range from 390 μ to 435 μ long and 240 μ to 255 μ wide, males from 285 μ to 325 μ and 125 μ to 160 μ.

FIG. 4: *Eotetranychus pseudomori.* A, B, female, distal end of peritremes; C, female, dorsal integumentary lobes; D, female, palpus, terminal segment; E, female, tibia and tarsus I; F, female, tibia and tarsus II; G, male, palpus, terminal segment; H, I, male distal end of peritremes; J, male, empodium I; K, male, tibia and tarsus I; L, male, tibia and tarsus II; M, male, aedeagus.


A
B
C
D
E
G
H
I
10μ
A-D,G-J,M.
J
K
M
F
L
30μ
E,F,K,L.

DESCRIPTION

FEMALE: Body in life yellow-green with dark lateral spots. Dorsal setae stout, evenly tapering, conspicuously pubescent, and relatively short, the dorso-centrals being only about one-fifth to one-quarter as long again as the longitudinal intervals between setae; dorsal hysterosomal setae inserted on low but distinct tubercles; stylophore evenly rounded in front or very slightly emarginate, 1·5 times as long as wide; peritreme variable distally, usually not identical even on both sides of the same specimen, but never a simple straight bulb, the distal chamber forming a bend or slight hook (fig. 4A, B); dorsal striae mostly transverse, sometimes slightly irregularly so between the third dorso-central setae and between the inner sacral setae; dorsal integumentary lobes small, separated, sub-triangular or almost semi-circular, uniformly dense without obviously thickened tip or basal spot (fig. 4C); a few obscure lobes ventrally between the third pair of ventral hysterosomal setae, but ventral striae mostly without lobes; striae transverse on the genital flap but longitudinal in region immediately forward of the genital flap; terminal sensillum of palpus stout, a little more than twice as long as wide (fig. 4D); forelegs about half as long and other legs about one third as long as the body (to tip of palpi); empodia with three pairs of proximoventral hairs, the proximal pair the strongest; tarsus I with the two pairs of duplex setae closely approximated, and with one sensory seta and three or four tactile setae proximal to the duplex setae; nine tactile setae and one sensory seta on tibia I (fig. 4E); tibia II with six or seven tactile setae (fig. 4F); tibiae III and IV with six and five tactile setae respectively.

The eggs, which are fixed singly to the leaf surface, are globular, slightly flattened, radially striated, and with a short dorsal stipe.

MALE: Terminal sensillum of palpus reduced, variable in appearance, visible as a small bluntly conical structure (fig. 4G) or sometimes apparently absent; peritreme variable distally, but with a distinct bend or weak hook (figs. 4H, I); empodium I a pair of claws, the dorsal and ventral pairs of hairs much reduced (fig. 4J); tarsus I with two pairs of duplex setae closely approximated, and with four tactile and three sensory setae proximal to the duplex setae, tibia I with nine tactile and three or four sensory setae (fig. 4K); tibia II with six or seven tactile setae (fig. 4L); empodia II–IV each with three pairs of proximoventral hairs; tibiae III and IV with six and five tactile setae respectively; aedeagus bent dorsad, then back in a very slight sigmoid curve, tapering evenly to a point, the dorsally directed part only about half as long as the dorsal margin of the main shaft (fig. 4M).

HABITAT

Colonies of *E. pseudomori* occur on the undersides of the leaves, especially beside the main veins. On the two occasions when collections were made, mite populations were low, but they can evidently reach sufficient numbers at times to cause cupping and distortion of leaves. The mite colonies produce very little webbing.

COMMENTS

The specific name is derived from the generic name of the only known host plant.

E. pseudomori resembles *E. cendanai* Rimando, 1962, and *E. mandensis* Manson, 1963—both species from citrus in Philippines and India respectively—in having the aedeagus bent dorsad, slender and slightly sigmoid, and in the reduced (or absent) terminal sensillum of the male palpus. Several features distinguish *E. pseudomori* from these two species namely: the dorsal hysterosomal setae of *E. pseudomori* are borne on small tubercles; striae between the third dorso-centrals are transverse; there is an area of longitudinal striae ventrally just forward of the genital flap; the peritreme terminations are distinctly bent or slightly hooked rather than straight. There are also differences in leg setation, and although the aedeagus is similar to that of the other two species, it has a relatively much shorter dorsally directed portion.

Genus **Schizotetranychus** Trägårdh

The genus *Schizotetranychus* Trägårdh as defined by Pritchard and Baker (1955), is one of the larger genera of the family Tetranychidae and includes species from most countries of the world. The two species now described are the first of this genus to be recorded from Australia.

Schizotetranychus russeus sp. nov.

MATERIAL EXAMINED

HOLOTYPE: Male (360 μ long to tip of palpi, 150 μ wide) Palmwoods, on a mat-rush (*Lomandra multiflora* (R. Br.) (J. Britt.), J. J. Davis, 11.x.66, in Hoyer's medium, Qd Mus. W2824.

ALLOTYPE: Female (450 μ long to tip of palpi, 180 μ wide), same data as holotype, in Hoyer's medium, Qd Mus. W2825.

PARATYPES: Ten males, eight females, same data as holotype. One male, one female, same data as holotype except collected D. A. Ironside, 7.x.67. All paratypes in Hoyer's and Heinze P.V.A. media, in collection of Queensland Department of Primary Industries. Mounted paratype females range from 375 μ to 465 μ long, and 160 μ to 225 μ wide, males from 300 μ to 375μ and 120 μ to 180 μ.

DESCRIPTION

FEMALE: (Fig. 5A). Body in life distinctly pink or reddish. Dorsal setae slender, very finely pubescent, tapered from a slight widening near the base; first dorso-central seta relatively short, about equal in length to the distance from its base to that of the second dorso-central seta; inner sacral setae more closely spaced than the dorso-central setae (fig. 5A); dorsal setae not set on tubercles; a slight division evident between

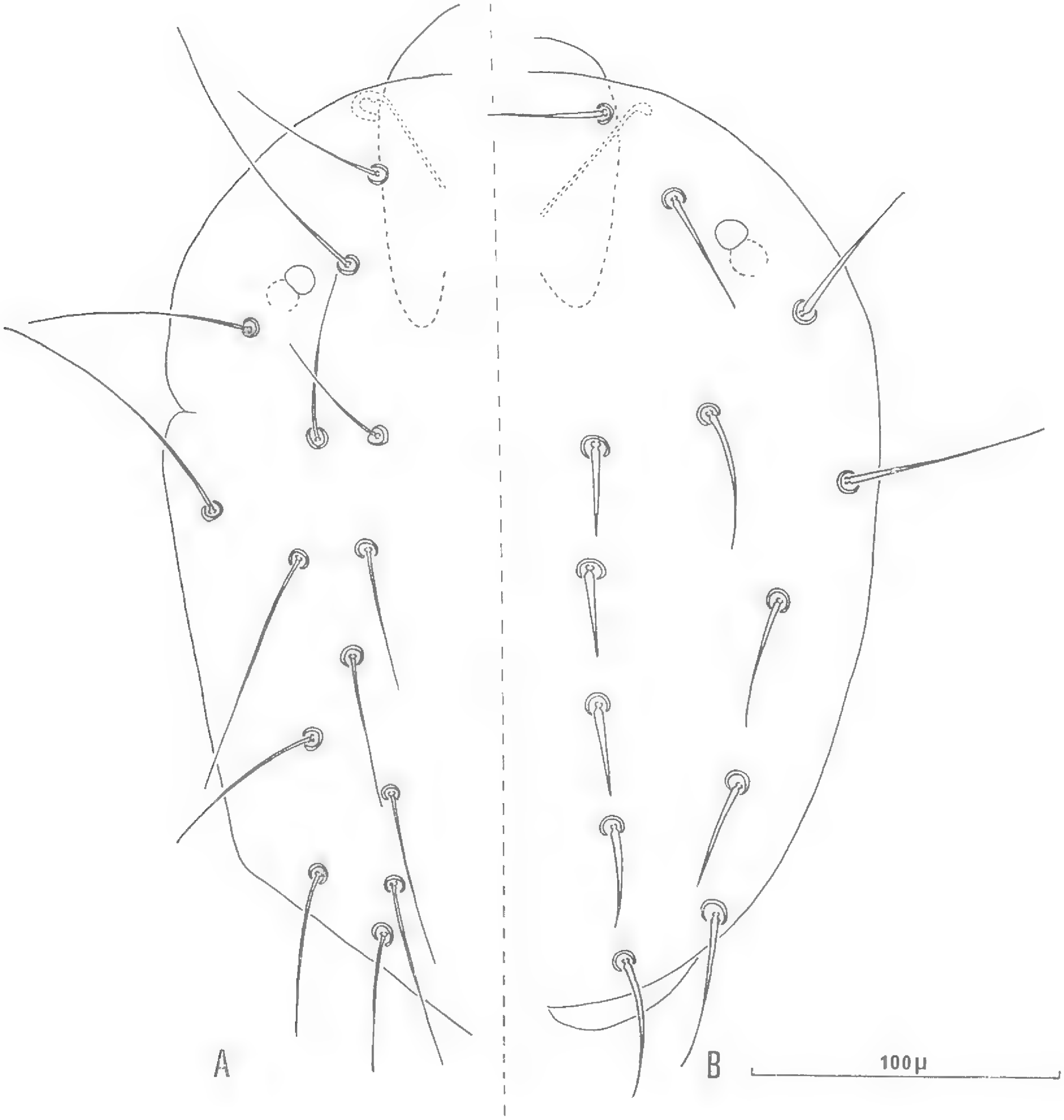


FIG. 5: A, *Schizotetranychus russeus*, female, dorsal setae; B, *Schizotetranychus sagatus*, female, dorsal setae.

proposdooma and hysterosoma; dorsal striae smooth and transverse on the hysterosoma, including those areas between the third dorso-central setae and between the inner sacral setae; ventral striae transverse on the genital flap and on the region anterior to the genital flap; stylophore slender, twice as long as wide, bluntly pointed in front; peritreme hooked (fig. 6A); terminal sensillum of palpus three times as long as wide (fig. 6B); legs short, leg I a little less than half as long as the body (to tip of palpi); each empodium a proximal pair of slender claws, with two pairs of fine hairs distally (fig. 6C); arrangement of setae on tarsus I as in fig. 6D, seven or eight tactile setae and one sensory seta on tibia I; five tactile setae on tibia II (fig. 6E), and also on tibiae III and IV.

The eggs are pink, globular, with a minute dorsal stipe.

MALE: Terminal sensillum of palpus a little less than three times as long as wide (fig. 6F); peritreme hooked distally; empodium I as in fig. 6G, other empodia similar to those of the female; tarsus I as in fig. 6H, tibia I with eight tactile and three sensory setae; tibia II (fig. 6I) and tibiae III and IV each with five tactile setae; aedeagus bent dorsad, the dorsally directed portion stout, gradually tapering, about as long as the dorsal margin of the main shaft, with a very small tip bent back and pointed (fig. 6J).

HABITAT

Colonies of *S. russeus* occur protected by moderate webbing on the slightly concave sides of the elongate leaves of the host plant.

COMMENTS

The specific name is descriptive of the colour of living mites.

S. russeus resembles *S. eremophilus* McGregor, (south-western U.S.A., on grasses) in having the first dorso-central setae relatively short, but differs in the relative lengths of some of the other dorsal setae; males of *S. russeus* lack the characteristic type of sensory setae found in males of *S. eremophilus*, and the aedeagus of *S. eremophilus* has a much larger caudally directed portion than has that of the former species (McGregor, 1950; Pritchard and Baker, 1955).

Schizotetranychus sagatus sp. nov.

MATERIAL EXAMINED

HOLOTYPE: Male (345 μ long to tip of palpi, 165 μ wide) Atherton, on *Themeda australis* (R. Br.) Stapf (Kangaroo-grass), R. J. Elder, 10.x.66, in Hoyer's medium, Qd Mus. W2826.

ALLOTYPE: Female (405 μ long to tip of palpi, 225 μ wide) same data as holotype, in Hoyer's medium, Qd Mus. W2827.

PARATYPES: Eleven males, twelve females, same data as holotype. All paratypes in Hoyer's and Heinze P.V.A. media, in collection of Queensland Department of Primary Industries. Mounted paratype females range from 375 μ to 405 μ long to tip of palpi and from 210 μ to 240 μ wide, males from 330 μ to 360 μ and 150 μ to 180 μ.

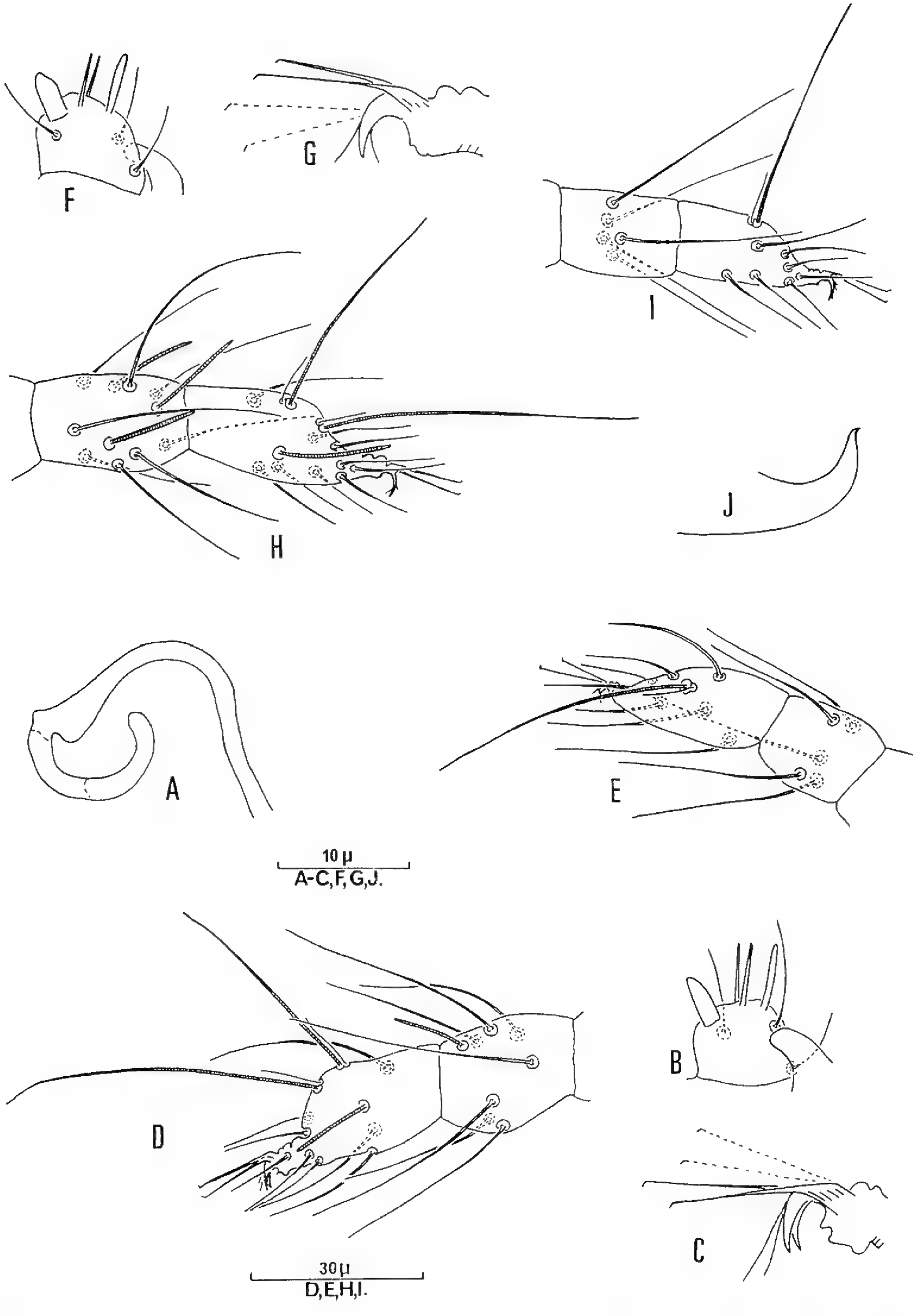


FIG. 6: *Schizotetranychus russeus.* A, female, distal end of peritreme; B, female, palpus, terminal segment; C, female, distal appendages tarsus I; D, female, tibia and tarsus I; E, female, tibia and tarsus II; F, male, palpus terminal segment; G, male, distal appendages tarsus I; H, male, tibia and tarsus I; I, male, tibia and tarsus II; J, male, aedeagus.

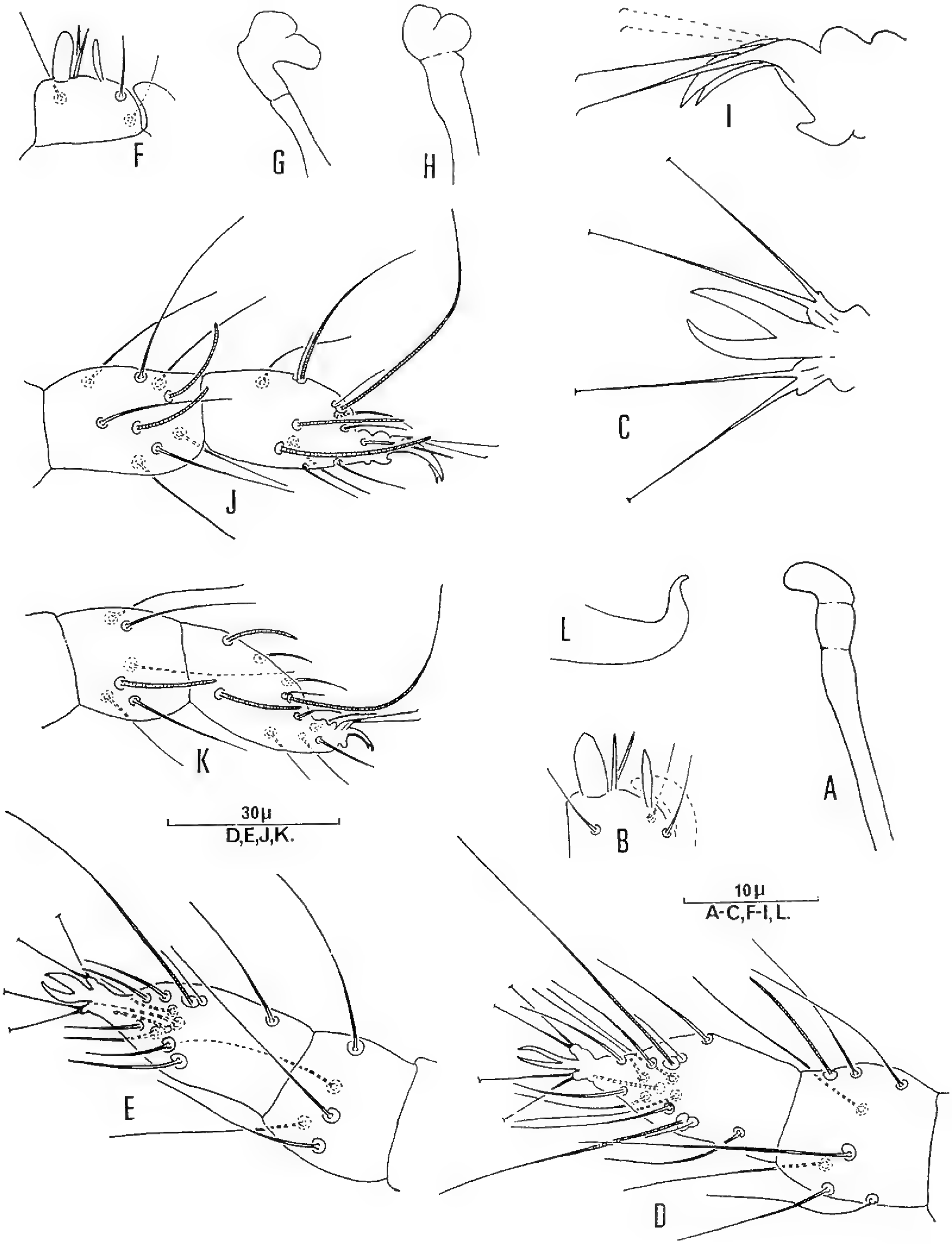


FIG. 7: *Schizotetranychus sagatus*. A, female, distal end of peritreme; B, female, palpus, terminal segment; C, female, distal appendages tarsus I; D, female, tibia and tarsus I; E, female, tibia and tarsus II; F, male, palpus, terminal segment; G, H, male, distal end of peritremes; I, male, distal appendages tarsus I; J, male, tibia and tarsus I; K, male, tibia and tarsus II; L, male, aedeagus.

DESCRIPTION

FEMALE: (Fig. 5B) Body in life pale yellow-green with black spots along each side. Dorsal setae much thickened near the base, tapering evenly to a fine point almost without pubescence; dorso-centrals shorter than the longitudinal intervals between bases of setae (fig. 5B); inner sacral setae about the same distance apart as the dorso-central setae; dorsal setae not set on tubercles; dorsal striae smooth and transverse on the hysterosoma, including those areas between the third dorso-central setae and between the inner sacral setae; ventral striae transverse on the genital flap and on the region anterior to the genital flap; stylophore about one and one half times as long as wide, broadly rounded in front; peritreme variable distally, usually slightly bent (fig. 7A); terminal sensillum of palpus a little over twice as long as wide (fig. 7B); legs short, leg I about half as long as the body to the tip of the palpi; each empodium a pair of stout claws, without associated hairs (fig. 7C); arrangement of setae on tarsus I as in fig. 7D, seven tactile setae and one sensory seta on tibia I; five tactile setae on tibia II (fig. 7E), and also on tibiae III and IV.

The eggs are round, slightly flattened dorso-ventrally, without a dorsal stipe.

MALE: Terminal sensillum of palpus nearly three times as long as wide (fig. 7F); peritreme variable distally, bent or slightly hooked (fig. 7G, H): each empodium with a pair of stout claws, without associated hairs, similar to those of the female (fig. 7I); tarsus I as in fig. 7J, tibia I with seven tactile and two sensory setae; tibia II with five tactile setae and one sensory seta (fig. 7K); tibiae III and IV each with five tactile setae; aedeagus bent dorsad in a short sigmoid curve, ending in a blunt point, the dorsally directed part slightly shorter than the dorsal margin of the main shaft (fig. 7L).

HABITAT

S. sagatus occurs on the undersides of the leaves in small colonies each protected by a closely woven cover. These patches of webbing, about three millimetres long, appear as a series of roughly oval white spots along either side of the midrib of the infested leaf.

COMMENTS

The specific name is descriptive of the webbing covering each colony of this species.

S. sagatus resembles *S. spiraefolia* Garman (north-eastern U.S.A. on *Spiraea latifolia*) and *S. andropogoni* (Hirst) (India, on *Andropogon annulatus* and *Saccharum spontanum*) as described by Pritchard and Baker 1955, in the general form of the dorsal setae and of the aedeagus. It differs from *S. spiraefolia* in the number of setae on tibiae I and II and from *S. andropogoni* in leg setal patterns as well as having a more slender terminal sensillum on the female palpus and relatively shorter dorso-central setae.

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The Director of the South Australian Museum made available on loan all of the Museum's material of *Anatetranychus hakea* Womersley and paratypes of *Synonychus eucalypti* Miller.

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NEOTETRANYCHUS VICTORIAE SP. NOV. (ACARINA:TETRANYCHIDAE)

A SPIDER MITE FOUND ON *SPYRIDIUM PARVIFOLIUM* F. MEULL. IN VICTORIA

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ABSTRACT

Neotetranychus victoriae sp. nov. is described. This species was found on the native plant *Spyridium parvifolium* F. Muell. in the Dandenong Ranges district of Victoria. *N. victoriae* is unlike any mite previously recorded from Australia, and represents a new generic record for this country.

Neotetranychus victoriae sp. nov.

Material Examined

Holotype: Female (450 μ long to tip of palpi, 285 μ wide), The Basin—Dandenong Ranges district near Melbourne, Victoria, on *Spyridium parvifolium* F. Muell., J. J. Davis, 10.i.67, in Hoyer's medium, Qd Mus. W2951.

Allotype: Male (315 μ long to tip of palpi, 180 μ wide), same data as holotype, in Hoyer's medium, Qd Mus. W2952.

Paratypes: Eight females, fourteen males, same data as holotype. One female in Heinze P.V.A. medium, Qd Mus. W2953, other paratypes, in Hoyer's and Heinze P.V.A. media, in collection of Queensland Department of Primary Industries. Mounted paratype females range from 420 μ to 465 μ long to tip of palpi, 270 μ to 300 μ wide, males from 300 μ to 375 μ and 165 μ to 195 μ.

Description

Female: Body rounded, in life yellowish with dark lateral spots; stylophore broadly rounded in front; cuticular striae are fine and appear smooth, but in some preparations are seen to be very minutely lobed; dorsal hysterosomal striae irregularly longitudinal between the closely spaced third pair of dorso-central setae and between the inner sacral setae—striae between these two pairs of setae transverse but not in a defined rhomboidal pattern; the dorsal integument of much of the idiosoma presents an unusual irregular basketweave appearence due to the presence of small relatively raised areas; dorsal setae (fig. 1), long, thickly pubescent, fairly slender but scarcely

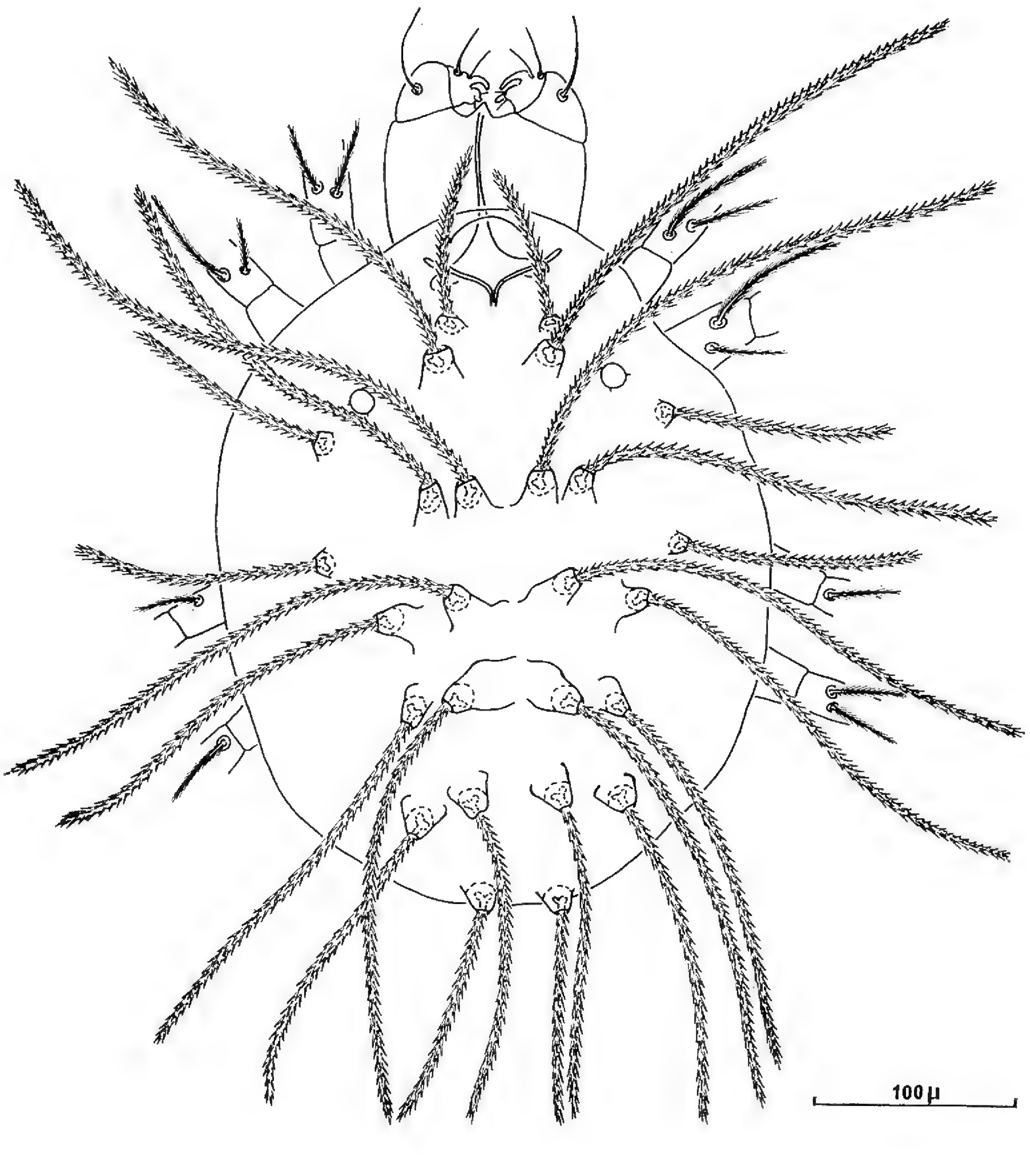


FIG. 1: *Neotetranychus victoriae*. Female, dorsal setae.

tapered—more or less cylindrical—and inserted on very strongly developed tubercles; the second pair of dorsal propodosomal setae, the dorso-central, and dorso-lateral hysterosomal setae are all similar in length, about three quarters as long as the body not including the palpi; the inner and outer sacral setae are about two-thirds as long as the dorso-central setae; the remaining dorsal setae—two pairs on the propodosoma and the humeral and clunal setae—are about one-third to one-half as long as the dorso-central setae; ventral striae transverse on the genital flap, a small area of longitudinal striae in front of the genital flap, then striae further forward transverse; two pairs of short slender finely pubescent para-anal setae present; peritreme almost straight distally, with slightly expanded bulb (fig. 2A,B); palpus with terminal sensillum well developed, nearly twice as long as wide, about half as long as the longer of two adjacent stout rod-like sensilla (fig. 2C); legs short, one half to two thirds as long as the body not including the palpi; tarsus I with three tactile setae and one sensory seta well proximal to the two pairs of duplex setae which are placed close together, tibia I with eight tactile setae and a very short, peg-like sensory seta distally on the dorsal side (fig. 2D); tibia II with seven tactile setae (fig. 2E); tibiae III and IV each with five tactile setae; empodia with short proximoventral hairs, often apparently only two pairs, but in some preparations a third pair can be seen (fig. 2F).

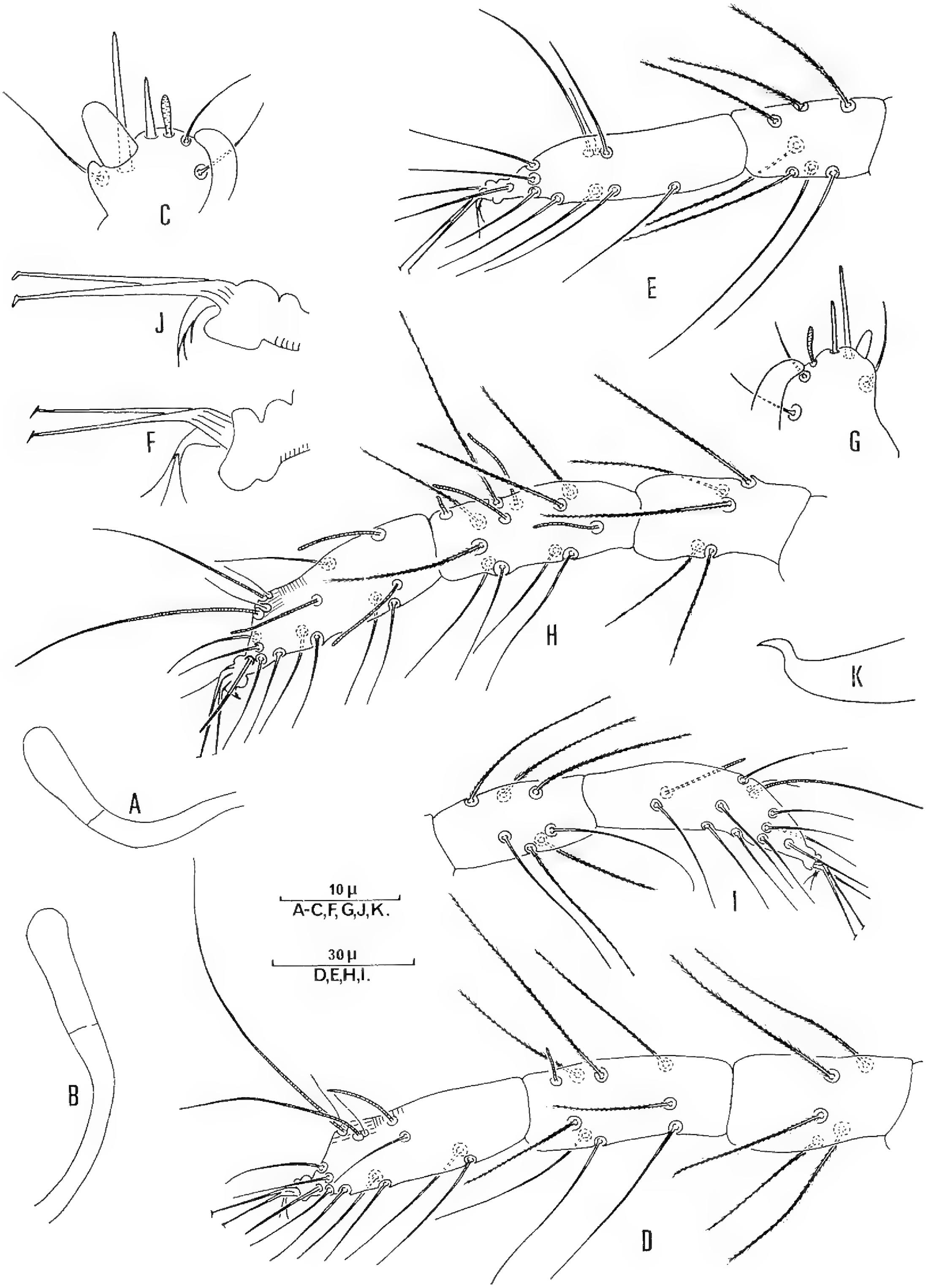
MALE: Body strongly tapered caudad; dorsal setae long, scarcely tapering, thickly pubescent, inserted on prominent tubercles; peritreme almost straight distally; palpus with terminal sensillum small, sub-conical, about twice as long as wide, about one third as long as the longer of the two adjacent rod-like sensilla (fig. 2G); legs short, from one third to a little over one half as long as the body not including the palpi; tarsus I with five tactile and two sensory setae proximal to the two pairs of duplex setae, tibia I with nine tactile and three long sensory setae, with one very short peg-like sensory seta distally on the dorsal side (fig. 2H); tibia II with seven tactile setae; (fig. 2I); tibiae III and IV each with five tactile setae; emplodium I a slender claw-like structure with associated hairs (fig. 2J), other empodia resembling those of the female; aedeagus stout, bent dorsad, the dorsally directed part very short, then bent back to form a short caudad directed, sharp angulation (fig. 2K).

HABITAT

The mites occurred on the thickly haired undersides of the leaves of the host plant in a dusty situation by the roadside.

COMMENTS

Neotetranychus victoriae is unlike any spider mite previously recorded from Australia and is the first species from this country to be placed in *Neotetranychus* Trägårdh as this genus is presently understood. While resembling other species of the genus in the form and placement of the dorsal tubercles, *N. victoriae* is readily distinguishable by the shape of the dorsal setae, the setation of the legs, and the shape of the aedeagus.


C
J
F
E
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K
A
I
10 µ
A-C,F, G,J,K.
30 µ
D,E,H,I.
B
D

The aedeagus of *N. victoriae* resembles that of a species in a related genus, *Mononychus georgicus* (Reck), but this mite from Georgian S.S.R. has relatively short dorsal setae inserted on tubercles which, though distinct, are not very strongly developed (Reck, 1948; Wainstein, 1960).

ACKNOWLEDGEMENTS

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FIG. 2: *Neotetranychus victoriae*. A, B, female, distal end of peritreme; C, female, terminal segment of palpus; D, female, genu, tibia tarsus I; E, female tibia, tarsus II; F, female, distal appendages tarsus I; G, male, terminal segment of palpus; H, male, genu, tibia tarsus I; I, male, tibia and tarsus II; J, male, distal appendages tarsus I; K, male, aedeagus.

THE REDISCOVERY OF *HIRUDO ELEGANS* GRUBE, 1867

Laurence R. Richardson

ABSTRACT

Leeches from Rockhampton (Queensland), Grafton (New South Wales), and Port Moresby (Papua), are recognised as *H. elegans*, the type for the genus *Goddardobdella* Richardson, 1969 (F. Richardsonianidae Richardson, 1969). *G. elegans* is monostichodont; pharynx and associated structures, hirudoid; salivary papillae present on the jaws; pharynx terminates at viii/ix; crop with 11 caecate compartments, a single pair of simple median caeca on ix to xi, a simple small anterior and larger pair of median caeca on xii to xix; epididymis in xii essentially posterior to the ejaculatory bulb in xi; median regions of reproductive system bimyomeric, mesomorphic; vagina simple fusiform; no vaginal duct. Small. Longitudinally striped. Aquatic. Sanguivorous.

Grube (1867) briefly described a glossiphonid, *Clepsine octostriata*, and two other leeches, *Hirudo elegans* and *H. novemstriata* from Rockhampton, Queensland. In 1871 he provided some few further details and in error referred to the original account as published in 1866. None of these leeches have been recognised since, nor referred to other than listed (e.g. Vaillant 1890, etc.) excepting that Goddard (1909) considered *novemstriata* to be a synonym of '*Limnobdella*' *australis* which Johansson (1911) did not accept. From the nature of Grube's description, I considered that these species could not be recognised again with confidence excepting in material from the original area (Richardson, 1968). Following the recent war, I was advised that Grube's collections had been destroyed.

Through Mr. R. B. J. Pilbeam, M.L.A., Mayor of Rockhampton, I was placed in touch with the Rockhampton Field Naturalists' Club. The club collected and sent me seven leeches from Mount Lizard at Yeppoon. I received them on August 27, 1967, in excellent condition.

They were longitudinally striped hirudinids of moderate size. There is a median dorsal stripe, and two pairs of dorsal lateral stripes, all with narrow black borders. The median is the widest, reddish to reddish fawn in colour, commencing anterior to the first pair of eyes at the dark margin of the velum and extending posteriorly onto the dorsum of the sucker. A blackish brown to dark slate band which is wider than the median stripe along most of the body, separates the median from the inner of the lateral stripes which are both narrow and lighter coloured than the median, the outer slightly the wider, and the two separated by a narrower blackish brown band. There is a dark greyish marginal band external to the outer lateral stripe and this band extends onto the submarginal area where it is separated from the immaculate uniformly light brownish orange venter by a distinct darker blackish grey band. The eyes are typical, there being the length of an annulus between 3 and 4, and of two annuli between 4 and 5.

Grube (1867, 1871) had knowledge of '*H.*' *australis* but makes no comparison with this species in his descriptions of the Rockhampton hirudinids which can be taken as indicating that they differ strikingly from *australis*. The descriptions are brief and refer only to general external features. In *H. elegans* the eyes are as in *H. medicinalis*, the venter uniform pale olive without a lateral black stripe and the edge somewhat paler. On the dorsum a median stripe with delicate black borders commences near the front margin between the eyes and extends onto the dorsum of the posterior sucker more or less dividing it. On each side are two stripes of less intense colour, each delicately black bordered, the inner commencing behind the eyes and the other further posteriorly. The distance between these paired stripes is about equal to their width as is the distance from the lateral stripe to the margin; but the distance between the median and inner stripes is greater than the width of the median. Length, 34·5 mm; width, 7·5 mm.

H. novemstriata was strikingly slender with a transverse row of 10 papillae on all body annuli both above and below. The oral ring divided by a transverse furrow on the dorsal aspect but the following ring with only a trace of this so that the fourth and fifth eyes are separated by only a half ring (this is open to several interpretations). No median fissure on the lower surface of the velum (present in *elegans*, but this is not a fixed anatomical structure and may disappear when the sucker is fully extended as seems to be the case in this leech); the venter uniformly coloured, continuing onto the lateral edge; the dorsum with longitudinal stripes, a median and on each side four other dark stripes which are all of the same width and separated by lighter stripes of no greater width excepting those on either side of the median. Hence the pattern appears as nine dark stripes or eight light stripes. The median stripe commences between the first pair of eyes but the paired stripes commence at about the tenth ' ring '. He refers to an olive-brownish lighter basic colouration of the body. Length, 50·0 mm; width, 4·0 mm.

The Mount Lizard leeches conform to *elegans* in the relative widths of the stripes and intervening bands; the extension of the median band between the first pair of eyes and onto the dorsum of the posterior sucker; the anterior level of the commencement of the paired stripes; and the narrow black margins to the stripes. They differ only in the presence of a ventral submarginal band separating the lighter marginal band from the venter, but the intensity of the submarginal band varies and is quite lost in some of the preserved specimens.

I have no hesitation in referring the Mount Lizard leeches to *H. elegans*. Leeches from Alumy Creek, Grafton, N.S.W., conform in size, form, colour, pattern, annulation, and in the morphology of the alimentary and reproductive systems, and I recognize these also as *H. elegans*.

I cannot completely satisfy myself that the two species Grube described are in fact distinct. It is clear that *novemstriata* was well extended. In this condition, the furrows v a_1a_2/a_3 and vi a_1/a_2 which are dorsal and do not continue onto the ventral surface can be separately either one or both, partly or totally lacking which would agree with Grube's statement concerning the separation of the fourth and fifth pairs of eyes. Full extension accentuates longitudinal markings such as the black marginal lines in *elegans*. In several specimens of *elegans* from Grafton, the longitudinal stripe in the dorsal median field is dark and margined by narrow light stripes which include the paramedian sensillae. This then gives six light stripes on the dorsum and seven dark bands; but I have not yet seen a specimen which fully conforms to Grube's description of *novemstriata*. If *elegans* and *novemstriata* should prove to be the one species, *elegans* has page priority.

I have found so far (Richardson, 1969) that the jawed sanguivorous hirudinoid leeches of the Australian Region are monostichodont and with only one exception possess an hirudoid pharynx: bulbous, muscular, attached to the body-wall by obvious extrinsic radial muscles, terminating no further posteriorly than ix/x, and carrying six internal muscular ridges as a dorsomedian pair and two ventrolateral pairs, each pair joining anteriorly to enter as a single ridge into the appropriate jaw. There are no ridges ending independently on the margin of the entrance to the pharynx between the bases of the jaws. The entrance to the pharynx and the lumen of the pharynx are narrow, the entrance little wider than the base of the dorsomedian jaw, and the lumen tapers posteriorly. The three jaws are housed in open recesses. This is associated with a crop divided into compartments, each compartment carrying one or more pairs of caeca, and the last pair of caeca extending as postcaeca into xxv and further. The one exception is *Hirudobdella antipodum* (Benham, 1904), known only in Benham's two accounts (1904, 1907) which make it clear that the pharynx extends to at least xii/xiii, the crop has only five pairs of caeca, the vagina is acaecate, etc. With these features, *H. antipodum* stands apart not only from the jawed aquatic leeches of the Australian Region, but from all other jawed leeches.

The nature of the pharynx separates the Australian jawed aquatic leeches from those of the American Region of the F.Macrobdellidae Richardson, 1969, as also from the macrophagous jawed and agnathous leeches of the Northern Hemisphere and South America which I have placed together for the time being in a F. Haemopidae. Afro-Asian jawed aquatic sanguivorous leeches cannot be properly systematised at this time, nor until they have been restudied, for critical information is lacking for most species and especially for the species which are the types of many genera; but there are clear indications on other evidence of two groups recognisable at this time, the one group having an acaecate vagina, the other with the vagina caecate.

So far five genera of the Australian Region all have the vagina caecate; but differ from those of Europe and Afro-Asia having this character—as also from the Macrobdellidae and Haemopidae—in having an essentially linear and not subparallel relationship of the epididymis and ejaculatory bulb on the anterior portion of the paired male ducts, the epididymis being essentially in xii and posterior to the ejaculatory bulb which is in xi

Following from my indications that *Hirudo australis* Bosisto, 1859, could not be congeneric with *Limnobdella mexicana* Blanchard, 1893, on the evidence provided by the persistent exploration of the leech fauna of Mexico over many years by Dr. Ed. Caballero, evidence fully supported in my study of specimens kindly sent me by Dr. Caballero, Dr. A. Soos re-examined Blanchard's type-material in the collections of the Zoological Institute and Museum of the University of Torino, confirmed that these were " potamobdellid " or " pintobdellid " in nature, and provided a new genus, *Richardsonianus* for *australis*. On this basis I have established the F. Richardsonianidae for five of the genera of jawed aquatic sanguivorous leeches so far known for the Australian Region. The genera *Ornithobdella* Benham, 1909, and *Aetheobdella* Moore, 1935, stand together in a second family, the F.Ornithobdellidae, both known species having simple miniature non-muscular atria on both the male and female median regions and entirely lacking strong muscular organs in these regions.

Family RICHARDSONIANIDAE Richardson, 1969.

Monostichodont; pharynx and associated structures, hirudoid; anterior end of the paired male duct linear, without loop-formation, epididymis essentially in xii posterior to the ejaculatory bulb in xi; median reproductive structures bimyomeric (or secondarily hemimyomeric) male median structures mesomorphic or micromorphic; female mesomorphic; vagina caecate; vaginal duct present or absent; salivary papillae, absent or present; 15 or 16 5 annulate somites. Freshwater. Sanguivorous. The Australian Region. Type genus *Richardsonianus* Soos, 1968.

Genus **Goddardobdella** Richardson, 1969.

TYPE SPECIES: *Hirudo elegans* Grube, 1867. Rockhampton, Queensland.

Richardsonianidae. Jaws with salivary papillae; pharynx short, terminating at viii/ix; crop with 11 caecate compartments, a single pair of small simple median caeca on ix to xi, a pair of small simple anterior caeca and a pair of larger simple median caeca on xii to xix, the larger caeca extending into the following somite and those of xix reaching to xxv/xxvi; bimyomeric; male and female median regions mesomorphic; common oviduct loosely coiling, longer than oviducts and of the length of the vagina; vagina simple fusiform with a small caecum; no vaginal duct; 15 5-annulate somites.

Two specimens, one dissected and figured in this paper, from Mount Lizard, near Yeppoon, are deposited in the Queensland Museum, Reg. No. G5116 and G5117. Two from Mount Lizard (Reg. No. W4172) and two from Alumy Creek, Grafton, N.S.W. (W4173), are deposited in the Australian Museum. These are all *Hirudo elegans* Grube, 1867, by my identification.

Leeches taken from an irrigation ditch, Laloki River, Port Moresby by Mr. L. J. Jones in March 1950, are in the collections of the Australian Museum, Coll. No. 4192. These have 15 complete somites; salivary gland papillae on the jaws; genital pores xi b_5/b_6 and xii b_5/b_6; the epididymis posterior to the ejaculatory bulb; the penis sheath a simple posterior primary loop with the two limbs equivalent in length; a caecate vagina; no vaginal duct; the common oviduct thin-walled, wide and sinuous. The colour pattern on the dorsum has the light stripes as in *elegans*, but the dark paramedian and intermediate bands are partially to almost completely reduced to narrow black stripes by olive to olive grey, and these stripes then appear as black margins to the median and the intermediate paired stripes. There is variation.

This is the first knowledge of an aquatic jawed sanguivore from New Guinea and Papua. I can see no reason to separate these specimens from *Goddardobdella elegans* and assign them to this species with full confidence.

The genus is named in recognition of the pioneer studies on leeches in Australia by the late Professor E. Goddard.

Goddardobdella elegans (Grube, 1867).

(Figs. 1, 2.)

Moderate sized colourfully striped hirudinid leeches, contracted 15·0 to 20·0 mm. long and extending to 60·0 and 65·0 mm. The first three pairs of eyes large and obvious, the fourth pair smaller, and the fifth pair somewhat concealed. A median reddish to reddish-fawn longitudinal stripe extending from the dark greyish anterior margin of the velum, between the first pair of eyes along the length of the body, and onto the dorsum of the posterior sucker where it may widen into a diamond-shaped or triangular patch. This stripe is just wider than the median field and includes the paramedian series of somital sensillae. On each side of this stripe a narrow black line lies immediately lateral to the paramedian sensillae. A blackish brown area spreads from the margin over the velum lateral to the median stripe, including the first 3 pairs of eyes but not the dorsolateral margin of the sucker which is light grey. The blackish brown area continues as a band, narrow anteriorly, widening at vi, subequal posteriorly to the median stripe and then wider than it behind xiv, narrowing again about xxiii to cross xxvii and spread over the dorsum of the sucker as a band surrounding the patch of the median stripe and excluding the patch from the posterior border. A narrow black margined yellowish grey stripe commences in iv a_3 and passes medial to the fourth and fifth pair of eyes and extends posteriorly medial to the row of intermediate somital sensillae and terminates on xxv near to the posterior border of this somite. Accordingly the paramedian field includes a wide dark band and this narrow lateral stripe. The dark brown on the velum extends lateral to this light stripe as a very narrow blackish brown band including the fourth and fifth eyes and the intermediate series of somital sensillae,

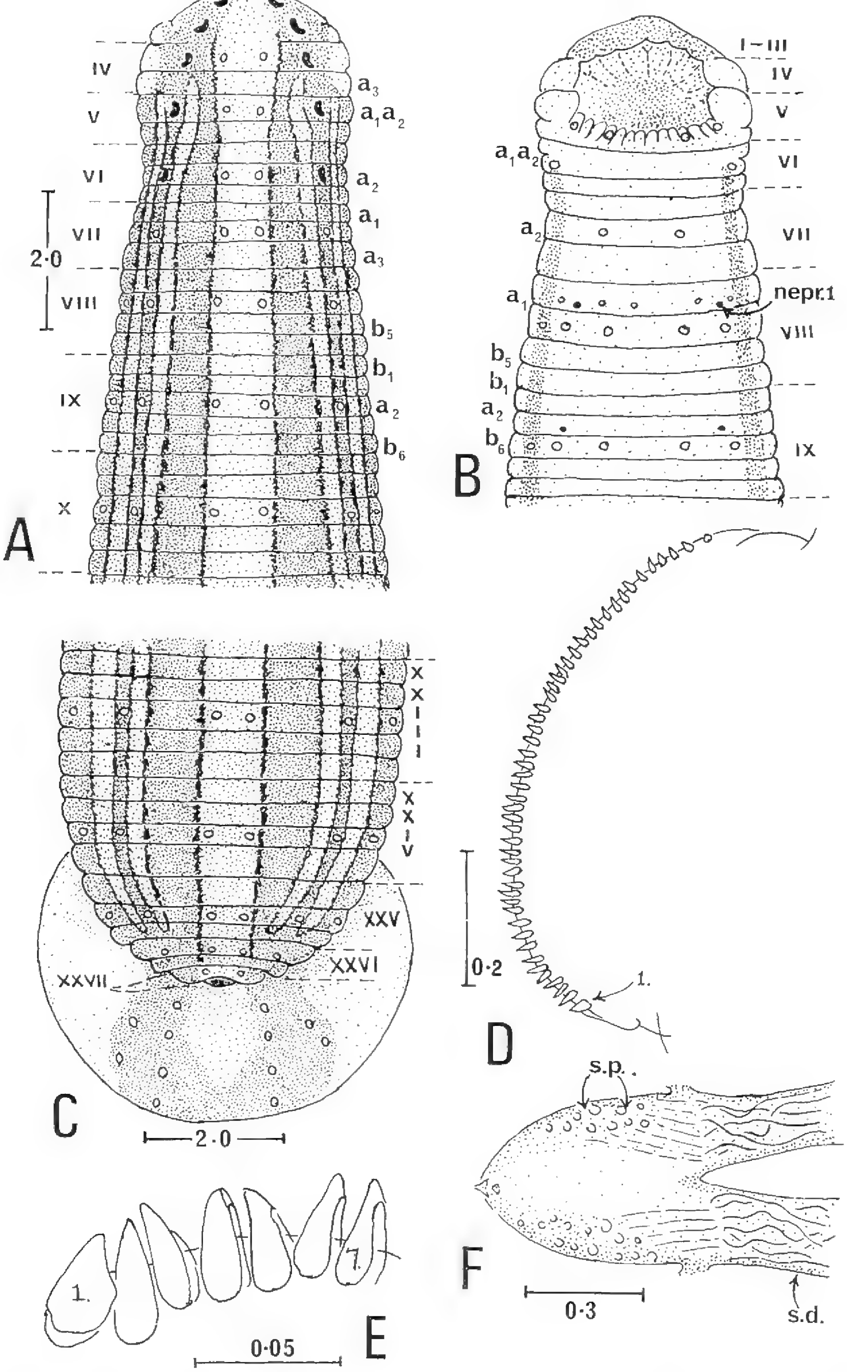

FIG. 1: *Goddardobdella elegans*. A, Dorsal view, somites i to x; B, Ventral view, somites i to ix, nepr. 1, first nephridiopore; C, Dorsal view, somites xxiii to xxvii; D, Dorsomedian jaw, side view; E, Teeth 1 to 7, median end dorsomedian jaw; F, Dorsal view of dorsomedian jaw showing salivary papillae (s.p.) and aggregated salivary ducts (s.d.) Scales in mm.

and joins the inner wider dark band behind xxv. This dark band of the intermediate line is narrower everywhere posterior to vii than the light stripe medial to it as also to the light stripe lateral to it which is yellowish grey and extends from iv/v lateral to the fourth and fifth eyes and the intermediate series of somital sensillae to terminate at the posterior border of xxv. This outer of the pair of light stripes is wider along the post-genital region than the other light stripe. It is also black-margined. The supramarginal and marginal somital sensillae lie in a greyish brown wide band, lighter than the dorsal bands and extending from iv/v to xxvii where it spreads over the lateral and anterior regions of the dorsum of the sucker. This band can be seen also along the edge of the body on the ventral surface and is separated from the immaculate light brownish orange of the venter by a darker less definite greyish black band which includes the submarginal somital sensillae.

The somital sensillae are not raised, are white, surrounded each by a white area, generally obvious; but other than this there is no metameric colouration. The more numerous secondary sensillae are seen as a transverse row on annuli other than a_2 but are very minute and show only as white points. Irregular white sensory patches are present in about 3 transverse rows each of about 20 patches on the margin of the velum and on the dorsolateral lobe of the margin of the anterior sucker, but not on the ventral margin where the ventral paramedian and intermediate somital sensillae of v are obvious.

The body is smooth-skinned, without cutaneous papillae and not obviously divided by delicate longitudinal striae. The form is simple, moderately low convex above, flat below, the margins smoothly rounded over most of the body but keeled from xxiii to xxvii. The margin of the velum is rounded or only slightly angled, lacks a median incision, and the cephalic region narrows only sufficiently to suggest a very short 'neck' at somite vi, which widens gradually over the pregenital region to xi, the sides then subparallel with the width increasing almost imperceptibly so that the region of maximum width from xvi to xxiii is little wider than anteriorly. The body narrows obtusely from xxiv to xxvii where it forms a wide basis for the sucker which is itself rounded and nearly two thirds of the maximum width of the body. The clitellum is not obvious but appears to include x b_5 to xiii b_2.

A typical preserved specimen of a total length of 52·0 mm is 3·2 mm wide at v; 3·0 mm wide and 2·0 mm deep at vi/vii; 5·0 mm wide and 2·5 mm deep at xi; 5·5 mm wide and 2·5 mm deep at xx; 3·0 mm wide at the basis of the posterior sucker which is 4·0 mm wide and of the same length.

ANNULATION: (Fig. 1 A, B, C.) The annulation is distinct and well-defined excepting on the velum. There is some indication of an arrangement into couplets and triplets, more often couplets of annuli separated by a single annulus, but no constant pattern is shown and only occasional somites are obvious as such. There is a relatively high incidence of minor abnormal irregularities in the annulation. In five specimens, only one was without such irregularities, two showed two instances, one showed three, and the fifth exhibited four areas of abnormal annulation. In no case was the somital annulation grossly disturbed.

The velum carries the first three pairs of eyes. There is no indication of furrowing across the dorsum of the velum anterior to iv/v excepting a short incision on the margin of the velum behind the level of the second pair of eyes which in some extends medially but no further than the line of the sensillae of the paramedian series. This incision marks the anterior edge of the dorsolateral lobe of the margin of the sucker and so corresponds to iii/iv and this permits recognition of iv a_1a_2—which contains the third pair of eyes and the first pair of paramedian sensillae—as being longer than iv a_3, so that this somite is 2-annulate. In v, $a_1a_2 > a_3$ with the fourth pair of eyes in a_1a_2 and v is strongly 2-annulate above but the furrow a_1a_2/a_3 extends only to the level of the submarginal sensillae so that a_1a_2 forms the lateral portion of the margin of the sucker but medial to this v is uniannulate and forms the ventral margin of the sucker. Somite vi is 3-annulate dorsally $a_1 < a_2 > a_3$, the fifth pair of eyes being in a_2; a_1/a_2 is weak, may not show in the median field but only at the margins, and is lacking below where vi is 2-annulate and $a_1a_2 > a_3$. Somite vii is fully 3-annulate with $a_1 < a_2 < a_3$; vii $a_3 =$ viii a_1. Somite viii is 4-annulate with $a_1 > a_2 > b_5 = b_6$. The lesser sensillae in viii a_1 are slightly posterior in the annulus. The first pair of nephridiopores are posterior in viii a_1 and just medial to the line of the ventral intermediate somital sensillae. Somite ix is 5-annulate with $b_1 = b_2 < a_2 > b_5 = b_6$ which is the same also in x to xiii but behind this the annuli are more or less subequal with a_2 if anything little longer than the other annuli back to and including xx. In xxi $b_1 = b_2 < a_2 > b_5 = b_6$ as also in xxii, and xxiii which is the last 5-annulate somite. Accordingly there are 15 5-annulate somites. In xxiv, $b_1 = b_2 = a_2 < a_3$ and somite xxiv is very distinctly 4-annulate and carries the last pair of nephridiopores close to the posterior edge of b_2. Somite xxv is 3-annulate, a_1 (= xxiv a_3)$> a_2 > a_3$ and xxv a_3 is the last annulus which is complete on the venter. Somite xxvi is 2-annulate, $a_1a_2 > a_3$ and with the somital sensillae posterior in a_1a_2. Somite xxvii is uniannulate and forms the dorsal and lateral margins of the anus. The dorsum of the posterior sucker variously shows indications of four to five rows of somital sensillae.

The genital pores are at xi b_5/b_6 and xii b_5/b_6. There are no indications of copulatory glands or other similar accessory reproductive structures in this vicinity and the annulation is undisturbed. The nephropores are 17 pairs as usual, small, in some obscure but in most mounted on low-mounded cutaneous papillae.

ALIMENTARY CANAL: (Figs. 1D–F, 2G.) The three jaws are small, about 0·75 mm long, a little taller (0·4 mm) than wide (0·35 mm), low in profile and armed along the entire edge with a single row of about 48 acutely conical sharp spaced teeth, the tallest (0·04 mm) at the medial end and diminishing in height very gradually so that the fortieth tooth is about 0·028 mm high and only the last one or two teeth are granular. Along the sides of the jaw there are many openings of salivary ducts which might be termed salivary papillae but in general they are so low as to hardly disturb the profile of the jaw and are seen as small rounded barely elevated white areas not arranged in any obvious pattern.

The acini of the salivary glands extend through vii to x a_2. They are relatively large, semitranslucent, whitish, not crowded but showing more as distinct individual bodies in loose, not compacted, aggregations. The individual ducts are minute, almost transparent, and those on the dorsal aspect of the pharynx and first crop compartment aggregate into main right and left trunks separated by a row of extrinsic muscles of the pharynx, almost concealing the body of the pharynx but quite readily separated and raised from it, and the two trunks enter the median dorsal jaw at vii a_2. The individual ducts appear to follow a tortuous course in these trunks.

The pharynx commences at the mouth proper at the base of the jaws at vii/viii, is thin-walled so that the intrinsic muscle layers are not individually obvious, and internally it shows only six very low narrow longitudinal folds. The radial extrinsic muscles are mostly comparatively short, spaced, and are located in vii to ix.

The pharynx terminates at viii/ix. The crop commences in ix with a complete compartment of the full length of this somite, carrying a single pair of short simple caeca which originate half-way along the compartment, the length at their origin is about one third of the length of the compartment and they penetrate the array of dorsoventral muscles at the side of the compartment so that this compartment with its caeca is fully equivalent morphologically to the compartments in x and xi, these also having only a single pair of simple caeca each. In xii to xix, the compartments of the crop increase progressively in length and the caeca at the mid-level of each compartment perforate the dorsoventral muscles and then extend posteriorly to the level of b_2/a_2 in the following somite excepting those of xix which extend back to xxv/xxvi. These large caeca are simple. In addition to the large caeca, the compartments in xii to xix also carry a pair of small anterior simple caeca which are confined within the paramedian longitudinal array of dorsoventral muscles but are laterally plicated and could be expected to expand in the partly fed leech to show as the small anterior simple lobed caeca known in several genera. The compartment in xix narrows behind the origin of the main pair of caeca to form a narrow tube the wall of which is of the same nature as that of the crop. This tube joins the ventral face of the intestine shortly beyond its anterior end at xix/xx so that a short slightly bilobed intestinal caecum, wider than the intestine, is formed.

The intestine is thin-walled tapering, tubular, only slightly constricted at the intersomital levels, and reduced to a narrow tube at xxii/xxiii which is loosely folded in xxiii and enters the rectum in xxiv so as to form a short rectal caecum narrower in diameter than the main portion of the rectum which terminates at the anus.

REPRODUCTIVE SYSTEM: (Fig. 2H.) The female reproductive system is situated between xii a_2 and xiii a_2. The ovaries are slightly flattened small white bodies pear-shaped in profile just anterior to xii/xiii, ventral to the crop, medial to the paramedian longitudinal row of dorsoventral muscles, and resting near the medial face of the posterior third of the epididymis. The oviducts are short, little longer than the ovary, with a few initial open coils and then straight, the left passing ventral to the nerve-cord immediately behind ganglion xii to enter the common oviduct independently from the right oviduct. The common oviduct does not show a distinct oviducal atrium, but in these specimens it is thin-walled and enlarged nearly to the diameter of the penis sheath and an atrium might be anticipated otherwise. It shows indications of a slightly tortuous path and is surrounded for its full length by a transparent gelatinous structureless material which would seem to be an extensive albumin gland. The common oviduct extends from the floor of the body cavity along the anterior face of the vagina which it enters shortly before the end so forming a small but distinct vaginal caecum. Accordingly the common oviduct is almost of the length of the vagina. The vagina stands sub-erect lateral to the crop between the major caeca of xii and xiii, and is swollen simple fusiform below the entry of the oviduct, narrowing briefly before entering the body-wall at xii b_5/b_6 giving the appearance of a very short vaginal duct. The caecum, vagina, and the ' duct ' are all of the one nature, opalescent, covered with a compact layer of fine circular fibres and accordingly to describe this organ as divided into distinct vagina and duct may be morphologically incorrect.

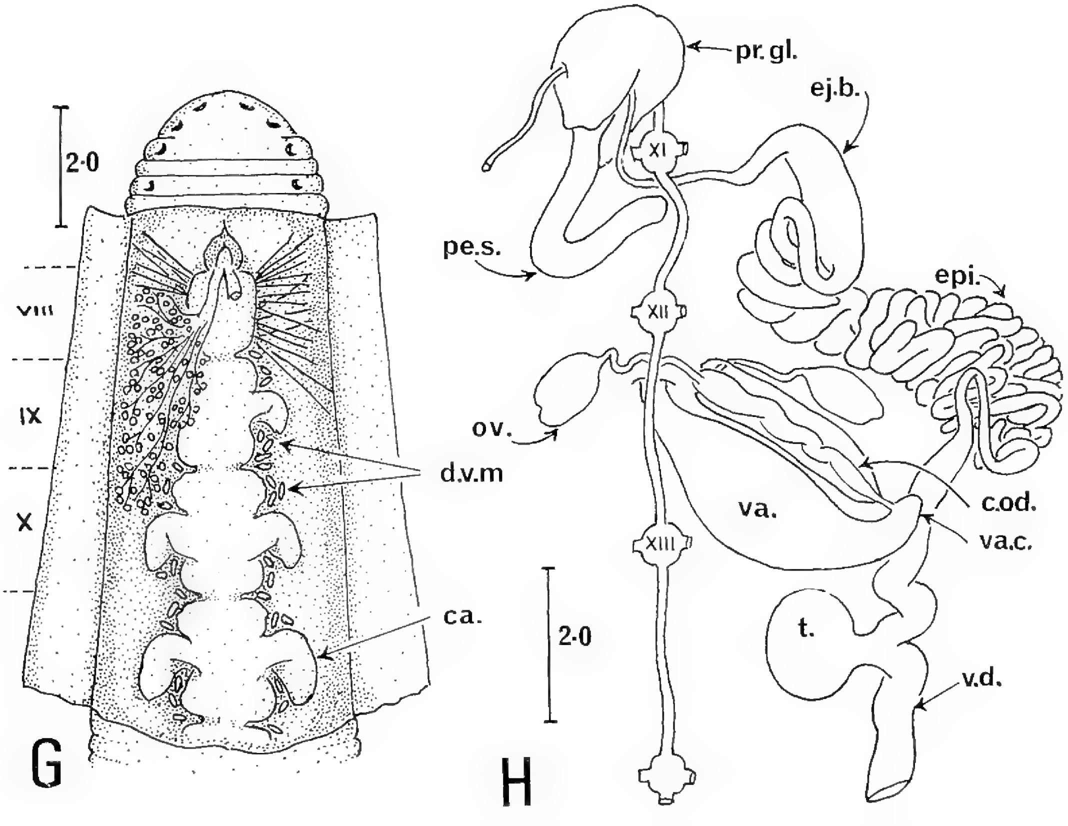

FIG. 2: *Goddardobdella elegans*. G, Dissection from the dorsal aspect showing pharynx and crop compartments with caeca (ca.) in ix to xi, dorsoventral muscles (d.v.m.); H, Dissection of reproductive system from the dorsal aspect with the vagina, epididymis and bulb turned to show the medial aspect, c.od. common oviduct, ej.b. ejaculatory bulb, epi. epididymis, ov. ovary, pe.s. penis sheath, pr.gl. prostate glands, t. testis, va. vagina, va.c. vaginal caecum, v.d. vas deferens. Scales in mm.

The male reproductive system is mature in these specimens, the testes, vasa efferentia, vasa deferentia and epididymi are swollen, enlarged and opaque white. There are 10 pairs of testes which are ventral to the crop and intestine and medial to the paramedian longitudinal row of dorsoventral muscles on either side of the alimentary canal. The vasa efferentia are short, the length less than the diameter of the testis, and pass laterally through the dorsoventral muscles of the paramedian longitudinal row to join the vas deferens on each side. The anterior pair of testes is at xiii/xiv, the posterior pair at xxii/xxiii. The vas deferens is slightly wider in diameter than the penis sheath and tortuous in its path, extending anteriorly to about xii b_5/b_6 which is apparently the end of the glandular region for at this level it diminishes to a narrow tube which turns posteriorly to about xiii b_2 to enter the posterior end of the compactly coiled tapering mass of the large epididymis which is situated for the greater part in xiii b_2 to xi/xii, lateral to the paramedian longitudinal row of dorsoventral muscles and ventrolateral to the crop. The terminal anterior portion of the epididymis is a short enlarged tube in a few compact coils which turns posteriorly to enter from below the posterior vertical limb of the small, opalescent, muscular ejaculatory bulb extending from xii b_2 to xi a_2 and so is anterior to the epididymis excepting for the terminal portion which alone is ventral to the bulb. The ejaculatory bulb is wider but not greatly wider than the penis sheath. It passes anteriorly into a vertical descending tapering limb which narrows into the delicate, short, muscular ejaculatory duct which passes through a cleft in the prostate gland to enter the male atrium independently from its fellow. The right duct passes ventral to the nerve cord. The prostate glands form a bulbous mass tapering onto the penis sheath and both are ventral to the crop and medial to the rows of dorsoventral longitudinal muscles on each side of the crop. The penis sheath is muscular, opalescent, extending from xi a_2 to xii b_2 before curving back to enter the body-wall at xi b_5/b_6. A minute filamentous penis is extruded in one specimen. It is 0·06 mm in diameter and 0·8 mm long.

DISCUSSION

The above description is based on the specimens from Mount Lizard, Rockhampton, being the original area for *Hirudo elegans*. This then enabled me to recognise with confidence that leeches taken from Alumy Creek, Grafton, N.S.W. are of the same species.

The agreement in detail between the Grafton and Mount Lizard specimens is excellent. The colour patterns are the same saving that in two of the Grafton specimens the median light stripe is a darker brownish grey for the width of the median field, with the paramedian sensillae included in a light yellowish brown stripe forming a narrow light margin to the median area, and the more obvious in contrast to the black line lateral to them. In this phase, the pattern appears to be one of three pairs of light stripes, the paramedian the narrowest, lateral to it a slightly wider stripe, and the outer stripe obviously wider than the other two.

After several weeks in a glass jar in moderate light, a dark phase of colouration developed. The median stripe is blackish brown and of the width of the median field. It is bordered by a narrow stripe which is light green with brown maculations. The lateral paired stripes are a dark blackish brown with yellowish brown maculations. The black marginal lines are replaced by dark brown, and in the pregenital region and from xx posteriorly, the lateral stripes are solid brown. The intervening bands are all brightly darkish green with black and dark brown maculations. The margin is light green and does not continue onto the venter which is slightly reddish brown.

In contraction, the annuli of the posterior somites become sharply keeled and there is some suggestion of many small papillae, but there is nothing regular or persistent.

The leeches from Alumy Creek, Grafton, were taken by High School Students on Sept. 21, 1967, from a mud bottom in standing water some six inches deep and also in submerged vegetation. They reported them as extremely abundant, in the order of 8 to a square yard. This suggests a possible mass-movement or migration such as I have reported for Canadian hirudinids (Richardson, 1942). I visited the location the following day but there were no leeches in the open at this point, nor could I see them elsewhere on the stream, which is in agreement with the sudden disappearance of the leeches in the instances seen in Canada. The only specimens I found were concealed in the axils of bull-rush, and these were few, much less common than an erpobdellid of similar size, a glossiphonid, and a *Placobdella.*

G. elegans is an essentially aquatic leech, a graceful rapid swimmer, swimming with the body in extension, mostly horizontal but equally well with the body on its side. Removed from water, they rapidly lose the ability to hold with the suckers on a dry surface and become helpless. They seem incapable of biting on the dry skin. Held in a jar, they frequently leave the water for long periods but remain little more than an inch above the surface of the water and occasionally lower the anterior half of the body into the water. This does not seem to be related to any essential requirement since while one may do so, others rest quietly on the bottom of the jar.

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A NEW SUBSPECIES OF THE WESTERN GRASS-WREN, *AMYTORNIS TEXTILIS* (DUMONT) IN NORTH-WESTERN QUEENSLAND

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Until lately, real evidence of the occurrence of the desert genus *Amytornis* Stejneger in Queensland has been lacking, although Keast (1958) referred to a possible record of an unidentified species in the far south-west, near Bulloo Lake. Further reports of a grass-wren in the Cloncurry–Mount Isa district have given rise to speculation concerning the identity of all these birds.

The genus is characterised by the occurrence of numerous small, isolated populations, which have undergone morphological differentiation partly as a result of such isolation. In some instances, these relict populations, or "isolates" (Keast, 1958, p. 34) have attained species rank; in others, the differences are subspecific. It could be expected, therefore, that grass-wrens in Queensland would differ from those found elsewhere and, following the taking of museum specimens, such has proved to be the case. The Bulloo birds belong to a new species of the " *striatus* type " (Favaloro and McEvey, 1968) whilst those obtained near Mt. Isa can be assigned to an undescribed race of *Amytornis textilis* (Dumont), the so-called Western Grass-Wren of the Official Checklist (1926). The two specimens from the Mount Isa area, obtained by Mr. R. K. Carruthers, had been tentatively determined by Mr. D. P. Vernon of the Queensland Museum as *Amytornis textilis*. Subsequently, they were submitted to the writer for further examination.

Amytornis textilis ballarae subsp. nov.

MATERIAL EXAMINED

HOLOTYPE: Adult female, Qd Mus. O10692. Collected July 17, 1966, R. K. Carruthers. Wing, 60 mm; tail, 75; culmen (exposed) 10·4; culmen (total) 14; tarsus, 23; total length, 147; wing span, 180. Gonads not enlarged (4 x 2·5 mm). Iris, " dark brown "; bill, upper and lower, " horn brown "; base of lower mandible, " dark grey "; legs and feet, " dark brown ".

PARATYPE: Adult female, Qd Mus. O11011. Collected October 27, 1966, R. K. Carruthers. Wing, 60 mm; culmen (exposed) 10·4; tarsus, 23; tail worn; total length, 159; wing span, 171; weight, 19 gm. In partial moult (tail), gonads not enlarged.

TYPE LOCALITY: Six miles south of Mary Kathleen, near Ballara copper mine, east-southeast of Mount Isa, north-western Queensland.

DIAGNOSIS: Sides of body and flanks deep reddish brown ("Liver Brown" of Ridgway, 1912, plate XIV); edgings of buffy-white feathers of throat and upper breast deep reddish brown; general colour of back and rump about the same as that of flanks but becoming somewhat paler in worn plumage.

DISTRIBUTION: So far as known, restricted to the Mount Isa area, specimens having been taken at the type locality and at Sybella Creek.

REMARKS: *A. t. ballarae* is a small, short-tailed rufous form which resembles members of related populations in the Macdonnell Ranges (*purnelli*), Everard Ranges (*everardi*) and near Tennant Creek. It differs in being much deeper rufous brown below: the ventral coloration of the two last-named is towards cinnamon ("Wood Brown" of Ridgway, 1912, pl. 50).

The single specimen from near Tennant Creek, a male collected on May 22, 1962 is rather pale but for the present may be referred to *purnelli*. As mentioned by Storr (1967), reports of "*purnelli*" from Barrow Creek and Coniston, Northern Territory require confirmation. If one followed the nomenclature of the current Official Checklist, all these birds would comprise the central Australian "species" *Amytornis purnelli*, Dusky Grass-Wren. However, Keast (1958) has shown that the *purnelli* group of populations is merely a geographical representative of the Western Grass-Wren, *Amytornis textilis*, whose known range extends from Eyre Peninsula, South Australia (subspecies *myall*) through the interior of Western Australia to coastal regions near Point Cloates in the north (subspecies *textilis*) and inland in the southwest (subspecies *macrourus*).

In all subspecies females are more rufous on the flanks than males. General body coloration shows little rufous in the nominate form and in *macrourus* Gould, which are dull brown above and below. In the last-named, the tail is exceedingly long (91–100 mm, according to Keast), the head is rather dark and the abdomen not pale but brownish like the breast. The race named *myall* by Mathews is distinguished by its shorter tail (83 mm), whitish throat and abdomen, and slightly more rufous dorsal coloration than in *textilis* and *macrourus*.

Keast has drawn attention to the slightly greater dimensions of the bill and tail in *everardi*, viz. 10·7 and 80 mm.

The discovery of the Western Grass-Wren in north-western Queensland has increased our knowledge and understanding of the former distribution of the species, which must have been fragmented by the ecological changes arising from the climatic fluctuations during and since the Pleistocene. North-south shifts of the desert belt would have resulted in the disappearance of suitable habitats over a wide area and such changes, catastrophic to sedentary forms, would account for the present "spotty" distribution.

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ON THE ALLEGED QUEENSLAND MOA, *DINORNIS QUEENSLANDIAE* DE VIS

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ABSTRACT

Examination of the holotype of *Dinornis queenslandiae* De Vis, a part left femur, has shown that it is from a *Pachyornis elephantopus* (Owen) derived from a Moa-hunter Maori midden from the South Island of New Zealand and it must therefore be expunged from the list of Australian fossil birds.

In 1884 C. W. De Vis, then Director of the Queensland Museum, described the holotype femur as *Dinornis queenslandiae.* In his first paper he stated that it "was recognised in a collection of bones from King's Creek, presented to the Queensland Museum by Mr. J. Daniels, late of Pilton". Subsequently (De Vis, 1891) he stated more specifically that it was "picked up in King's Creek, on the Darling Downs, by Mr. Daniels and by him presented with other contemporaneous fossils to the Queensland Museum". I shall show later that the bone did not belong with the other King's Creek material. It is certain that De Vis did not at any time question its derivation and in his original description he realised its close resemblance to "*Dinornis elephantopus*" and to "*Dinornis crassus*" (= *Euryapteryx gravis* of modern classification). In De Vis' day there was great confusion between what today are known as *Euryapteryx*, *Emeus*, and *Pachyornis* as few, if any, skeletons were available for comparison and classification was done mainly on leg bones). It is all the more to his credit that with very little comparative material, if the Moa collection in the Queensland Museum today is any guide, he realised the affinities of the fragmentary bone which he was examining. Lydekker (1891) and Jack and Etheridge (1892) accepted the bone as a Queensland Moa without question. In 1893 F. W. Hutton, working from a rather poor cast (still in the Canterbury Museum), compared it with *Euryapteryx gravis* and "*Euryapteryx ponderosus*" (= *Pachyornis elephantopus*) and concluded that it was not a Moa and placed it among the Casuariidae, stating "it probably represents the ancestors of the Emus and Cassowaries".

There the matter rested until 1949 when Dr. W. R. B. Oliver, who had had the holotype bone for examination rightly recognised it as belonging to the genus *Pachyornis* but, accepting the Queensland derivation, published it as *Pachyornis queenslandiae.* In 1963 Alden H. Miller, working from the five excellent photographs published by Oliver, but accepting Hutton's arguments, called it *Dromiceius queenslandiae.*

From examination of the cast and from Oliver's photographs, I had already had my suspicions about the bone in question and on 10 April 1967, through the courtesy of Mr. J. T. Woods, Director of the Queensland Museum, and Mr. A. Bartholomai, Research Curator (Geology), was able to examine it at the Queensland Museum and subsequently at Canterbury Museum. Messrs. Woods and Bartholomai were already suspicious of the bone because of its great difference in colour and general appearance from the other King's Creek material—a difference which was strikingly apparent when I also looked at bones from King's Creek. With many years of experience of handling thousands of Moa bones from caves, swamps, sandhills and Moa hunter middens, I recognised the holotype as a bone from a South Island, New Zealand, midden and that it was almost certainly *Pachyornis* as Oliver had stated.

It is significant that both De Vis and Oliver, who had handled the actual bone, as well as myself, recognised its resemblance to *Pachyornis elephantopus*.

Pachyornis elephantopus (Owen, 1856)

Dinornis elephantopus Owen, 1856, p. 54.

Dinornis queenslandiae De Vis, 1884, pp. 23–8, pls. 3 and 4. Lydekker, 1891, p. 222. Etheridge, 1892, p. 662.

Pachyornis elephantopus (Owen): Archey, 1941, pp. 36–9.

Pachyornis (*Pachyornis*) *elephantopus* (Owen): Oliver, 1949, pp. 74–80, figs. 53–61.

Pachyornis queenslandiae (De Vis): Oliver, 1949, pp. 80–3, 88, fig. 61 A–E.

Dromiceius queenslandiae (De Vis): Miller, 1963, p. 417.

The holotype of *Dinornis queenslandiae* is the partial proximal end of a left femur. It is broken transversely across the upper shaft 9·7 cm from what remains of the head, or upper condyle. Much of the great trochanter (trochanter major) and the proximal portion of the head, are missing. De Vis considered " These have been lost by abrasion while projecting above the surface of the creek bed ". However, this bone has been removed much more recently than when the shaft was broken and has the appearance of having been cut by a sharp instrument, probably a ploughshare, which has exposed the cancellous tissue (which, incidentally, agrees perfectly with that exposed in other moa bones broken in similar places).

De Vis used *Dinornis* in the sense of Owen who placed all Moas in the one genus. De Vis wrote " this bone is in much the same peculiar state of mineralization as the great majority of the Darling Downs fossils ", a strange statement, as it is on this point that the bone differs very strongly from the Darling Downs bones whereas in this particular the holotype agrees strongly with many bones from Moa-hunter middens.

His excellent original description reads, in part: " The shaft at its place of fracture is rather more rounded than in D. crassus . . . Its section is a full, irregular oval, as in D. elephantopus, very dissimilar to the pure oval of Dromornis, but somewhat less unlike that of the emu's femur, in which the inner side is rather more convex than the outer. The base of the head presents a strong annular constriction . . . which, as in

Dinornis, renders the head quite distinct from the neck . . . and contrasts it with the subsessile heads of Dromaeus and Dromornis . . . In Dinornis crassus there is a sub-central pit nearer to the hinder part of the periphery of the head and excavated to a moderate depth. In the fossil . . . it is in a similar position, but deeply sunken, and its hinder edge is raised into a rough ridge. In neither D. crassus nor in the fossil is there a concave slope behind the ligament pit. The neck . . . of our subject is distinctly longer and narrower than in D. crassus, and consequently more divergent in both respects from that of Dromaeus. The neck at its junction with the epitrochanterian surface . . . is far more deeply hollowed than in the emu, and therefore conspicuously unlike that of Dromornis, in which the upper outline is nearly horizontal. The saddle so formed is in fact more deeply seated than in D. crassus. The outer surface of the trochanter . . . is nearly flat, devoid of the sub-marginal convexity shown in Dromaeus, and the muscular attachments . . . are in two shallow depressions raised above the level of the bone by two tubercular outgrowths, as in Dinornis, instead of into two excavations from the surface, separated by a bridge, as occurs in the emu. The mode of origin of the great trochanter of the fossil strongly resembles that of the moa—it rises abruptly from the shaft, and forms immediately a prominence, which curves over towards the inner aspect of the bone, and overlooks the markedly concave interior surface between it and the head".

Hutton (1893) disagreed strongly with De Vis' attribution of the bone to the Moa group, and published figures, outline drawings, viewed end on from the top of the holotype bone and "*Euryapteryx ponderosus*" (= *Pachyornis elephantopus*) to show the differences which he thought existed. *Pachyornis* is a genus which varies greatly in size and shape from one skeleton to another, and Hutton must have used an abnormally shaped femur for comparison, for, as I shall show later, the holotype bone agrees very well with *Pachyornis* and *Euryapteryx* in this particular, as Oliver also realised.

For comparison I have used four left femora of *Pachyornis elephantopus* and four of *Euryapteryx gravis* (the latter equating with "*Dinornis crassus*" in the sense in which De Vis used this name) all from more or less complete skeletons from Pyramid Valley swamp, North Canterbury, New Zealand, so that there can be no doubt as to their correct attribution to genera and species, as well as other femora from cave, swamp and midden deposits. As stated above *Pachyornis elephantopus* is a variable species and so is *Euryapteryx gravis*. Although the two genera are not closely related the leg bones, by convergent evolution, often resemble each other, and it requires careful study, when dealing with an odd bone or fragment thereof, to decide to which of the two genera it belongs. Oliver (1949) discussing the holotype states: "The depression on the head for the round ligament is deep and angular with several large perforations. In moas this depression is shallow on the surface level". While this statement is in general true, there are exceptions. In the femur of *Pachyornis elephantopus* AV8382 from Pyramid Valley, the depression is almost as deep as in "*Dinornis queenslandiae*" and is surrounded by a "lip" of bone outgrowth. This skeleton is of a very mature bird. A left femur, from Kapua Swamp, Waimate, AV9170, also of a very mature *Pachyornis*, again has this depression almost as deep as in the bone under consideration. It is probably a sign of age. It certainly varies greatly in *Pachyornis* but much less so in *Euryapteryx*. The neck of the holotype is well defined below by an irregular transverse groove. This is characteristic of *Pachyornis*. In *Euryapteryx*, usually, this groove is broader and not quite so clearly defined. The rear portion of the trochanter of the holotype projects as in all the genera of Moa. Ironically, this is a feature which Hutton considered *distinguished* "queenslandiae" *from the Moa*. The trochanter is markedly produced forward. Although much of the cnemial crest thus produced is absent, being removed when the proximal portion of the trochanter was sheared off, sufficient—3·9 cm—remains to form an important diagnostic feature in distinguishing the bone as *Pachyornis* rather than *Euryapteryx*. It is one of the few features remaining on the bone which can be used for this purpose. In *Dromiceius* and *Casuarius* the cnemial crest, in profile, is a smooth curve. In all the genera of Moa it is irregular in outline and particularly so in *Pachyornis* and *Euryapteryx*. In both genera the crest begins as a "bulge" near the shaft, dips inward, then curves outward around the proximal end of the trochanter. It is the shape of the remaining lower portion of the crest which places the holotype definitely as *Pachyornis* rather than *Euryapteryx*, more clearly than any other feature remaining on the bone. There is always a little intra-specific variation, but this is not nearly as marked as the inter-specific differences in this particular. In *Euryapteryx* the cnemial crest begins with a much more gradual slope from the shaft to form the "bulge" than in *Pachyornis*, where the cnemial crest begins abruptly. In the holotype the "bulge" would originally have been even more pronounced than it is now as abrasion has slightly reduced the edge. This feature is shown well in Oliver's fig. 61C. Viewed from the front of the bone (the dorsal aspect) it begins slightly below the level of the roughened surface which forms the attachment for the iliacus internus muscle. (This muscular attachment, or scar, varies in position in both the genera under consideration. In some femora it is nearly level with, in others well above, the beginning of the cnemial crest and it also varies considerably in size, shape and position in relation to the neck; it cannot be used as a diagnostic feature.) The dorsal pretrochanteric surface is concave, agreeing well with both *Pachyornis* and *Euryapteryx*. A ridge running from close to the trochanter diagonally from right to left towards the shaft (cf. Oliver's fig. 61B) can be paralleled in some, but not all, *Pachyornis* femora. This again is a variable feature and along with the pronounced blood vessel markings and the roughened surface of the pretrochanteric region, fairly prominent in the holotype, is probably a sign of age. They occur in varying degress on some, but not all, of the femora used for comparison. (Blood vessel markings on tibio-tarsi, although varying a little intra-specifically, form consistently differing patterns between the genera and are a good diagnostic feature.) On the ventral and outer faces the muscle scars and other markings are variable in both shape and position in *Pachyornis* and *Euryapteryx*. Those on the holotype fit well into the *Pachyornis* pattern. Oliver considered the muscular impressions on the holotype bone more prominent than in *Pachyornis elephantopus* but they can be paralleled in very mature examples of the latter. Measured transversely across the pretrochanteric face, at the lowest point where it is possible to get a complete measurement, the shaft measures 5·75 cm and from front to back at the same relative position 4·5 cm. Measured in the same position, six *Pachyornis elephantopus* femora were: 5·15/4·3 (=1·20); 5·3/5·0 (=1·06); 5·4/4·75 (=1·14); 5·55/4·8 (=1·16); 5·8/4·6 (=1·26); and 6·1/4·95 (=1·23) while five *Euryapteryx gravis* were: 4·9/4·1 (=1·20); 5·4/3·9 (=1·38); 5·5/4·3 (=1·28); 5·5/4·6 (=1·20); and 5·55/4·7 (=1·18) respectively.

It is obvious that the lower range of *Pachyornis* cannot be separated from *Euryapteryx* by measurement at this point. Most *Pachyornis* and *Euryapteryx* femora, where sectioned specimens are available for measurement, have densely solid, thick walls and the holotype is no exception. The lumen, or hollow centre, measures 1·1 x 0·9 cm, the walls varying from 1·3 to 2·2 cm. Very occasionally in both species one finds a large lumen and comparatively thin walls, e.g. a lumen of 2·1 x 1·6 cm, walls from 1·0 to 2·4 cm in *Euryapteryx*, but the holotype is in the usual range of thickness and density of bone for both genera. There is not one feature on it which cannot be paralleled in *Pachyornis elephantopus* when a sufficient range of the latter is examined and while it in general appearance also closely resembles *Euryapteryx gravis*, the differences in the groove defining the neck, and more particularly in the shape of the cnemial crest, separate it from that species. My conclusion, therefore, is that "*Dinornis queenslandiae*" is a New Zealand *Pachyornis elephantopus*.

There remains the question of its midden derivation. When I first saw the bone I was impressed by the shaft break as typical of that made by human agency when the bone was "green". I have handled thousands of moa bones from caves, swamps and sandhills, and have not found one instance where sub-fossil bone was broken in the same way that fresh, green bone breaks. The difference is not easy to convey in words. Figs. 61A, B, C and D in Oliver show the shaft break from four angles. Even though the surface of the break on the holotype is now partly obscured by traces of plaster left when casts were being made, it has all the appearance of a man-made break. Sub-fossil Moa limb bones when broken accidentally or purposely usually, although not always, fracture longitudinally. When they *do* break *across* the shaft the appearance differs considerably from "green" breaks. I have made many experiments breaking and cutting Moa bone from various sub-fossil sources and whether it is comparatively light bone from sandhills or "ivory" from swamps, the appearance is very different from "green" bone broken or cut. Mr. L. Lockerbie, of Otago Museum, independently made similar experiments, with the same results. In my opinion the shaft break on the holotype was made by man when the bone was green.

The reasons for concluding that the holotype came from the South Island and not the North Island of New Zealand are as follows: *Pachyornis elephantopus* is very rare in the North Island, where it is known from two localities only—Waipukurau (skeletons were found here buried with other genera under an ash-shower) and a cave in the Mahoenui area (a single tibio-tarsus was found in October 1967). In the North Island *P. elephantopus* has not so far been discovered in human association. It is not particularly common in the Moa-hunter middens in the South Island, being known from those at Papotowai, Pounawea, Hawkesburn, Tai Rua and Shag River (Southland and Otago sites) and Redcliffs, Sumner, a few miles from Christchurch, Canterbury. The *Pachyornis* found in North Island middens belong to the much smaller *P. mappini* and *P. septentrionalis*. *Euryapteryx gravis*, very common in South Island middens, was a very rare bird in the North Island, being confined to the East Coast, and there is only one midden record, a single part femur from a midden in the Wellington area, where it could possibly have been taken across Cook Strait from the South Island.

It is improbable that we shall ever know from which South Island midden the holotype was derived. Very few were known when De Vis described it. As Miss Eleanor Crosby has suggested (pers. comm.), Shag River is a distinct possibility. It may have been ploughed up from an unrecorded site. This is all speculation, probably profitless. The most that can be said with certainty is that the bone was derived from a South Island Moa-hunter Maori midden.

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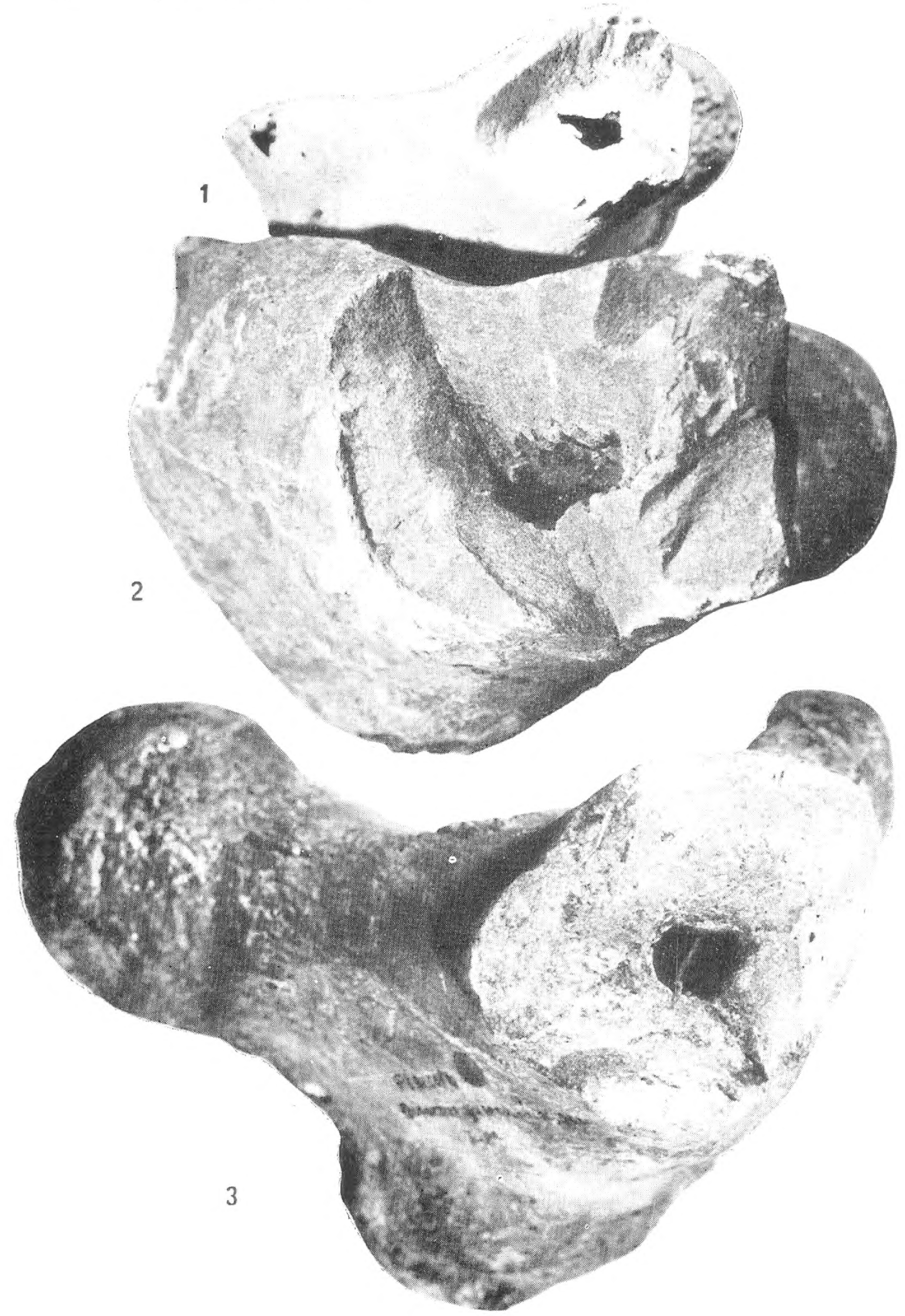

FIG. 1: Right femur of *Euryapteryx* sp., AV27579, Moa-hunter midden, Old Neck, Stewart I., N.Z.
FIG. 2: Right femur of *Euryapteryx gravis* (Owen), AV17651, Moa-hunter midden, Tairua, Otago, N.Z.
FIG. 3: Left femur of " *Dinornis queenslandiae* " De Vis, holotype, F1116.

Front face upwards in all cases.

CONTENTS