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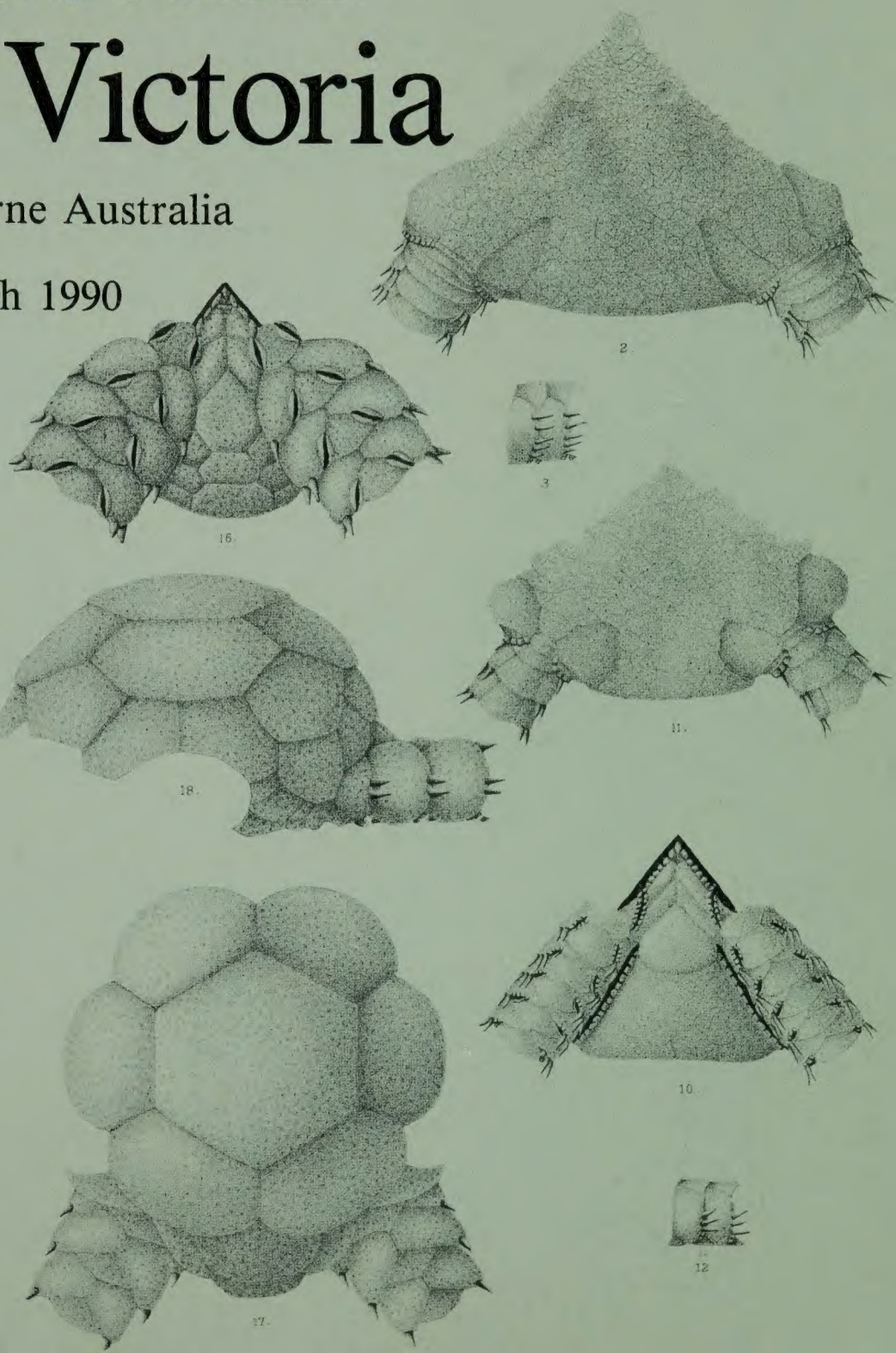

Cover. Part of Plate VIII from Theodore Lyman's report on the Ophiuroidea dredged by HMS "Challenger" during its exploratory voyage around the world between 1873 and 1876. Figures 16–18 are of *Ophiomastus tequlitius* Lyman which is reported in this volume of the *Memoirs* by Timothy O'Hara for the first time since its description in 1878.

MEMOIRS

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MELBOURNE AUSTRALIA

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PRIONOSPIO AND *PARAPRIONOSPIO* (POLYCHAETA: SPIONIDAE) FROM SOUTHERN AUSTRALIA

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Abstract

Wilson, R.S., 1990. *Prionospio* and *Paraprionospio* (Polychaeta: Spionidae) from southern Australia. *Memoirs of the Museum of Victoria* 50(2): 243–274.

Eight new species of *Prionospio* are described from southern Australia: *P. coorilla*, *P. kirrae*, *P. kulin*, *P. nirripa*, *P. pilkena*, *P. tatura*, *P. wambiri* and *P. yuriel*. *Prionospio steenstrupi* Malmgren is removed from the Australian fauna and *P. dubia* Day is recorded from Australia for the first time. A key is provided to all species of *Prionospio* known from southern Australia. The type species of *Paraprionospio* Caullery, *P. pinnata* (Ehlers) is redescribed from the type material and a lectotype designated. All Australian records of *Paraprionospio pinnata* are referred to a new species, *P. coora*. The distribution of species of the *Prionospio* complex in south-eastern Australia is discussed and a distinct fauna is shown to be present on the continental shelf.

Introduction

During the years 1979–1983 the Museum of Victoria made a survey of the soft bottom benthos of Bass Strait (Wilson and Poore, 1987). In 1984 and 1985 additional collections were made from the continental shelf and coastal bays around Tasmania and further specimens have come to hand from inshore habitats in southwestern Western Australia. This paper reports on the dominant group of spionid polychaetes from these collections, the *Prionospio* complex of genera.

Material and methods

Sources for material examined in this study are as follows. Stations occupied during the Bass Strait Survey are numbered in 2 series: BSS and S05/84 are the prefixes used and full data for these stations was given by Wilson and Poore (1987). PPBES prefixes refer to Port Phillip Bay Environmental Study stations (Poore, 1986), and TAS station numbers refer to inshore collections from Tasmania, full locality details for which are given in the Appendix. Station numbers prefixed by HT refer to the list of localities given by Hutchings and Turvey (1984: Table 1). Width measurements given in the species descriptions refer to the post-branchial body width (excluding parapodia, at about setiger 10) measured with an eyepiece scale on a stereomicroscope. Width measurements are used for selecting maximum and minimum size specimens among the material examined.

Materials examined here are deposited in the following institutions: Australian Museum, Sydney (AM); British Museum (Natural History), London (BMNH); National Museum of Wales, Cardiff (NMW); Museum of Victoria, Melbourne (NMV); Tasmanian Museum, Hobart (TM); United States National Museum, Smithsonian Institution, Washington (USNM).

I have given new species names derived from Australian aboriginal words; all are to be treated as indeclinable. Species are treated in alphabetical order within each genus.

Systematics

The *Prionospio* complex comprises a group of genera which have historically been treated together. The form of the prostomium, peristomium, anterior parapodia and branchiae (which are concentrated on anterior segments) are broadly similar throughout the complex, however there is no character which could define the *Prionospio* complex as a monophyletic taxon within the Spionidae. Most keys distinguish *Prionospio* complex genera by the absence of character states present in other genera (e.g. Blake and Kudenov, 1978; Fauchald, 1977). Within the *Prionospio* complex, genera are distinguished on the basis of the degree of fusion of setiger 1 with the peristomium, the form and arrangement of branchiae, and the form of the pygidium and anal cirri (Table 1).

Blake and Kudenov (1978) included *Paraprionospio* Caullery, 1914, *Orthoprionospio*

HAVE SET THIS TABLE LANDSCAPE

Table 1. Comparison of characters in *Prionospio* and related genera.

Genus [source of data]	Peristomium	Setiger 1	Branchiae	Dorsal ridges or collars	Hooded hooks	Pygidium
Apoprionospio [Maciolek, 1985]	reduced, lateral wings absent	reduced, fused to peristomium	commence setiger 2, 4 pairs: 1-3 apinnate, 4 pinnate with plate-like pinnules	absent or with dorsal crest on setiger 7	present in notopodia and neuropodia, secondary hood small	1 long dorsomedial cirrus and 2 lateral lappets
Aurospio [Maciolek, 1981a]	reduced, lateral wings absent	reduced, fused to peristomium	commence setiger 3, 2 pairs, both apinnate, partly fused to notopodial lamellae	absent	present in notopodia and neuropodia, secondary hood absent	1 long dorsomedial cirrus and 2 lateral lappets
Laubieriellus [Maciolek, 1981b]	reduced, without lateral wings	reduced, partly fused to peristomium	commence setiger 2, 4 pairs, all apinnate	absent	present in neuropodia only, secondary hood small	1 short dorsomedial cirrus and 2 lateral lappets
Orthoprionospio [Blake & Kudenov, 1978]	enlarged, with moderate wings	well-developed, free from peristomium	commence setiger 1, 18-22 pairs, all apinnate	absent	present in notopodia and neuropodia, secondary hood absent	1 ventral lobe and 4 small lateral papillae
Paraprionospio [Yokoyama & Tamai, 1981; this paper]	enlarged, with prominent wings	well-developed, free from peristomium	commence setiger 1, 3 pairs, all pinnate, with plate-like pinnules	prominent ridge across setiger 1	present in notopodia and neuropodia, with conspicuous secondary hood	1 long dorsomedial cirrus and usually 2 short lateral lappets
Prionospio [Maciolek, 1985; this paper]	reduced, with or without lateral wings	reduced, fused to peristomium	commence setiger 2 or 3, 3-40 pairs, apinnate or with digitiform pinnae, or both	membranous dorsal crests may be present on some post-branchial setigers	present in notopodia and neuropodia, secondary hood small	1 long dorsomedial cirrus and 2 lateral lappets
Streblospio [Blake & Kudenov, 1978]	enlarged, with low lateral wings	reduced, fused to peristomium	1 pair only, on setiger 1, apinnate	low ridge across setiger 1, prominent collar across setiger 2	present in notopodia and neuropodia, secondary hood conspicuous	2 rounded lobes, appendages absent

Blake and Kudenov, 1978, *Streblospio* Webster, 1879 and *Prionospio* Malmgren, 1867 in the *Prionospio* complex with *Aquilaspio* Foster, 1971, *Minuspio* Foster, 1971 and *Prionospio sensu stricto* being treated as subgenera of *Prionospio sensu lato*. Maciolek (1981a, b) added 2 new genera, *Aurospio* and *Laubieriellus*, to the complex to accommodate species from deep water in the north and south Atlantic Ocean. A recent revision by Maciolek (1985) accepted Blake and Kudenov's arrangement of genera and subgenera but resurrected and redefined *Apoprionospio* Foster, 1971. *Aquilaspio*, *Minuspio* and *Prionospio sensu stricto* as used by Maciolek are artificial groupings of species (Maciolek, 1985) and I have therefore preferred to dispense with subgenera. All taxa elsewhere treated as species of *Aquilaspio* and *Minuspio* are here referred to *Prionospio*. Maciolek's (1985) arrangement of subgenera can however be recognised in the artificial key to Australian species of *Prionospio* provided below.

Three genera, *Prionospio*, *Paraprionospio* and *Orthoprionospio*, are known to occur in Australia and can be distinguished using the characters given in Table 1. *Orthoprionospio* contains a single species, *O. cirriformia* Blake and Kudenov, 1978, which occurs in areas of reduced salinity and was not encountered in this study. Australian material of the remaining 2 genera is treated below.

Discussion

Numerous extensive benthic collections from southern and south-eastern Australia have now provided material for taxonomic study (Poore et al., 1975; Blake and Kudenov, 1978; Hutchings and Turvey, 1984; Poore, 1986; Wilson and Poore, 1987; appendix to this paper), and the taxonomy and species distribution patterns of the *Prionospio* complex in southern, and especially south-eastern Australia, must now be considered moderately well known. In the absence of a phylogenetic classification of the *Prionospio* complex it is not possible to attempt a biogeographic analysis, but a summary of the diversity and degree of endemism of the southern Australian fauna is useful. (The following discussion is restricted to Australian waters south of 26°S; northern waters remain poorly known.)

Of the 20 species in the *Prionospio* complex now known from southern Australia, 17 are endemic; only *Prionospio aucklandica* Augener, 1923 (known also from New Zealand), *P. dubia* Day, 1961 (also from South Africa) and *P. ehlersi* Fauvel, 1928 (also from the Mediterranean, North Atlantic and Indo-Pacific) occur outside the region. Nine new species and one new record (*P. dubia*) are added to the Australian fauna in this paper. The additions result from the discovery of a distinct fauna on the continental shelf of Bass Strait (see below), and the resolution of several species complexes: Australian records of *P. steenstrupi* are assigned to *P. coorilla* sp. nov., *P. dubia*, *P. kulin* sp. nov. and *P. multicristata* Hutchings and Rainer, 1979, and the species is removed from the Australian fauna. Records of *Prionospio cirrifera* Wirén, 1883 from southern Australia have been referred to three new species (*P. tatura*, *P. wambiri* and *P. yuriel*), and records of *Paraprionospio pinnata* (Ehlers, 1901) from southern Australia are referred to *Paraprionospio coora* sp. nov. It is unlikely that either *Prionospio cirrifera* or *Paraprionospio pinnata* occur in Australia.

There are distinct differences between the faunas of the continental shelf and inshore waters (including the major embayments of Port Phillip Bay and Western Port in south-eastern Australia). Six species (*Orthoprionospio cirriformia* Blake and Kudenov, 1978, *Prionospio aucklandica*, *P. multipinnulata* Blake and Kudenov, 1978, *P. paucipinnulata* Blake and Kudenov, 1978, *P. tatura* and *P. yuriel*) occur only in inshore waters and are most common in shallow muddy sediments or in seagrass communities in Port Phillip Bay and Western Port. *Orthoprionospio cirriformia* and *P. tatura* are restricted to estuarine conditions. No species in the *Prionospio* complex occurs in the deep muddy basin of Port Phillip Bay or near the entrance. Outside the bays, a distinct fauna is present: five species (*Prionospio dubia*, *P. kulin* sp. nov., *P. nirripa* sp. nov., *P. pilkena* sp. nov. and *Paraprionospio coora* sp. nov.) occur only on the continental shelf; most of these species are recorded from both muddy and well-sorted carbonate sediments. Of the 13 species now known from south-eastern Australia (Victoria and Tasmania, where both inshore and shelf communities have been well sampled) only two, *Prionospio kirrae* sp. nov. and *P. wambiri* sp. nov., occur widely in both inshore waters and on the continental shelf.

Prionospio Malmgren, 1867

Prionospio Malmgren, 1867: 201.
Aquilaspio Foster, 1971: 105–106.
Minuspio Foster, 1971: 106–107.

Diagnosis. Prostomium with anterior margin incised or rounded, without frontal horns,

caruncle variously developed. Peristomium fused in varying amounts with setiger 1 often forming low lateral wings. Branchiae pinnate, apinnate, or both pinnate and apinnate. Branchiae present on a series of consecutive anterior setigers commencing at setigers 2 or (rarely) 3. Between 3 and 13 pairs of branchiae usually present, or up to 39 pairs in one species: *P. polybranchiata* Fauvel, 1929. Anterior setae all capillaries, hooded hooks in posterior noto- and neuropodia; hooks bi- to multidentate, inferior sabre setae present in all species except *P. perkinsi* Maciolek, 1985. Pygidium with 1 long medial cirrus and 2 short ventrolateral cirri or lappets.

Type species. Prionospio steenstrupi Malmgren, 1867, by monotypy.

Remarks. The above diagnosis is essentially that of Maciolek, 1985, except that the description of branchiae has been expanded slightly to include *P. ockelmanni* Pleijel, 1985, and *P. pilkena* sp. nov. The most recent major work is the revision by Maciolek (1985), which includes a redescription of the type species.

Key to species of *Prionospio* known from southern Australia (south of 26°S)

This key excludes 3 species recorded from north-western Australia by Hartmann-Schröder (1979, 1981): *Prionospio fallax* Söderström, 1920; *P. lanceolata* Hartmann-Schröder, 1979 and *Prionospio sexoculata* Augener, 1918.

1. Four pairs of branchiae, at least one pair of which have digitiform pinnae 2
— Three to 12 pairs of branchiae, all apinnate (branchiae may have fine lateral cilia; subgenus *Minuspio* sensu Maciolek, 1985) 15
2. Three or 4 pairs of branchiae, all with digitiform pinnae (subgenus *Aquilaspio* sensu Maciolek, 1985) 3
— Both pinnate and apinnate branchiae present (subgenus *Prionospio* sensu Maciolek, 1985) 5
3. Three pairs of pinnate branchiae on setigers 2–4 ..... *P. aucklandica*
— Four pairs of pinnate branchiae on setigers 2–5 4
4. Neuropodial lamella of setiger 1 rounded in shape; neuropodial hooded hooks appear at setigers 17–22 ..... *P. multipinnulata*
— Neuropodia of setiger 1 inflated, pyramidal in shape; neuropodial hooded hooks appear at setigers 8–12 ..... *P. pyramidalis*×
5. First 3 pairs of branchiae apinnate, fourth pair pinnate; hooded hooks with one pair of apical teeth 6
— Branchiae otherwise; hooded hooks with 4 or more pairs of apical teeth 7
6. Dorsal crest on setiger 7 ..... *P. tridentata*×
— Dorsal crest on setiger 11 ..... *P. kirrae* sp. nov.
7. First pair of branchiae pinnate, second to fourth pairs apinnate; interparapodial pouches present from between setigers 2 and 3 *P. ehlersi*×
— Either third of fourth pairs of branchiae pinnate; interparapodial pouches (if present) do not appear until at least setigers 8 and 9 ... 8
8. First and third pairs of branchiae pinnate, second and fourth pairs apinnate; dorsal crests on setigers 7 and 8 only ..... *P. paucipinnulata*×
— First and fourth pairs of branchiae pinnate, second and third pairs apinnate; dorsal crest either completely absent or present on 6 or more setigers 9
9. Dorsal crests absent; neuropodial sabre setae first present at setigers 12–18 10
— Dorsal crests present; sabre setae appear at setigers 10–11 11
10. Sabre setae appear at setigers 12–14, usually 13 .. P. *coorilla* sp. nov.
— Sabre setae appear at setigers 15–20, usually 17–19 ..... *P. dubia*

11. Sabre setae appear at setiger 11; dorsal crests present on setigers 11–18 ..... *P. australiensis*×
— Sabre setae appear at setiger 10; dorsal crest present before setiger 11 12
12. Dorsal crests present setigers 7–20 at least 13
— Dorsal crests otherwise 14
13. Dorsal crests present setigers 7–30; caruncle extends back to setiger 4 ..... *P. multicristata*
— Dorsal crests present setigers 7–20; caruncle extends back to setiger 2 ..... *P. kulin* sp. nov.
14. Dorsal crests present on setiger 5 and setigers 9–13; notopodial hooded hooks present from setigers 35–40 ..... *P. queenslandica*×
— Dorsal crests present setigers 10-30; notopodial hooded hooks appear setigers 22–36 ..... *P. nirripa* sp. nov.
15. 3 pairs of apinnate branchiae present on setigers 3–6 ..... *P. pilkena* sp. nov.
— At least 6 pairs of apinnate branchiae commencing at setiger 2 ... 16
16. Prostomium narrow anteriorly, broadest posteriorly; longest branchiae (on setigers 3–5) 4–5 times notopodial length ..... *P. yuriel* sp. nov.
— Prostomium broadest at anterior margin or at median region; longest branchiae (on setiger 2) 2 times notopodial length 17
17. Sabre setae present from setigers 10–12, neuropodial hooded hooks present from setigers 13–15; neuropodia of setiger 2 without ventral projection ..... *P. tatura* sp. nov.
— Sabre setae present from setigers 14–16 (rarely setigers 11–12 in very small worms), neuropodial hooded hooks present from setigers 16–20 (rarely 14); neuropodia of setiger 2 with prominent ventral projection ..... *P. wambiri* sp. nov.

× denotes species not recorded in this study

Prionospio aucklandica Augener, 1923

Prionospio aucklandica Augener, 1923: 69.—Blake and Kudenov, 1978: 221–222, fig. 25b–g.

Aquilaspio aucklandica.—Hutchings and Turvey, 1984: 8–9.

Material examined. Western Australia: Nornalup, "sample 3", coll. J. Shaw, NMV F53897, 4 specimens.

Victoria: Port Phillip Bay, PPBES Stn 944, NMV G3097, 7 specimens.

New South Wales: Botany Bay, Towra Pt, New South Wales Fisheries Stn 335, NMV G3143, 7 specimens.

Remarks. The material examined here agrees closely with the detailed description of Hutchings and Turvey (1984). Sabre setae appear at setiger 10 in all specimens, neuropodial hooded hooks appear at setigers 18–19 in eastern Australian specimens and at setigers 19–22 in Western Australian specimens (all specimens of similar size range, from 0.3 to 0.45 mm postbranchial width, excluding parapodia). Notopodial hooded hooks also appear earlier in specimens from eastern Australia (setigers 27–30) than in Western Australian material (notopodial hooks from setigers 31–36).

Blake and Kudenov (1978) reported that a dorsal crest was present on setiger 7; reexamination of their material shows that this was an error and that no dorsal crests are present in *P. aucklandica*. Augener (1923) made no mention of dorsal crests and Hutchings and Turvey (1984) noted the absence of dorsal crests in their material). This is the first record of *P. aucklandica* from Western Australia.

Distribution. Southern Australia from southwestern Western Australia to Botany Bay, New South Wales.

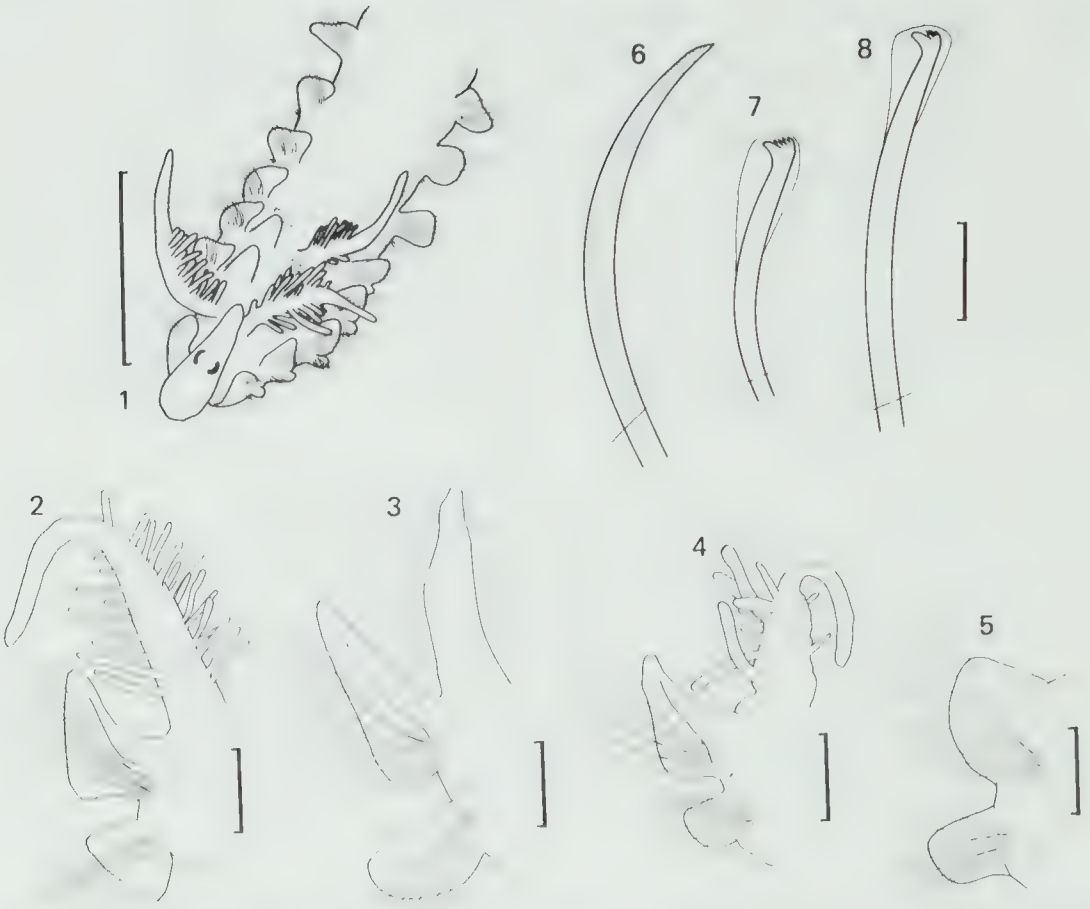
Prionospio coorilla sp. nov.

Figures 1–8

Prionospio sp. 5 Poore et al., 1975: 59.

Material examined. 67 specimens, size range 45 setigers, 10 mm long, 0.25 mm wide (entire specimen) to 21 setigers, 5 mm long, 0.5 mm wide (anterior fragment).

Holotype: entire specimen, 62 setigers, 10 mm long, 0.3 mm wide, NMV F52633. Central Bass Strait, 6 km SE of Stanley, Tasmania, 40°48.8′S, 145°22′E, 22 m, fine sand, Smith-McIntyre Grab, 4 Nov 1980, M. Gomon et al. (Stn BSS-G 114).



Figures 1–8. *Prionospio coorilla*: 1, dorsal view, holotype NMV F52633; 2–5, paratype NMV F52636: 2, setiger 2 parapodium; 3, setiger 4 parapodium; 4, setiger 5 parapodium; 5, setiger 9 parapodium; 6–8, holotype: 6, sabre seta, setiger 19; 7, neuropodial hooded hook, setiger 19. 8, notopodial hooded hook, posterior setiger, holotype.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 1); 0.1 mm (Figs 2–5); 0.02 mm (Figs 6–8).

Paratypes: Central Bass Strait, type locality: NMV F52634–52637, 4 paratypes. Central Bass Strait, 25 km S of Aireys Inlet, 38°44.6′S, 144°9.0′E, 77 m, fine sand, Smith-McIntyre Grab, 19 Nov 1981, R. Wilson et al. (Stn BSS-G 182) AM W203947, 3 paratypes; NMW.Z.1989.116.1, 4 paratypes; USNM 122745, 3 paratypes; NMV F52638-52639, 2 paratypes.

Other material: Southern Ocean: Stn S05/84/54, NMV F50447, 1 specimen.

Tasmania: Stn TAS 28, NMV F50474, 3 specimens.

Bass Strait: Stn BSS 49, NMV F52640, 1 specimen; Stn BSS-G 68, NMV F52641, 1; Stn BSS-G 112, NMV F50319, 14; Stn BSS-G 113, NMV F52642, 2 ; Stn BSS-S 115, NMV F52643, 3; Stn BSS-G 115, NMV F50320, 16; Stn BSS-G 117, NMV F52644, 7; Stn BSS-G 163, NMV F52645, 6; Stn BSS-G 165, NMV F52646, 2; Stn BSS-S 165, NMV F52647, 1; Stn BSS-G 181, 2; Stn BSS-G 184, NMV F52649, 1.

Victoria: Port Phillip Bay: PPBES Stn 938, NMV G3192, 1; PPBES Stn 946, NMV G3194, 1; PPBES Stn 965, NMV G3195, 1; PPBES Stn 978, NMV G3196, 1 (*Prionospio* sp. 5 of Poore et al., 1975; material identified as *P. steenstrupi* by Blake and Kudenov, but not published).

Description. Prostomium with rounded anterior margin, extending posteriorly as narrow caruncle to anterior margin of setiger 2 (Fig. 1). Nuchal organ present on either side of caruncle. Two pairs of red eyes, posterior pair larger, comma shaped; anterior pair much smaller and indistinct (or absent in some specimens). First setiger fused to peristomium, forming lateral wings which partially enclose prostomium. First setiger with noto- and neurosetae and reduced parapodial lobes. Four pairs of branchiae on

setigers 2–5. First pair of branchiae about 3–4 times as long as notopodial lobe, densely covered with long digitiform pinnae on posterior surfaces; bare on anterior surfaces and on extreme distal region. Branchiae 2 and 3 stout, triangular, about as long as notopodial lobes, apinnate but with strongly ciliated lateral margins. Fourth pair of branchiae about 1.5 to 2 times as long as branchiae 2 and 3, densely covered with long digitiform pinnae on posterior surface, bare anteriorly and distally. Notopodia asymmetrical triangular-lanceolate, largest on setigers 2–4, reducing to low rounded lobes by about setigers 12–15 and further reducing posteriorly. Neuropodia anteriorly asymmetrical ovoid lobes, largest and with small ventrally directed process on setiger 2, reducing posteriorly to low semicircular lobes similar to, but smaller than, notopodia by about setiger 20 (Figs 2–5). Dorsal crests and interparapodial pouches absent.

Setae anteriorly granulate capillaries, arranged in 3 rows in notopodia and 2 rows in neuropodia. Capillaries most common in anterior 15–18 setigers, thereafter losing granulations, becoming fewer and longer; capillaries of posterior setigers up to twice as long as body diameter. Sabre setae appear in ventral neuropodial positions at setigers 12–14, usually 13 (sabre setae from setiger 13 in holotype). Sabre setae number 1 or occasionally 2 per parapodium, granulated, sheath not visible (Fig. 6). Neuropodial hooded hooks, with 3–4 pairs of small teeth in 2 rows above the main fang (Fig. 7), appear at setigers 15–18 (setiger 18 in holotype). Hooded hooks usually number 5–6 per neuropodium. Notopodial hooded hooks, similar to neuropodial hooded hooks but with longer shafts (Fig. 8), one or 2 per notopodium, appear at setiger 50 in holotype, at setiger 42 in the only other specimen with notopodial hooks (paratype NMV F52634). Pygidium with a single short threadlike anal cirrus, lateral lobes absent.

Remarks. Prionospio coorilla is allied to *P. steenstrupi* and related species compared in Table 3 of Maciolek (1985: 375, species 1–12). Including *P. coorilla*, *P. kulin* sp. nov. and *P. nirripa* sp. nov. described here, 15 species are now included in this group. *Prionospio coorilla* is most similar to *P. dubia* from southern Africa and Bass Strait (see description below) but can be readily distinguished on the basis of the earlier appearance of neuropodial sabre setae and hooded hooks in *P. coorilla*. *Prionospio coorilla* also has a narrower prostomium.

Etymology. The specific name *coorilla* is derived from an Australian aboriginal word meaning "south".

Distribution. South-eastern Australia, from the continental shelf of Bass Strait and Tasmania, and Port Phillip Bay, Victoria.

Prionospio dubia Day, 1961

Figures 9–15

Prionospio malmgreni var. *dubia* Day, 1961: 489–490, figs 3j–n.

Prionospio (Prionospio) dubia.—Maciolek, 1985: 336–339, figs 2, 3 (in part, South African specimens).

Prionospio (Prionospio) steenstrupi.—Blake and Kudenov, 1978: 213, fig. 20a (in part; not Malmgren, 1867).

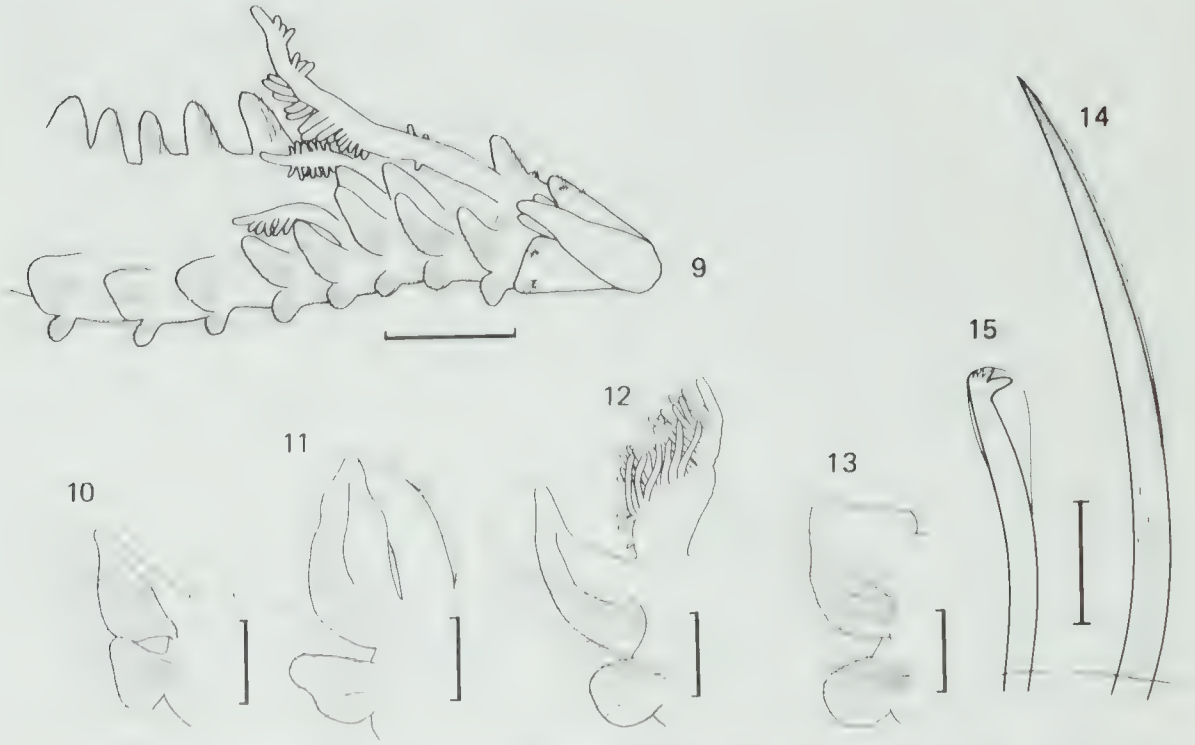
Material examined: South Africa: mixture of 9 stations off South Africa, J.H. Day, BMNH ZK 1961.19.635/662, 9 specimens.

Australia, Southern Ocean: Stn S05/84/01, NMV F50453, 1 specimen; Stn S05/84/64, NMV F50449, 6.

Tasmania: Stn TAS 30, NMV F50478, 2 specimens.

Bass Strait: Stn BSS 66, NMV F50318, 2 specimens; Stn BSS-G 117, NMV F52650, 4; Stn BSS-G 155, NMV F52651, 9; Stn BSS-S 155, NMV F52652, 2; Stn BSS-S 156, NMV F52653, 2; Stn BSS-G 156, NMV F52654, 3; Stn BSS 163, NMV F50321, 1; Stn BSS-G 165, NMV F52655, 7; Stn BSS-G 167, NMV F52656, 2; Stn BSS-S 167, NMV F53164, 1; Stn BSS-S 194, NMV F53165, 1; Stn BSS-S 209, NMV F53166, 1. 112 km S of Lakes Entrance, 148°24.8′S, 139°00.0′E, 99 m, sand, May 1969, Esso Gipps Stn 20, C. Phipps, 1 of 2 specimens in AM W13012 (other specimen indeterminable; part of material identified as *P. steenstrupi* by Blake and Kudenov, 1978).

Description. (based on South African specimens) Size range of material 50 setigers, 11 mm long, 0.4 mm wide to 26 setigers, 7.5 mm long, 0.7 mm wide (anterior fragments). Prostomium narrow and rounded anteriorly, extending posteriorly as narrow high caruncle extending back to anterior margin of setiger 2. Eyes visible only in largest specimen as a pair of faint red pigmented spots. Peristomium fused to setiger 1 and forming lateral wings which are more prominent on larger specimens. Prominent nuchal organs on either side of the caruncle (Fig. 9). Palps lost from all specimens. Four pairs of branchiae on setigers 2–5, first pair (intact on one specimen only) 4–5 times as long as notopodial lobe, densely covered with long digitiform pinnae on the anterior surfaces, anteriorly bare but faintly annulate. Branchiae 2 and 3 equal to or slightly



Figures 9–15. *Prionospio dubia*, South African material, BMNH ZK 1961.19.635/662: 9, dorsal view; 10, setiger 2 parapodium (branchia lost); 11, setiger 3 parapodium; 12, setiger 5 parapodium; 13, setiger 10 parapodium; 14, sabre seta, setiger 21; 15, neuropodial hooded hook, setiger 21.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 9); 0.2 mm (Figs 10–13); 0.02 mm (Figs 14–15).

longer than notopodial lobes, stout triangles, apinnate but with ciliated lateral margins. Fourth pair of branchiae equal to or slighly longer than branchiae 2 and 3, densely covered with long digitiform pinnae on posterior surfaces, anterior surfaces bare. Dorsal crests and interparapodial pouches absent. Notopodia elongate asymmetrical triangular lanceolate lobes, largest on setigers 2–4, reducing to low rounded lobes by about setiger 15 and becoming further reduced posteriorly. Neuropodia smaller than notopodia, asymmetrical ovoid lobes over setigers 2–4, subsequently becoming symmetrical and approximately semi-circular, reducing in size posteriorly and becoming low rounded lobes by setiger 20, similar to, but smaller than, notopodium (Figs 10–13). Setae of anterior setigers granulate capillaries, 3 rows in notopodia and 2 rows in neuropodia; capillaries most numerous on anterior 15 setigers, thereafter becoming fewer and longer (up to twice the body diameter).

Stout sabre setae (Fig. 14) appear in ventral neuropodial positions at setigers 17–20, usually setigers 18 or 19, and number 1 or 2 per parapodium. Neuropodial hooded hooks (6–8 per parapodium) appear at setigers 18 or 19, usually on same or next setiger to appearance of sabre setae. Neuropodial hooded hooks with 3–4 pairs of small teeth in 2 rows above the main fang (Fig. 15). Notopodial hooded hooks absent from all specimens, the longest of which are anterior fragments of 46 and 50 setigers (Day, 1961 reported the appearance of notopodial hooded hooks at setiger 49). Pygidium unknown.

Additional notes on Australian material. (39 anterior fragments, size range 26 setigers, 4 mm long, 0.25 mm wide to 39 setigers, 11.5 mm long, 0.6 mm wide): The specimens from south-eastern Australia agree in every respect with the above description of South African material. A single small specimen (75 mm long for 40 setigers, 0.3 mm wide) has notopodial hooded hooks from setiger 35; these differ from neuropodial hooks only in having a longer shaft. Larger specimens of 39 and 41 setigers have no notopodial hooks. Pygidium unknown.

Remarks. The above description agrees closely with the original description of Day (1961) but

differs from that of Maciolek (1985), notably in the positions at which neuropodial sabre setae and hooded hooks appear. According to Maciolek sabre setae should be present from setigers 13–16 and hooded hooks from setigers 15–19, whereas the material examined here has sabre setae from 17–20 and hooded hooks from 18–19. Maciolek (1985: figs 2a, b) show the prostomium to be truncate and broader anteriorly than that figured here and the first pair of branchiae are shorter than in the South African and southern Australian specimens. Maciolek's list of material examined includes specimens from widespread localities (Atlantic coast of North America, Surinam, Mediterranean, Canary Islands and Bay of Biscay, Sweden; encompassing a depth range of 85 to 2379 m) in addition to the South African material. In view of the above discrepancies it seems likely that Maciolek's material and descriptions may confuse one or more additional species with *P. dubia* and I regard her widespread records as requiring verification. The Australian material is however indistinguishable from the South African specimens both qualitatively and quantitatively (in respect of the distribution of setae) and these specimens are therefore identified as *P. dubia* and represent the first record of that species from Australian waters.

Distribution. South Africa and south-eastern Australia, shelf and upper slope depths, 37 to 630 m.

Prionospio kirrae sp. nov.

Figures 16–23

Material examined: 42 specimens, anterior fragments, size range 18 setigers, 2.5 mm long, 0.3 mm wide to 36 setigers, 13 mm long, 0.5 mm wide.

Holotype: anterior fragment, 36 setigers, 13 mm long, 0.5 mm wide, NMV F50366. Western Bass Strait, 10 km WNW of Cape Otway, 39°49.0'S, 143°24.0'E, 56 m, fine sand, Smith-McIntyre Grab, 20 Nov 1981, G. Poore et al. (Stn BSS-G 184).

Paratypes: Western Bass Strait, type locality: NMV F50367–50372, 6 specimens; AM W203948, 2; NMW.Z.1989.116.2, 2; USNM 122746, 2.

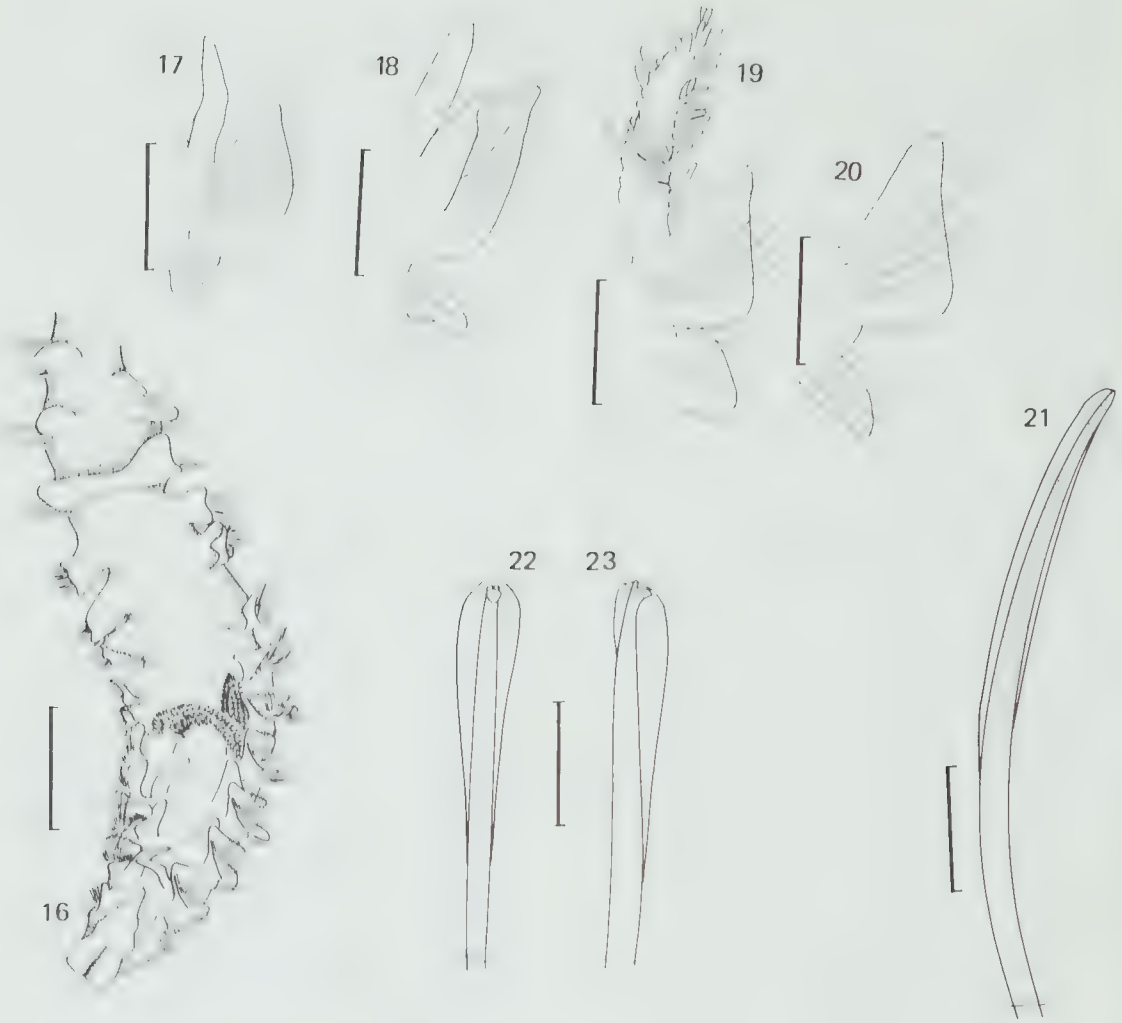
Other material: Tasmania: off entrance to Little Swanport, 10 m, sand, Van Veen Grab, 8 Jun 1977, A.J. Dartnall, TM K1009, 3; off Hellfire Bluff, S of Cape Bernier, 12 m, sand, Van Veen Grab, 7 Jun 1977, A.J. Dartnall, TM K1008, 2; Lagoon Bay, Forestier Peninsula, 16 m, sand, Van Veen Grab, A.J. Dartnall, TM K1007, 1.

Western Bass Strait: Stn BSS 49, NMV F50373–50374, 19 specimens; Stn BSS-G 111, NMV F50375, 12; Stn BSS-S 121, NMV F50376, 1.

Comparative material of other taxa: *Prionospio tridentata*: New South Wales: Towra Pt, Botany Bay, April 1973, 1 specimen, NMV G2844; 2, NMV G2845 (part of material of Blake and Kudenov, 1978).

Description. Prostomium with anterior margin indented and with deep dorsal groove extending back to a point between the first pair of eyes (Fig. 16). Two pairs of eyes, small red points, anterior pair more widely separated. Eyes faint to invisible in holotype and several other specimens. Caruncle attached to dorsum throughout, extending back to posterior margin of setiger 2. Peristomium fused to setiger 1, lateral wings absent. Four pairs of branchiae on setigers 2–5. Apinnate branchiae on setigers 2–4, about equal in length to notopodial lobes; first pair slender, cirriform, pairs 2 and 3 more stout, triangular, with fine marginal cilia. Fourth pair of branchiae about 3 times as long as anterior branchiae, densely pinnate on anterior surfaces, smooth on posterior surfaces and basally. Setiger 1 well developed, with notosetae, neurosetae and small parapodial lobes. Notopodia consisting of triangular lamellae folded dorsally around notosetae on setigers 2–10, largest over setigers 2–7, decreasing posteriorly. Notopodia of setiger 11 unite to form high dorsal crest (Fig. 16). Notopodia of setiger 12 consist of an ovoid postsetal lobe extending partly onto the dorsum but not forming a continuous dorsal crest. Notopodia similar on all posterior setigers, reducing in size and becoming semi-circular in shape by about setiger 15. Neuropodia lanceolate lobes throughout, reducing gradually in size posteriorly but not changing significantly in shape posteriorly (Figs 17–20). Low presetal neuropodial ridge present throughout (to at least setiger 36) but becoming very small on posterior setigers.

Notosetae of setiger 1 single bundles of capillaries, setigers 2 to about 15 with posterior row of granulate unilimbate capillaries and 1–2 anterior rows of shorter simple capillaries, reducing to a single row of granulate capillaries at about setiger 16. Granulate sheathed sabre setae (Fig. 21), one or two per setiger, in ventral neuropodial positions from setiger 10 or 11 (setiger 11 in holotype). Hooded hooks, with 2 apical teeth above main fang (Figs 22–23), appear in neuropodia at setiger 20 in holotype, at setiger 19 to 21 in most specimens or as early as setiger 17 in small worms. Only one specimen, paratype NMV F50369, has notopodial hooded hooks (from setiger 18) but this worm is regenerating new posterior setigers from setiger 16 and is undoubtedly atypical. All other specimens



Figures 16–23. *Prionospio kirrae*, holotype NMV F50366: 16, dorsal view; 17, setiger 2 parapodium; 18, setiger 4 parapodium; 19, setiger 5 parapodium; 20, setiger 10 parapodium; 21, sabre seta, setiger 20; 22, neuropodial hooded hook, setiger 36, frontal view; 23, same, lateral view.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 16); 0.2 mm (Figs 17–20); 0.02 mm (Figs 21–23).

are anterior fragments of up to 36 setigers and all lack notopodial hooded hooks. Paratype NMV F50369, regenerating posteriorly, is the only specimen with a pygidium: it is typical for the genus with a long medial cirrus and a pair of lateral lappets.

Remarks. Prionospio kirrae sp. nov. belongs to the *P. caspersi* group of species which are characterised by having the first three pairs of branchiae apinnate, the fourth pair pinnate and hooded hooks with only 1 or 2 apical teeth. This group of species was placed in the new genus *Apoprionospio* by Foster (1969) but this approach has not been generally followed by other workers (e.g. Blake and Kudenov, 1978). *Apoprionospio* was redefined by Maciolek (1985) and the *P. caspersi* species group was returned to *Prionospio*. The four previously known species of the *P. caspersi* group were compared in Table 3 of Maciolek (1985: 375, species 18–21). *Prionospio kirrae* most closely resem-

bles *P. tridentata* Blake and Kudenov, 1978 in possessing hooded hooks with 2 apical teeth but can be distinguished from that species by having a prominent dorsal crest on setiger 11 and by having the fourth pair of branchiae pinnate on the anterior surfaces (*P. tridentata* has a dorsal crest on setiger 7 and has the fourth pair of branchiae pinnate on the posterior surfaces). *Prionospio tridentata* is widespread in New South Wales (Blake and Kudenov, 1978; Hutchings and Murray, 1984) whereas *P. kirrae* occurs in western Bass Strait. Despite extensive sampling *P. kirrae* has not been collected from eastern Bass Strait.

Etymology. The specific name *kirrae* is derived from the name of an Australian aboriginal tribe whose territory encompassed the coastal region immediately west of Cape Otway, Victoria.

Distribution. Known only from western Bass Strait, from Cape Otway to north-western Tasmania. Sandy sediments, 29–84 m.

Prionospio kulin sp. nov.

Figures 24–33

Prionospio steenstrupi.—Blake and Kudenov, 1978: 213, fig. 20a (in part; not Malmgren, 1867).

Material examined: More than 400 specimens; size range 27 setigers, 5.5 mm long, 0.3 mm wide to 51 setigers, 20 mm long, 0.8 mm wide (anterior fragments).

Holotype: entire specimen, 58 setigers, 11 mm long, 0.5 mm wide at setiger 5, NMV F50377. Eastern Bass Strait. 112 km S of Lakes Entrance, 38°53.7′S, 147°55.2′E, 71 m, medium carbonate sand with 2% mud (sediment data from Smith-McIntyre Grab sample, same station), Agassiz trawl, 17 Nov 1981, G. Poore et al. (Stn BSS-T 171).

Paratypes: Eastern Bass Strait, type locality, NMV F50378–50379, 2 paratypes. Eastern Bass Strait, type locality, Smith-McIntyre Grab: NMV F50380-50381, 2 paratypes; AM W203949, 3 paratypes; NMW.Z.1989.116.3, 3 paratypes; USNM 12277, 3 paratypes. Eastern Bass Strait, type locality, epibenthic sled (Stn BSS-S 171), NMV F50382–50384, 3 paratypes. Eastern Bass Strait, 35 km E of Lady Barron, Flinders Island, 40°14.4′S, 148°40.0′E, 60 m, fine carbonate sand with 8% mud, Smith McIntyre Grab, 14 Nov 1981, G.Poore et al., Stn BSS-G 165, 8 paratypes, NMV F50385-50392.

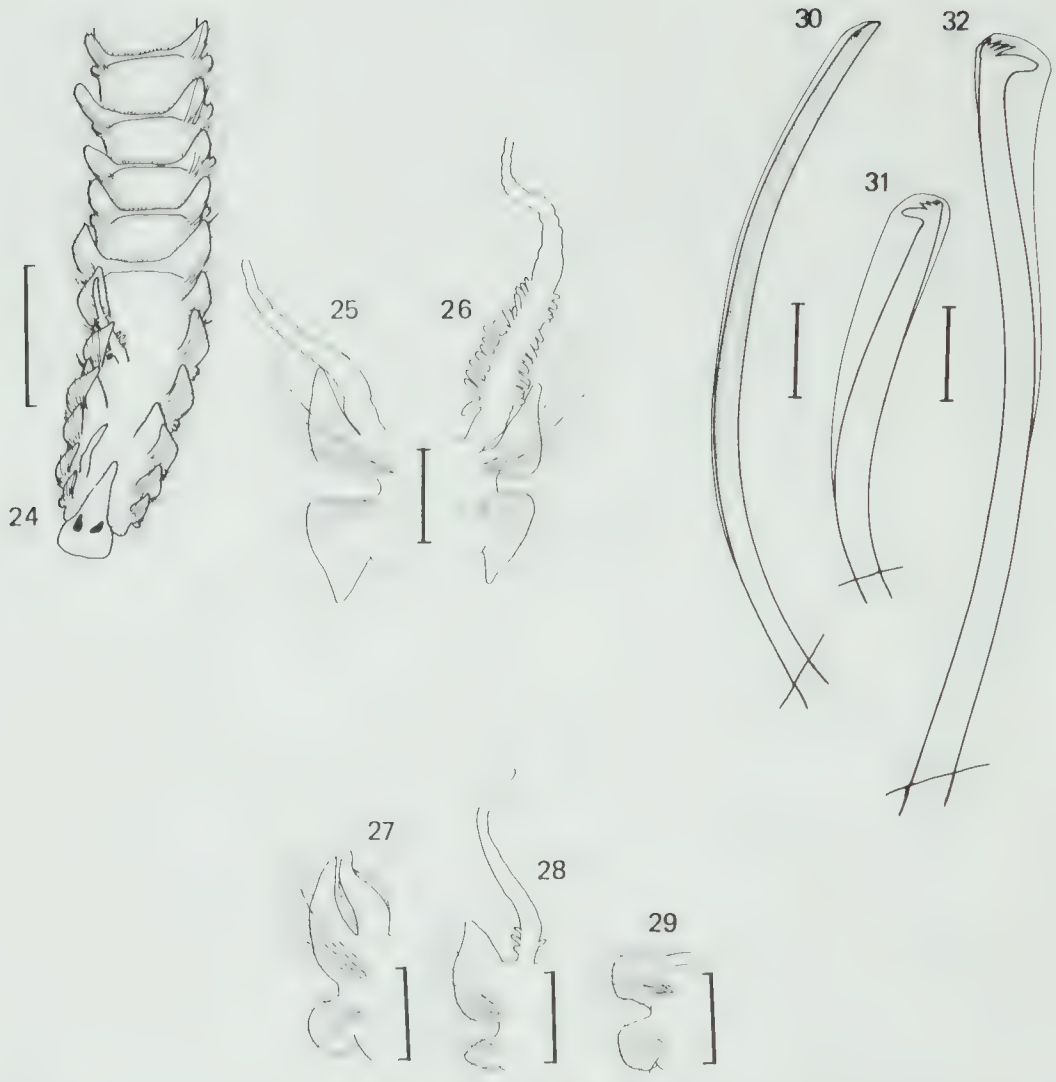
Other material: Tasmania: Pirates Bay, 7 Jun 1977, A.J. Dartnall, TM K1010.

Bass Strait: Erith Island, transect 3, algal washings, S.A. Shepherd, AM unreg.; Stn BSS 56, NMV F50393–50394, 8 specimens; Stn BSS-G 112, NMV F50395, 18; Stn BSS-S 165, NMV F50396, 7; Stns BSS-G 172, BSS-S 172, NMV F50397–50398, 14; Stn BSS-G 205, NMV F50399, 1. NMV unregistered, Stns BSS 48, 49, 64, 69, 108, 111, 115, 125, 156, 160, 193, 200, 202, 209 (a selection of material from over 60 stations).

New South Wales: North Head, Sydney, Shelf Benthic Survey, 32 m, 25 May 1972, AM W6505, 1 specimen (part of material identified as *P. steenstrupi* by Blake and Kudenov, 1978).

Description. Prostomium with anterior margin rounded, widest anteriorly, extending back as narrow caruncle back to posterior margin of setiger 2 (Fig. 24). Holotype with one pair of red comma shaped eyes, other material with 0–2 pairs of eyes. Peristomium fused to setiger 1, not forming lateral wings. Setiger 1 with notosetae, neurosetae and reduced parapodial lobes. Four pairs of branchiae on setigers 2–5, branchiae 1 and 4 up to 3 times as long as branchiae 2 and 3. First pair of branchiae with long pinnae on posterior surfaces, bare distally. Pinnae apparently readily lost from the first pair of branchiae: many specimens with only a few pinnae and most larger specimens (0.6 mm wide and more) with no pinnae visible on first pair of branchiae (Fig. 25). Branchiae 2 and 3 apinnate, stout triangles similar in length to notopodial lobes. Fourth pair of branchiae always with long pinnae basally on the posterior surfaces. Notopodia largest over setigers 2–6, becoming lower, rounded from setiger 7 and reducing posteriorly to about setiger 35. Notopodia becoming elongate to triangular from about setiger 35 and on all subsequent setigers. Neuropodia largest over setigers 2–4, with prominent acuminate ventral process on setiger 2, becoming rounded and reducing in size posteriorly back to about setiger 40 (Figs 25–29), thereafter present as a triangular lobe. Notopodia unite to form prominent dorsal crest on setiger 7. Dorsal crests much lower on setiger 8 and posteriorly, present as low ridges back to setiger 20 in holotype or to setigers 17-21 in other material. Interparapodial pouches absent in type series but occur over some or all of setigers 9–13 in some non-type specimens.

Setae anteriorly bilimbate granulate capillaries in notopodia and neuropodia, changing to smooth nonlimbate capillaries between about setigers 10–15. Unilimbate granulate sabre setae (Fig. 30) appear in ventral neuropodial positions from setiger 10. Hooded hooks with 4–5 pairs of apical teeth above main fang (Figs 31–32) appear in neuropodia at setiger 19 and in notopodia at setiger 32 in holotype (hooded hooks first present earlier in smaller specimens, appearing in neuropodia at setigers 13–21 and in notopodia at setigers 21–39 in other material studied). Neuropodial hooded hooks with longer



Figures 24–32. *Prionospio kulin*: 24, dorsal view, holotype NMV F50377; 25, setiger 2 parapodium, holotype; 26, setiger 2 parapodium, paratype NMV F50387; 27, setiger 4 parapodium, holotype; 28, setiger 5 parapodium, paratype NMV F50387; 29, setiger 10 parapodium, paratype NMV F50387; 30, sabre seta, setiger 19, holotype; 31, neuropodial hooded hook, setiger 19, holotype; 32, notopodial hooded hook, holotype.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 24); 0.2 mm (Figs 25–29); 0.02 mm (Figs 30–32).

shaft than in other species of *Prionospio* examined in this study, projecting beyond neuropodial lamella. Pygidium unknown (all specimens incomplete or damaged posteriorly).

Remarks. Prionospio kulin sp. nov. belongs to the *P. steenstrupi* group of species which are characterised by having the first and fourth pair of branchiae pinnate and hooded hooks with 4–6 pairs of apical teeth. The 12 previously known species of the *P. steenstrupi* group were compared in Table 3 of Maciolek (1985: 375, species 1–12). Three additional species in the *P. steenstrupi* group are described in this paper: *P. coorilla*, *P. kulin* and *P. nirripa* spp. nov. *Prionospio kulin* is most similar to *P. steenstrupi* as redescribed by Maciolek (1985) but can be distinguished from the latter species by the earlier appearance of notopodial hooded hooks (at

setigers 25–39, compared with at setigers 43–54 in *P. steenstrupi*); the shape of the prostomium, which is widest anteriorly and narrower at the level of the eyes in *P. kulin* but is equally wide at the level of the eyes in *P. steenstrupi*; and the absence of peristomial wings in *P. kulin* (*P. steenstrupi* has low peristomial wings). *Prionospio kulin* is also characterised by the constancy of several other characters: dorsal crests are present over setigers 7 to 18–21 and sabre setae are always present from setiger 10 in *P. kulin* but both characters were reported by Maciolek (1985) to be more variable in *P. steenstrupi*. Among the Australian species of *Prionospio*, *P. kulin* is most similar to *P. multicristata* Hutchings and Rainer, 1979 but can be distinguished by the having a shorter caruncle (extending to setiger 2) and having dorsal crests limited to setigers 7–21 at most (*P. multicristata* has a caruncle extending to setiger 4 and dorsal crests on setigers 7–30).

The apparent ease with which the pinnae are lost from the first pair of branchiae in *P. kulin* requires comment. Presence/absence of branchial pinnae is a major taxonomic character within genera in the *Prionospio* complex and consistent absence of pinnae in any material under study would normally imply the presence of an additional species. However in this study no additional characters were found which would consistently separate specimens on the basis of presence/absence of first branchial pinnae. Even among those specimens which do possess pinnae on the first pair of branchiae, those pinnae are often fragile and few in number. Figure 33 shows that this variability appears to be size related and all material is thus referred to a single species. Branchial pinnae appear to be very readily shed in *P. kulin* and this character should be assessed cautiously in small or poorly preserved samples. (Such extreme fragility of branchial pinnae was not seen in any other species of *Prionospio* examined in this study.)

Etymology. *Prionospio kulin* is named for the four tribes of Australian aborigines from the

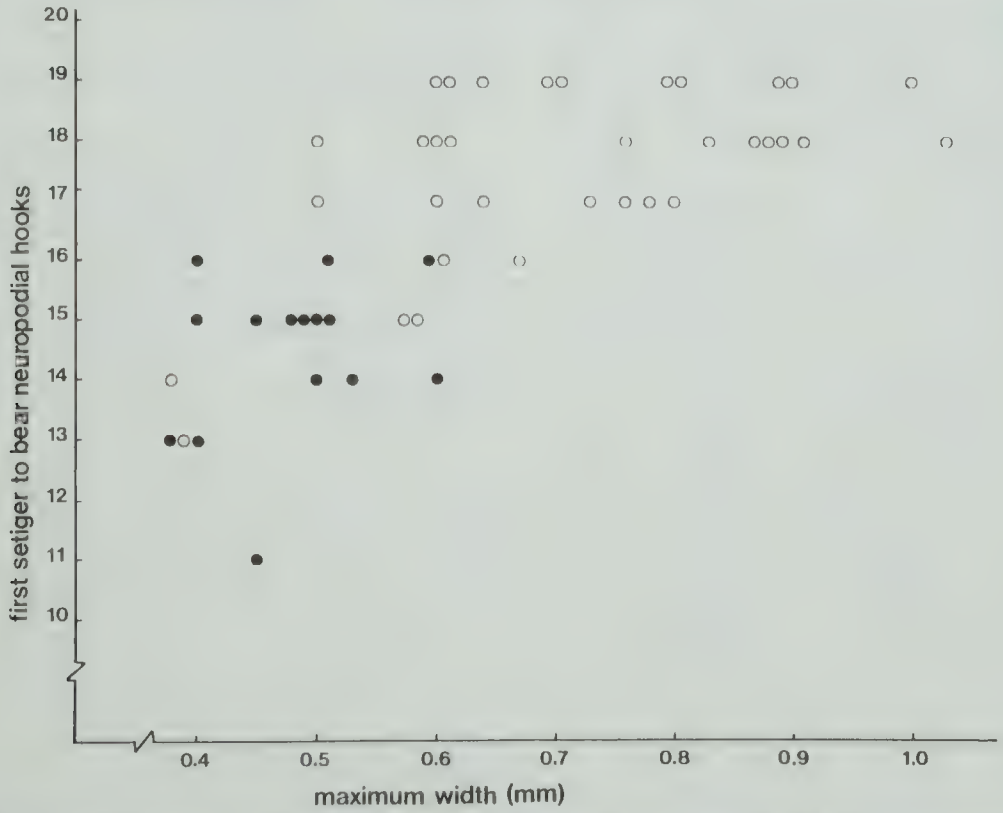


Figure 33. *Prionospio kulin*. Graph of first setiger to bear neuropodial hooks versus maximum width (in mm, including parapodia). Open circles = specimens apparently lacking pinnae on first pair of branchiae, closed circles = specimens with pinnate first pair of branchiae.

Port Phillip region of Victoria; these tribes collectively called themselves the Kulin "nation".

Distribution. Prionospio kulin is widespread in Bass Strait on a variety of sediments, 16–137 m, also known from a single record off North Head, Sydney, 32 m.

Prionospio multicristata
Hutchings and Rainer, 1979

Prionospio multicristata Hutchings and Rainer, 1979: 768–771, fig 5A–I.—Hutchings and Turvey, 1984: 11–12.—Hutchings and Murray, 1984: 60–61. —Hartmann-Schröder, 1982: 86–87, 1984: 36.

Prionospio malmgreni.—Hutchings, 1974: 182 (not Claparéde, 1870).

Material examined. South Australia: Port Lincoln: HT Stn 11A, AM W194022, 1 specimen; HT Stn 13A, AM W194021, 2.

New South Wales: Careel Bay, Pittwater, Posidonia, 30 Mar 1973, P. Hutchings, AM W8286, holotype. Material identified as *P. steenstrupi* by Blake and Kudenov, 1978: Wallis Lake, Forster, boatsheds, 0.3 m, *Zostera* beds and sand, 24 May 1968, H. Paxton, AM W4242, 1; Wallis Lake, Forster, boatsheds, 0.3 m, *Zostera* beds and sand, 21 May 1968, H. Paxton, AM W4254, 2; Wallis Lake, mixed weed bed, Dec 1970, Dixon and O'Gower, AM W5018, 1; Wallis Lake, *Zostera* beds, Dixon and O'Gower, Dec 1970, AM W5020, 19; Wallis Lake, near Charlotte Bay, thick weed and clayey mud, Dixon and O'Gower, Dec 1970, AM W5021, 2.

Description. Size range of material 48 setigers, 8 mm long, 0.5 mm wide to 69 setigers, 22 mm long, 1.0 mm wide (anterior fragments). Prostomium rounded anteriorly, extending back as narrow caruncle back to anterior margin of setiger 4. Two pairs of black eyes, posterior pair larger, comma shaped. Peristomium forming low lateral wings. Four pairs of branchiae: first and fourth pairs with long pinnae basally, bare distally, second and third pairs apinnate, shorter and triangular. Neuropodial lamellae of setiger 2 produced ventrally into acuminate lobes. Low dorsal crests from setiger 7 to about setiger 30. Neuropodial sabre setae from setiger 10, hooded hooks from setigers 14-18; notopodial hooded hooks from setigers 27–40. Hooded hooks with 4-5 pairs of teeth above the main fang.

Remarks. I have re-examined Blake and Kudenov's (1978) records of *Prionospio steenstrupi* from south-eastern Australia and compared this material with Maciolek's (1985) redescription of *P. steenstrupi* (based on the syntype series). Most of Blake and Kudenov's material was collected from the Wallis Lake estuary, New South Wales. These specimens (listed above) agree in every detail with the holotype and original description of *P. multicristata* Hutchings and Rainer and are thus referred to that species. *Prionospio multicristata* is distinguished from other Australian species of the genus by the long caruncle, the ventral neuropodial projection of setiger 2 and the dorsal crests on setigers 7–30. I have referred the remainder of Blake and Kudenov's material of *P. steenstrupi* to *P. dubia* Day, 1961, *P. coorilla* sp. nov. and *P. kulin* sp. nov. (see above).

Distribution. Western Australia, South Australia, New South Wales and southern Queensland, mostly from estuaries (Hartmann-Schröder, 1982, 1984; Hutchings and Murray, 1984).

Prionospio multipinnulata
Blake and Kudenov, 1978

Prionospio (Aquilaspio) multipinnulata Blake and Kudenov, 1978: 219–221, fig 24a–f.—Hartmann-Schröder, 1984: 81–82, 1986: 54.

Aquilaspio multipinnulata.—Hutchings and Turvey, 1984: 9.

Material examined. Victoria: Port Phillip Bay, PPBES Stn 953, NMV G2836, holotype; PPBES Stn 953, NMV G2833-2835, 5 paratypes.

Tasmania: Fortescue Bay, Tasman Peninsula, 10 m, sand, 7 June 1977, Van Veen Grab, A.J. Dartnall, TM K1004, 11 specimens; Pirates Bay, Eaglehawk Neck, 8 m, sand, 7 June 1977, Van Veen Grab, A.J. Dartnall, TM K1005, 2; off Spring Beach, SE of Orford, 20 m, 9 June 1977, A.J. Dartnall, TM K1006, 3. Stn TAS 11, NMV F50471, 4; Stn TAS 18, NMV F50472, 30; Stn TAS 35, NMV F50465, 7; Stn TAS 36, NMV F50456, 2; Stn TAS 37, NMV F50460, 30; Stn TAS 38, NMV F50457, 1; Stn TAS 40, NMV F50461, 3; Stn TAS 41, NMV F50459, 2; Stn TAS 47, NMV F50458, 1; Stn TAS 48, NMV F50462, 1.

Description. Size range of material 49 setigers, 9 mm long, 0.4 mm wide to 115 setigers, 25 mm long, 0.7 mm wide (anterior fragments). Prostomium rounded anteriorly, extending as narrow caruncle to anterior margin of setiger 2. Setiger 1 well developed, fused to peristomium which forms low lateral wings. Four pairs of branchiae on setigers 2–5, each branchia with digitiform pinnules on the posterior surfaces. Dorsal crests absent or occasionally present as very low membranes (barely visible) from about setiger 10. Sabre setae in ventral neuropodial positions from setiger 10–11. Hooded hooks, with 4–5 pairs of teeth above main fang, appear in neuropodia from setiger 17-22, and in notopodia from setiger 26–30. Pygidium with long medial cirrus and pair of lateral lappets.

Remarks. The specimens examined here agree closely with the descriptions of Blake and Kudenov (1978) and Hutchings and Turvey (1984), the only difference being that some specimens have more sparsely distributed branchial pinnules than in the type series.

Distribution. South Australia, Tasmania, Victoria, southern New South Wales. This is the first record of *P. multipinnulata* from Tasmania. Two small specimens close to *P. multipinnulata* were reported from Western Australia by Hartmann-Schröder (1984), but the material was too small to be confident of a specific identification.

Prionospio nirripa sp. nov.

Figures 34–40

Material examined. 250 specimens, size range 42 setigers, 12 mm long, 0.5 mm wide (entire specimen) to 61 setigers, 22 mm long, 0.9 mm wide (anterior fragment).

Holotype: anterior fragment, 28 setigers, 9 mm long, 0.9 mm wide, NMV F50359. Western Bass Strait, 27 km S of Cape Otway, 39°6.0′S, 143°35.8′E, 95 m, fine carbonate sand, Smith-McIntyre Grab, 31 Jan 1981, M. Gomon et al. (Stn BSS-G 118).

Paratypes: Western Bass Strait, type locality: NMV F50360–50361, 2 paratypes. Western Bass Strait, 30 km SSW of Cape Otway, 39°8′S, 143°24′E, 77 m, medium carbonate sand, Smith-McIntyre Grab, 8 Oct 1980, G. Poore (Stn BSS-G 56) USNM 122748, 4 paratypes; 65 km SSW of Cape Otway, 39°22′S, 143°10′E, 99 m, medium carbonate sand, pipe dredge, 10 Oct 1980, G. Poore (Stn BSS 71), AM W203950, 1 paratype; 30 km SW of Cape Otway, 39°01.1′S, 143°15.2′E, 84 m, medium sand, epibenthic sled, 31 Jan 1981, M. Gomon et al. (Stn BSS-S 121), AM W203951, 2 paratypes; 35 km W of Cape Otway, 38°50.0′S, 143°7.5′E, 69 m, medium carbonate sand, Smith McIntyre Grab, 20 Nov 1981, G. Poore et al. (Stn BSS-G 186), NMW.Z.1989.116.4, 3 paratypes.

Other material: Western Bass Strait: Stn BSS 55, NMV F50362, 3 specimens; Stn BSS-G 115, NMV F50363, 1 ; Stn BSS-G 171, NMV F50364, 7; Stn BSS-G 200, NMV F50365, 4. NMV unregistered: Stns BSS 47, 49, 50, 51, 55, 56, 57, 60, 61, 71, 75, 76, 77, 78, 108, 112, 115, 118, 119, 120, 121, 162, 165, 163, 165, 168, 171, 172, 173, 175, 182, 185, 186, 188, 193, 197, 198, 200, 201, 202, 205, 206, 208, (total of 223 specimens).

Description. Prostomium broad anteriorly with shallow indentation in anterior margin (Fig. 34). Two pairs of red eyes, anterior pair more widely separated and more deeply embedded (indistinct in holotype and some other specimens), posterior pair distinct in all material. Prostomium produced posteriorly into a long narrow

Figures 34–40. *Prionospio nirripa*, holotype NMV F50359: 34, dorsal view; 35, setiger 2 parapodium; 36, setiger 3 parapodium; 37, setiger 5 parapodium; 38, setiger 10 parapodium; 39, sabre seta, setiger 17; 40, neuropodial hooded hook, setiger 17. h, notopodial hooded hook, setiger 51, USNM paratype.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 34); 0.2 mm (Figs 35–38); 0.02 mm (Figs 39, 40).

caruncle extending back to posterior margin of setiger 2, attached to dorsum throughout. Peristomium fused to setiger 1, lateral wings absent. Four pairs of branchiae on setigers 2–5. First pair of branchiae as long as or up to twice as long as notopodial lobes, with long digitiform pinnae on posterior surfaces, bare anteriorly and on extreme basal and distal regions. Branchiae 2 and 3 equal in length to notopodial lobes, stout triangular, apinnate but with ciliated lateral margins. Fourth pair of branchiae 2 to 4 times as long as branchiae 2 and 3, with long digitiform pinnae on posterior surfaces, bare anteriorly and on extreme basal region. Setiger 1 well developed, with small ovoid parapodial lobes and setae in noto- and neuropodia. Notopodia of setigers 2–9 triangular lamellae, largest on setigers 3–5. Notopodia of setiger 10 and subsequent setigers becoming sub-ovoid in shape and extending across dorsum as low continuous dorsal crest from setiger 10. Dorsal crest reducing posteriorly but still present (but membranous and difficult to see) at least as far back as setiger 30. Neuropodium of setiger 2 distinctive, with a ventrally produced triangular lobe (Fig. 35), neuropodia of setiger 3 and subsequent setigers trapezoid in shape, reducing in size on posterior setigers (Figs 35–38). Neuropodia with low presetal ridge.

Notosetae of setiger 1 a single bundle of granulate unilimbate capillaries, setigers 2 to about 20 with anterior row of short, wide, bilimbate granulate capillaries and posterior row of longer curved bilimbate granulate capillaries. Posterior notosetae (from about setiger 15) unilimbate smooth capillaries. Neurosetae uni- and bilimbate granulate capillaries anteriorly, granulae becoming less obvious on setae of posterior setigers; capillaries smooth and unilimbate from about setiger 15. One or two large granulate sheathed sabre setae (Fig. 39) in ventral neuropodial positions from setiger 10. Hooded hooks with 5–6 pairs of teeth above main fang (Fig. 40) appear in neuropodia at setiger 17 in holotype, at setigers 15–17 in most specimens or as early as setiger 14 in small worms. Hooded hooks identical to those in neuropodia appear in notopodia from setigers 22–26 in small specimens (0.6 mm wide) or later at setiger 35–36 in specimens 1.0 mm wide. Pygidium typical for genus, with long medial cirrus and pair of lateral lappets.

Remarks. Prionospio nirripa belongs to the *P. steenstrupi* group of species which have the first and fourth pairs of branchiae pinnate and the second and third pairs apinnate. The *P. steenstrupi* group now comprises 15 species, including three new species described in this paper (*P. coorilla*, *P. kulin* and *P. nirripa*). The 12 previously known species were compared in Table 3 of Maciolek (1985: 375, species 1–12). *Prionospio nirripa* most closely resembles *P. multicristata* Hutchings and Rainer, 1979 in the setigers at which sabre setae and hooded hooks appear and in the ventral triangular projection of the neuropodia of setiger 2. The two species differ in the position at which dorsal crests occur: *P. multicristata* has a high dorsal crest on setiger 7, decreasing regularly in height posteriorly to about setiger 30 whereas *P. nirripa* has low dorsal crests on setiger 10, decreasing posteriorly to at least setiger 30. *Prionispio nirripa* also has a shorter caruncle than *P. multicristata* and differs further in the arrangement of the pinnae on the first and fourth pairs of branchiae: the branchiae are densely pinnate basally in *P. multicristata* and bare distally whereas in *P. nirripa* the branchiae are bare or sparsely pinnate basally and densely pinnate on the medial and distal portion. *Prionospio multicristata* has been recorded from South Australia, New South Wales and Queensland, mostly from estuaries. *Prionospio nirripa* is known only from Bass Strait where it occurs widely on carbonate sediments, 21 to 99 m depth.

Etymology. The specific name *nirripa* is derived from an Australian aboriginal word meaning "the sea".

Distribution. Widespread in eastern and western Bass Strait on a variety of sandy and muddy sediments, 21–99 m depth.

Prionospio pilkena sp. nov.

Figures 41–47

Material examined. 6 specimens, anterior fragments, size range 48 setigers, 10 mm long, 0.25 mm wide to 30 setigers, 4.5 mm long, 0.35 mm wide.

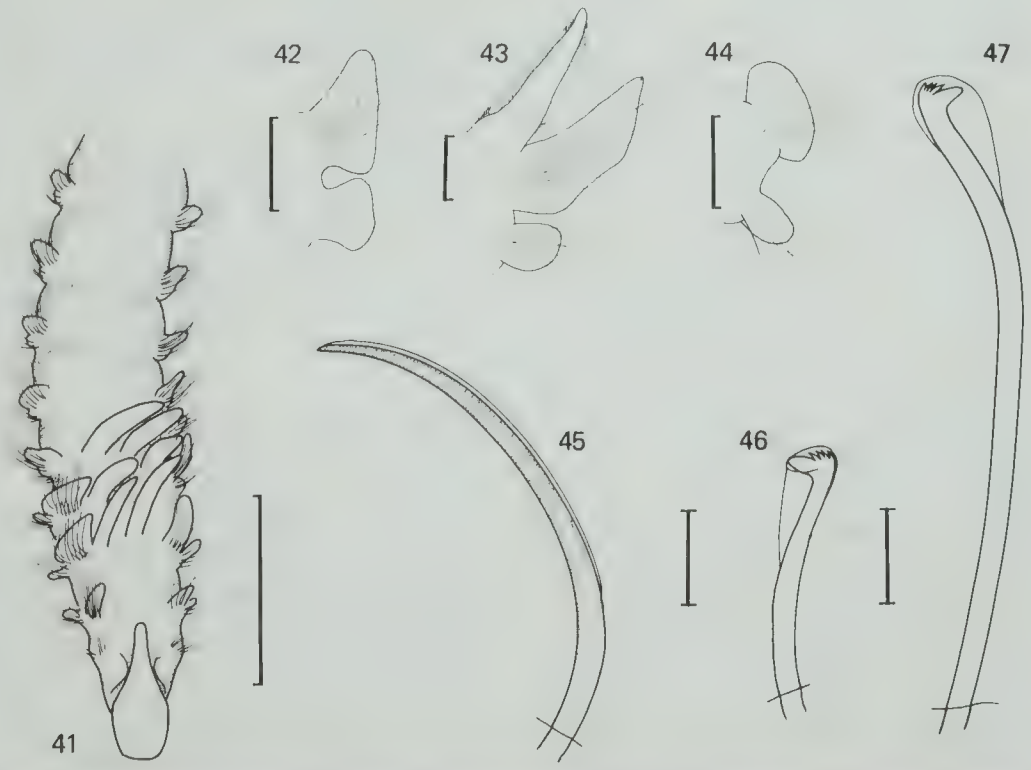
Holotype: anterior fragment, 57 setigers, 15 mm long, 0.35 mm wide, NMV F50407. Western Bass Strait, 65 km SSW of Cape Otway, 39°21′S, 143°06′E, 101 m, medium carbonate sand, pipe dredge, 10 Oct 1980, G. Poore et al. (Stn BSS 70).

Paratypes: Western Bass Strait, type locality, NMV F50408, 1 paratype. Western Bass Strait, 15 km S of Cape Otway, 39°00′S, 143°32′E, 79 m, medium carbonate sand, naturalists dredge, 8 Oct 1980, G. Poore et al. (Stn BSS 50), NMV F50409, 1 paratype. Western Bass Strait, 62 km SW of Cape Otway, 39°18′S, 143°03′E, 113 m, coarse carbonate sand, Smith McIntyre Grab, 10 Oct 1980, G. Poore et al. (Stn BSS 69), AM W203952, 1 paratype. South-western Bass Strait, mid-point of strait separating Three Hummock

Island and Walker Island, NW Tasmania, 40°31′S, 144°56′E, 27 m, very coarse shell, Smith McIntyre Grab, 2 Nov 1980, P. Forsyth et al. (Stn BSS-G 109), USNM 122749, 1 paratype. Western Bass Strait, 30 km S of Warrnambool, 38°42.8′S, 142°35.6′E, 69 m, coarse sand, pipe dredge, 20 Nov 1981, R. Wilson et al., (Stn BSS 189), NMW.Z.1989.116.5, 1 paratype.

Description. Prostomium broadly rounded anteriorly, narrowing sharply in posterior third to form caruncle extending back to posterior margin of setiger 1 (Fig. 41). No nuchal organ or eyes visible. Peristomium fused to setiger 1, forming low lateral wings which partly enclose the posterior third of prostomium. Setiger 1 reduced, with few capillary noto- and neurosetae but without parapodial lamellae. Notopodia lanceolate lobes, longest over setigers 2–4, thereafter reducing quickly to low rounded lobes, very small and barely visible by about setiger 20. Neuropodia largest over setigers 2–4 (Figs 42–44), ovoid in shape and reducing in size posteriorly from setiger 3 becoming vestigial rounded lobes by about setiger 20. Three pairs of apinnate branchiae on setigers 3-5, digitiform to slightly lanceolate in form. First pair of branchiae with heavily ciliated margins (Fig. 43) and slightly longer than longest notopodial lobe, other branchiae about equal to notopodial lobe length. Branchiae absent from setiger 2 in all specimens; no branchial scars visible under either light or scanning electron microscopes. Dorsal crests and interparapodial pouches absent.

Notosetae and neurosetae all granulate uni- and bilimbate capillaries in 2 rows anteriorly, reducing to a single row of smooth nonlimbate capillaries in each fascicle by setigers 15-20. Sabre setae appear in ventral neuropodial positions at setigers 15-16 (setiger 15 in holotype). Sabre setae anteriorly heavily granulate and strongly unilimbate (Fig. 45), posteriorly (by about setiger 40) with finer granulae present



Figures 41–47. *Prionospio pilkena*: 41, dorsal view, holotype NMV F50407; 42, setiger 2 parapodium, paratype NMV F50408; 43, setiger 3 parapodium, holotype; 44, setiger 9 parapodium, paratype NMV F50408; 45, sabre seta, setiger 16, holotype; 46, neuropodial hooded hook, setiger 51, holotype; 47, notopodial hooded hook, setiger 49, holotype.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 41); 0.02 mm (Figs 45–47); 0.1 mm (Figs 42–44).

only over distal half. Hooded hooks with 4 pairs of small apical teeth above main fang (Fig. 46) appear in neuropodia at setigers 18–19 (setiger 18 in holotype). Notopodial hooded hooks (Fig. 47), with longer shafts but otherwise identical to neuropodial hooded hooks, appear in holotype at setiger 45, and at setiger 52 in only other specimen to carry notopodial hooded hooks (paratype NMV F50408). Pygidium unknown.

Remarks. Prionospio pilkena is unusual among species in the *Prionospio* complex in lacking branchiae on setiger 2; only 3 other species share this character: *Prionospio banyulensis* Laubier, 1968, *P. ockelmanni* Pleijel, 1985 and *Aurospio boreus* Maciolek, 1981. The genus *Aurospio* Maciolek, 1981 was defined by Maciolek as having two pairs of apinnate branchiae on setigers 3 and 4, branchiae partly fused to the notopodia, and hooded hooks lacking secondary hood. Subsequently, *Prionospio banyulensis* Laubier, 1968 has been questionably referred to *Aurospio* by Maciolek (1985). Nevertheless, no other species of *Prionospio* shares the characters used to define *Aurospio*, and I prefer to retain *Aurospio* as a monotypic genus, containing *A. boreus*, until type material of all taxa can be examined.

Prionospio pilkena is most similar to *P. ockelmanni* and *P. banyulensis*, however the new species can be readily distinguished by the form of the prostomium and caruncle. The prostomium of *P. pilkena* is narrow and elongate and the caruncle extends back to the posterior margin of setiger 2 whereas *P. banyulensis* and *P. ockelmanni* have prostomia which are broader and blunt anteriorly and caruncles which barely extend to the posterior limit of the first setiger. The distribution of setae also distinguish *P. pilkena*: sabre setae appear at setigers 15–16 in *P. pilkena* but are present from setiger 10 in *P. banyulensis* and *P. ockelmanni*, and neuropodial hooded hooks appear at setigers 18–19 in *P. pilkena* and at setiger 12 in *P. banyulensis* and *P. ockelmanni*. (*Prionospio banyulensis* and *P. ockelmanni* are similar in the arrangement of branchiae and setae and may be synonymous.) *Prionospio pilkena* is also similar to *P. japonica* Okuda, 1935 but differs in the structure of the sabre setae have an unusual long fine point in *P. japonica* (Okuda, 1935: fig. 1e) which is lacking in *P. pilkena*, in lacking branchiae on setiger 2, in the later appearance of sabre setae (at setigers 15-16 as against at setiger 10 in *P. japonica*) and the later appearance of notopodial hooded hooks (at setiger 45–52 as against at setiger 27 in *P. japonica*).

The absence of dorsal crests, the strongly reduced notopodia (except on setigers 3–5) and the presence of apinnate branchiae on setigers 3–5 only, readily distinguish *P. pilkena* from all other Australian species of *Prionospio*.

Etymology. The specific name *pilkena* is derived from an Australian aboriginal word meaning "different".

Distribution. Known only from six specimens from western Bass Strait, south-eastern Australia, 27–113 m, carbonate sediments.

Prionospio tatura sp. nov.

Figures 48–56

Prionospio (Minuspio) cirrifera.—Blake and Kudenov, 1978: 222–224, Fig. 25a (in part, not Wirén, 1883).

Material examined. Over 200 specimens, size range 70 setigers, 7 mm long, 0.3 mm wide to 70 setigers, 9 mm long, 0.4 mm wide (entire worms).

Holotype: entire specimen, 70 setigers, 13 mm long, 0.3 mm wide, NMV F53898, Hobsons Bay and Yarra River, Port Phillip Bay, Victoria, 37°50′S, 144°53′E, about 8 m, Smith-McIntyre Grab, 9–11 Mar 1971, G.Poore et al., Marine Studies Group (PPBES Stn 131).

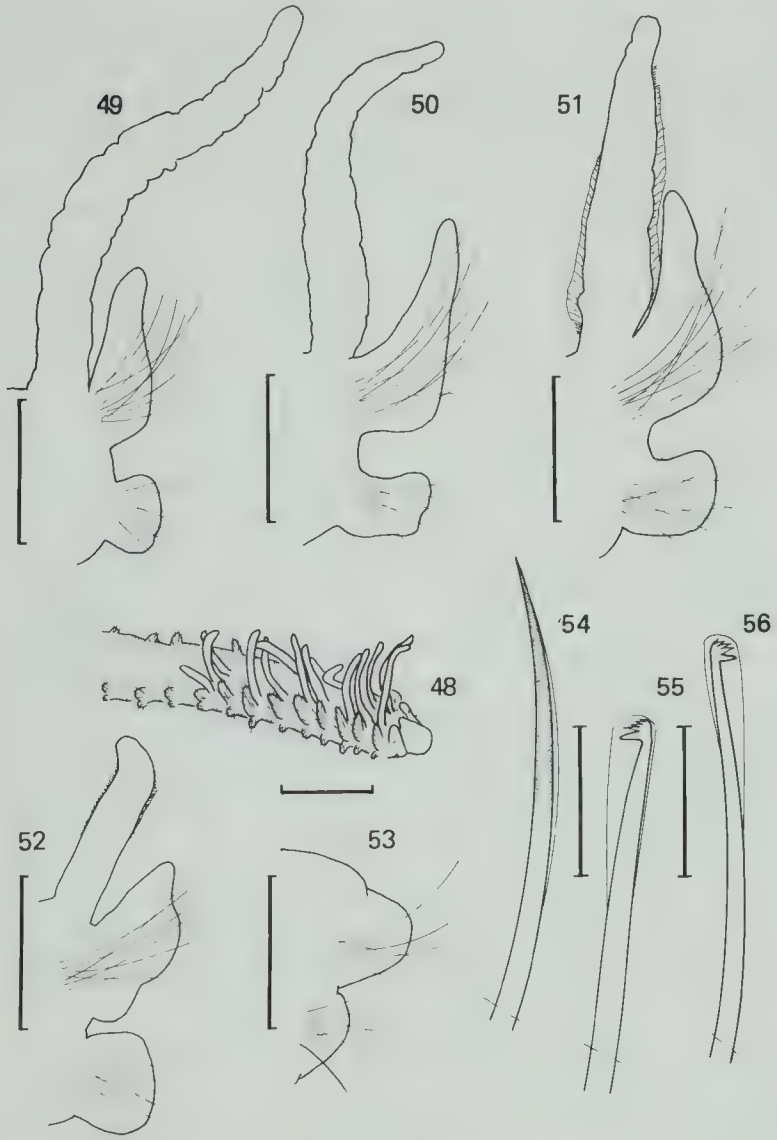
Paratypes: Hobsons Bay and Yarra River, type locality, NMV F53899–53902, 20 paratypes; AM W203953, 10 paratypes; NMW.Z.1989.116.6, 10 paratypes; USNM 122750, 10 paratypes.

Other material: Western Australia: Nornalup, J. Shaw, NMV F53903, 1 specimen.

Victoria: PPBES Stn 128, NMV G3155, 9 specimens; PPBES Stn 134, NMV G3197, 109; PPBES Stn 952, NMV G3151, 36; Gippsland Lakes, Paynesville, 2 m, sand, J.D. Kudenov, 7 Aug 1975, NMV G3145, 20.

Comparative material of other taxa. Prionospio multibranchiata.—Mackie, 1984 (not Berkeley, 1927): Scotland: Loch Creran (upper basin), Stn P, 25 m, mud, A.S.Y. Mackie, 14 Feb 1978, NMW Z.1985.023.19, 10 specimens.

Description. Prostomium widest at mid-point, broadly rounded anteriorly, produced posteriorly into narrow caruncle extending back to posterior margin of setiger 1 (Fig. 48). Paired nuchal organs surround caruncle. One or 2 pairs of red eyes, sometimes faint or absent. Peristomium partly fused to setiger 1, forming low lateral wings. Setiger 1 with small but distinct notopodial and neuropodial lobes, both with setae. Notopodia asymmetrical lanceolate lobes, largest on setigers 2–7, reducing to low rounded lobes by about setiger 12, then reducing further so as to be barely visible by setiger 20. Neuropodia irregular in shape, largest over anterior setigers, reduc-



Figures 48–56. *Prionospio tatura*: 48, dorsal view, holotype NMV F53898. 49– 55, paratype NMV F53899: 49, setiger 2 parapodium; 50, setiger 3 parapodium; 51, setiger 4 parapodium; 52, setiger 9 parapodium; 53, setiger 13 parapodium; 54, sabre seta, setiger 25; 55, neuropodial hooded hook, setiger 25. 56, notopodial hooded hook, setiger 57, paratype NMV F53900.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 48); 0.1 mm (Figs 49–53); 0.02 mm (Figs 54–56).

ing to low rounded lobes by setiger 12 (Figs 49–53). Six to 11 pairs of apinnate branchiae from setiger 2 (9 pairs in holotype), posterior branchiae with ciliated margins. First pair of branchiae 2–3 times as long as notopodium, branchiae of subsequent setigers decreasing in length with posterior-most (and shortest) branchial pair less than twice as long as notopodia and about one third as long as first pair of branchiae. Dorsal crests and interparapodial pouches absent.

Notosetae and neurosetae all granulate limbate capillaries in 2 rows anteriorly, reducing to a single row by about setiger 15. Granulate sheathed sabre setae (Fig. 54) appear in neuropodia at setigers 9–12 (setiger 10 in holotype).

Hooded hooks with 4 pairs of small teeth above the main fang (Fig. 55) appear in neuropodia at setigers 13–17 (setiger 15 in holotype). Notopodial hooded hooks (Fig. 56), with longer shafts but otherwise identical to neuropodial hooded hooks, appear at setigers 23–38 (setiger 33 in holotype). Pygidium with short median cirrus and pair of triangular lateral lappets.

Remarks. Among species of *Prionospio* with only apinnate branchiae (summarised by Maciolek, 1985: Table 4) *P. tatura* is most similar to *P. cirrifera* Wirén, 1883 and *P. multibranchiata* Berkeley, 1927. *Prionospio cirrifera* was redescribed by Mackie (1984) and can be distinguished from *P. tatura* (and 2 related Australian species: *P. wambiri* and *P. yuriel* spp. nov., described below) by the shorter branchiae, the longer caruncle (extending to the posterior margin of setiger 2 in *P. cirrifera*) and the presence of dorsal crests on post-branchial setigers. *Prionospio cirrifera* also differs in having acuminate ventral prolongation of the neuropodial lamellae of setiger 2. Mackie (1984) also provided a description of *P. multibranchiata* based on material from Scotland, however subsequent examination of specimens from near the type locality (Vancouver Island, Canada) indicates that *P. multibranchiata*.—Mackie, 1984 is distinct from *P. multibranchiata* Berkeley, 1927 (A.S.Y. Mackie, pers. comm.). *Prionospio multibranchiata*.—Mackie, 1984 possesses a long caruncle and dorsal crests on post-branchial setigers which distinguish this species from *P. tatura* (and *P. wambiri* and *P. yuriel*). In addition, *P. multibranchiata*.—Mackie, 1984, the first appearance of neuropodial sabre setae and hooded hooks moves posteriorly with increasing size of the specimen; no such size related variation was observed in either *P. tatura*, *P. wambiri* or *P. yuriel*. Mackie's unpublished notes show that *P. multibranchiata* from Canada can be distinguished from all 3 Australian species on the basis of the shorter branchiae and the distribution of sabre setae and hooded hooks (A.S.Y. Mackie, pers. comm.). All southern Australian records of *P. cirrifera* examined here have been referred to *P. tatura*, *P. wambiri* and *P. yuriel*. Additional more northerly records of *Prinospio cirrifera* that are not reassessed here are Blake and Kudenov (1978), Hutchings and Rainer (1979) and Hutchings and Murray (1984) (material from New South Wales and Queensland). I have seen the Hawkesbury River material of Hutchings and Murray (1984); the specimens are in poor condition but appear to represent one or more undescribed species. Additional species might be expected to occur in northern Australia, however it is beyond the scope of this paper to treat the tropical and subtropical fauna. Such a study should in any case include more comprehensive collections from northern Australia than are currently available. It is unlikely that *Prionospio cirrifera* occurs in Australia.

Among Australian species, *P. tatura* is most similar to *P. wambiri* and *P. yuriel*. The three species can be distinguished using the characters given in Table 2.

Table 2. Comparison of three related Australian species of *Prionospio*.

Species	prostomium	branchiae	first setiger with neuropodial: sabre setae	hooded hooks
P. tatura	widest at mid-point	longest on setiger 2, decreasing in length posteriorly	9–12	13–17
P. wambiri	widest close to anterior margin	longest on setiger 2, decreasing in length posteriorly	14–16	16-21
P. yuriel	widest at posterior-most region	longest on setigers 4–5, decreasing in length on anterior and posterior setigers	11–13	14-19

Etymology. The specific name *tatura* is derived from an Australian aboriginal word meaning "small lagoon".

Distribution. Estuarine localities in Western Australia and Victoria.

Prionospio wambiri sp. nov.

Figures 57–65

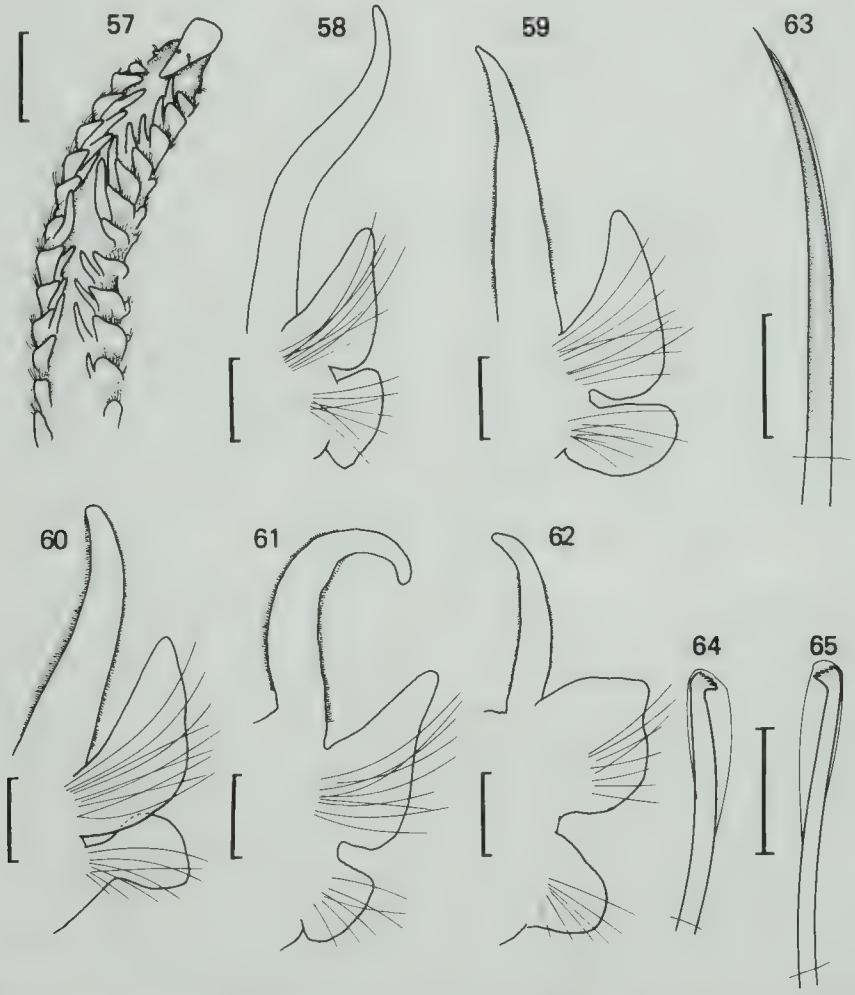
Minuspio cirrifera.—Hutchings and Murray, 1984: 59 (in part; not Wirén, 1883).

Material examined. 26 specimens, size range 35 setigers, 3.5 mm long, 0.3 mm wide (anterior fragment) to 81 setigers, 18 mm long, 0.9 mm wide (entire specimen).

Holotype: entire specimen, 88 setigers, 15 mm long, 0.8 mm wide, NMV F53904. Tasmania, Woodbridge, 43°9.5′S, 147°14.0′E, intertidal, fine muddy sand, hand spade, 28 Apr 1985, R. Wilson (Stn TAS 44).

Paratypes: Tasmania, type locality, NMV F53905-53906, 2 paratypes; AM W203954, 2 paratypes; USNM 122751, 2 paratypes. Tasmania, Dover Jetty, 43°19.0′S, 147°1.0′E, 1.5 m, muddy fine sand and *Zostera*, SCUBA airlift, 27 Apr 1985, R. Wilson (Stn TAS 40), NMW.Z.1989.116.7, 5 paratypes; NMV F53907, 26 paratypes.

Other material: Tasmania: Stn TAS 2, NMV F53908, 4 specimens; Stn TAS 4, NMV F53909, 2; Stn



Figures 57–65. *Prionospio wambiri*: 57, dorsal view, holotype NMV F53904. 58–65, paratype NMV F53905: 58, setiger 2 parapodium; 59, setiger 3 parapodium; 60, setiger 4 parapodium; 61, setiger 9 parapodium; 62, setiger 13 parapodium; 63, sabre seta, setiger 26; 64, neuropodial hooded hook, setiger 26; 65, notopodial hooded hook, setiger 60.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 57); 0.1 mm (Figs 58–62); 0.02 mm (Figs 63–65).

TAS 11, NMV F53910, 1; Stn TAS 41, NMV F53911, 3; Stn TAS 47, NMV F53912, 1; Stn TAS 48, NMV F53913, 8; Stn TAS 51, NMV F53914, 3.

Bass Strait: Stn BSS-S 109, NMV F50400, 1; Stn BSS-S 117, NMV F50401, 1; Stn BSS-S 179, NMV F50402, 1; Stn BSS-S 212, NMV F50403-50404, 2.

New South Wales: Jervis Bay, 25 Apr 1972, New South Wales Fisheries, AM W194090, 1 specimen (part of material of Hutchings and Murray, 1984).

Description. Prostomium widest close to anterior margin, narrower in mid-region and produced posteriorly into narrow caruncle which extends back to posterior margin of setiger 1 (Fig. 57). Paired nuchal organs surround caruncle. One pair of irregularly-shaped red eye spots present, sometimes with additional 1 or 2 pairs of smaller eye spots. Peristomium fused to setiger 1, forming low lateral wings. Setiger 1 with notosetae, neurosetae and small notopodial and neuropodial lobes. Notopodia asymmetrical lanceolate lobes, largest on setigers 2–9, reducing posteriorly to low rounded lobes, barely visible by setiger 20. Neuropodia irregular in shape, largest over setigers 2-9, reducing to low rounded lobes by setiger 20 (Figs 58–62). Neuropodia of setiger 2 with ventrally directed process. Seven to 12 pairs of apinnate branchiae from setiger 2 (9 pairs in holotype), all except anterior 1–2 pairs with ciliated margins. First pair of branchiae longest, 2–2.5 times as long as notopodia, branchiae of subsequent setigers decreasing regularly in length with posterior-most branchial pair 1.5–2 times as long as notopodial lobe and about half as long as first pair of branchiae. Dorsal crests and interparapodial pouches absent.

Notosetae and neurosetae all granulate limbate capillaries in 2 rows anteriorly, reducing to single rows by about setigers 15–20. Granulate limbate sabre setae (Fig. 63) appear in neuropodia at setigers 14–16 (setiger 15 in holotype). Neuropodial hooded hooks (Fig. 64) with 4 pairs of small teeth above the main fang appear at setigers 16–20 (setiger 17 in holotype). Notopodial hooded hooks (Fig. 65), with longer shafts but otherwise identical to neuropodial hooded hooks, appear at setigers 36–50 (setiger 41 in holotype). Pygidium with short median cirrus and pair of triangular lateral lappets.

Remarks. Prionospio wambiri is most similar to *P. tatura* and *P. yuriel*. All three species can be distinguished using the characters given in Table 2. Further comments comparing these three Australian species with related Northern Hemishere taxa are provided in the Remarks section of the account of *P. tatura*.

Etymology. The specific name *wambiri* is derived from an Australian aboriginal word meaning "sea coast".

Distribution. Tasmania, Bass Strait and Jervis Bay, New South Wales, from a variety of sediments, intertidal to 55 m depth.

Prionospio yuriel sp. nov.

Figures 66–74

Prionospio (Minuspio) cirrifera.—Blake and Kudenov, 1978: 222–224, Fig 25a (in part, not Wirén, 1883).

Minuspio cirrifera.—Hutchings and Turvey, 1984: 11 (not Wirén, 1883).—Hutchings and Murray, 1984: 59 (not Wirén, 1883; in part, material from Botany Bay).

Material examined. Over 1200 specimens, size range 30 setigers, 5 mm long, 0.2 mm wide (entire worm), to 34 setigers, 0.5 mm wide, 9 mm long (anterior fragment).

Holotype: anterior fragment, 43 setigers, 8 mm long, 0.3 mm wide, NMV F53915. Victoria, Port Phillip Bay, 9 km E of Portarlington, 38°7.0'S, 144°44.7'E, 4 m, sand, venturi sampler, 16 Nov 1971, Fisheries and Wildlife Department (PPBES Stn 945) (part of material of Blake and Kudenov, 1978).

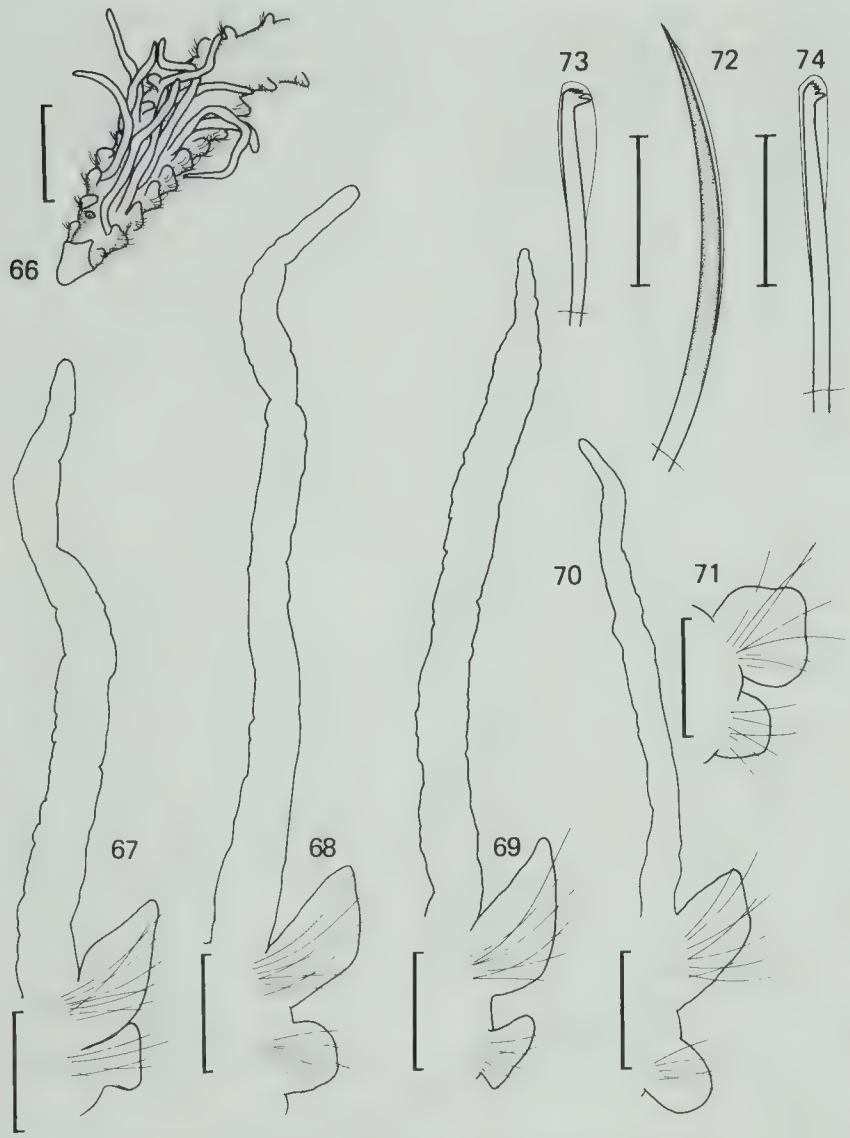
Paratypes: Victoria, Port Phillip Bay, type locality, NMV F53916–53918, NMV G3150, 41 paratypes; AM W203955, 4 paratypes; NMW.Z.1989.116.8, 6 paratypes; USNM 122752, 6 paratypes (part of material of Blake and Kudenov, 1978).

Other material: South Australia: Streaky Bay, HT Stn 02B, AM W19302, 1 specimen (material of Hutchings and Turvey, 1984). Bass Strait: Stn BSS-G 49, NMV F50405, 1 specimen; Stn BSS-G 197, NMV F50406, 1.

Victoria: Port Phillip Bay: PPBES Stn 128, NMV G3155, over 1000 specimens; PPBES Stn 131, NMV G3156, 1; PPBES Stn 901, NMV G3146, 93 specimens; PPBES Stn 913, NMV G3147, 2; PPBES Stn 921, NMV G3148, 9; PPBES Stn 932, NMV G3149, 3; PPBES Stn 952, NMV F53919, 5; PPBES Stn 962, NMV G3152, 1; PPBES Stn 978, NMV G3153; PPBES Stn 983, NMV G3154, 4 (part of material of Blake and Kudenov, 1978).

New South Wales: Towra Point, Botany Bay, *Zostera*, 2 m, 17 Apr 1973, New South Wales Fisheries, AM W16907-16910, 12 specimens (part of material of Hutchings and Murray, 1984).

Description. Prostomium narrow and elongate anteriorly, broadest at posterior-most third, produced posteriorly into narrow caruncle extending to posterior margin of setiger 1 (Fig. 66). Paired nuchal organs surround the caruncle. One pair of faint red eye spots present in some specimens posterior to widest part of prostomium. Peristomium separate from setiger 1, forming low lateral wings. Setiger 1 with both



Figures 66–74. *Prionospio yuriel*: 66–73, paratype NMV F53916: 66, dorsal view; 67, setiger 2 parapodium; 68, setiger 3 parapodium; 69, setiger 4 parapodium; 70, setiger 9 parapodium; 71, setiger 13 parapodium; 72, sabre seta, setiger 25; 73, neuropodial hooded hook, setiger 25; 74, notopodial hooded hook, setiger 43, holotype NMV F53915.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Fig. 66); 0.1 mm (Figs 67–71); 0.02 mm (Figs 72–74).

notosetae and neurosetae, without obvious parapodial lobes. Notopodia asymmetrical lanceolate lobes, largest on setigers 2–5, reducing posteriorly to symmetrical rounded lobes with median protuberances by setiger 12. Notopodia further reduced to low circular lobes by setiger 20, barely visible by setiger 30. Neuropodia largest on setigers 2–4; setigers 2 and 4 with conspicuous dorsally directed lobes (Figs 67, 69). Neuropodia of setigers 3, 5 and subsequent setigers symmetrical semicircular lobes reducing in size posteriorly to low lobes by setiger 12, barely visible by setiger 30 (Figs 68, 70, 71). Six to 9 pairs of apinnate branchiae from setiger 2 (6 pairs in holotype), basal region of branchiae with ciliated margins. Branchiae of setiger 2 about 4 times notopodial length, increasing in length to maximum at setigers 4–5 where branchiae meas-

ure up to 1.5 times length of first pair of branchiae. Branchiae then decrease in length posteriorly, last pair equal to or slightly shorter than first pair of branchiae. Dorsal crests and interparapodial pouches absent.

Notosetae and neurosetae all granulate limbate capillaries in 2 rows anteriorly, reducing to single rows by about setigers 15–20. Granulate limbate sabre setae (Fig. 72) appear in neuropodia at setigers 11–13 (setiger 11 in holotype). Hooded hooks, with 4–5 pairs of small teeth above main fang (Fig. 73), appear in neuropodia at setigers 14–19 (setiger 17 in holotype). Notopodial hooded hooks (Fig. 74), with longer shafts but otherwise identical to neuropodial hooded hooks, appear at setigers 34–42 (setiger 42 in holotype). Pygidium with long median cirrus and pair of very small lateral lappets.

Remarks. Prionospio yuriel is most likely to be confused with the two Australian species described above, *P. tatura* and *P. wambiri*; all three species can be distinguished using the characters given in Table 2. Further comments comparing these three Australian species with related Northern Hemishere taxa are provided in the *Remarks* section of the account of *P. tatura*.

I have examined Hutchings and Murray's (1984) material identified as *P. cirrifera*. The specimens from Botany Bay, New South Wales are referrable to *P. yuriel*. The specimens from the Hawkesbury River, New South Wales are generally in too poor condition to be confident of their identity, however the distribution of sabre setae and hooded hooks indicates that *P. yuriel* and another (possibly undescribed) species may be present in the Hawkesbury.

Etymology. The specific name *yuriel* is derived from an Australian aboriginal word meaning "coastal bay".

Distribution. Inshore waters of South Australia, Victoria and New South Wales from a variety of soft sediments; two records from the continental shelf of Bass Strait 46 and 81 m.

Paraprionospio Caullery, 1914

Diagnosis. Prostomium elongate to spindle-shaped, lacking posterior caruncle. Peristomium fused with achaetous first segment, forming large lateral wings enclosing prostomium. Setiger 1 well developed, distinct from preceding segment. Three pairs of branchiae, from setiger 1, all with flat flabellate or bifoliate pinnules. Distinct transverse dorsal ridge between branchial bases on setiger 1. Hooded hooks with conspicuous striated secondary internal hood.

Type species. Prionospio pinnata Ehlers, 1901, subsequent designation by Caullery, 1914.

Remarks. Yokoyama and Tamai (1981) described 4 "forms" of *Paraprionospio* and recognised many new characters but stopped short of formally describing any new species. The type species is redescribed below from the syntypes with reference to the new characters used by Yokoyama and Tamai.

Paraprionospio coora sp. nov.

Figures 75–83

Paraprionospio pinnata.—Blake and Kudenov, 1978: 209–210 (not Ehlers, 1901).

Material examined. 46 specimens, size range 48 setigers, 8 mm long, 0.4 mm wide (entire specimen) to 37 setigers, 19 mm long, 1.6 mm wide (anterior fragment).

Holotype: entire specimen, 71 setigers, 20 mm long, 0.8 mm wide at setiger 5, NMV F50424. Central Bass Strait, 90 km N of Wynyard, 40°10.9′S, 145°44.3′E, 75 m, sand-silt-clay, Smith-McIntyre Grab, 13 Nov 1981, G. Poore et al. (Stn BSS-G 157).

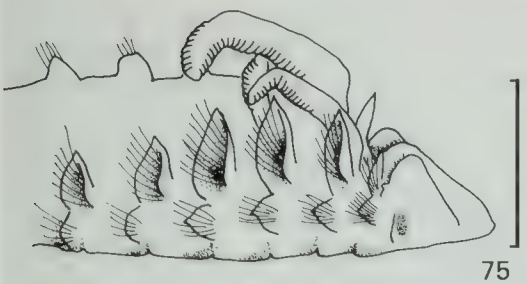
Paratypes: Central Bass Strait, type locality: NMV F50425, 1 paratype. Central Bass Strait, 90 km S of Tidal River, Wilsons Promontory, 39°49.5′S, 146°18.5′E, 82 m, sand-silt-clay, Smith-McIntyre Grab, 13 Nov 1981, G. Poore et al. (Stn BSS-G 158), AM W203956, 1 paratype. Eastern Bass Strait, 60 km E of North Point, Flinders Island, 39°44.8′S, 148°40.6′E, 124 m, clayey sand, Smith-McIntyre Grab, G. Poore et al. (Stn BSS-G 167), USNM 122753, 2 paratypes; NMW.Z.1989.116.9, 2 paratypes; AM W203957, 2 paratypes; NMV F50426- 50430, 5 paratypes.

Other material: Tasmania: Stn TAS 6, NMV F50470, 1 specimen; Stn TAS 30, NMV F50476, 3; Stn TAS 32, NMV F50481, 1.

Bass Strait: Stn BSS-G 115, NMV F50431, 3 specimens; Stn BSS-S 115, NMV F50421, 7; Stn BSS-S 155, NMV F50432, 1; Stn BSS-G 159, NMV F50433, 1; Stn

Figures 75–83. *Paraprionospio coora*: 75, dorso-lateral view, paratype NMV F50426. 76-83, holotype NMV F50424: 76, dorsal view, prostomium; 77, setiger 2 parapodium, anterior view; 78, setiger 9 parapodium, anterior view; 79, setiger 24 parapodium, posterior view; 80, setiger 45 parapodium, posterior view; 81, sabre seta, setiger 13; 82, neuropodial hooded hook, setiger 13; 83, notopodial hooded hook, setiger 56.

Scale bars represent: 2.0 mm (Fig. 75); 0.5 mm (Figs 76, 78–80); 0.2 mm (Fig. 77); 0.02 mm (Figs 81–83).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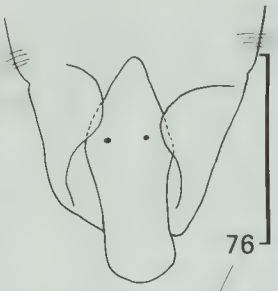
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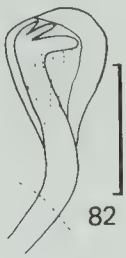
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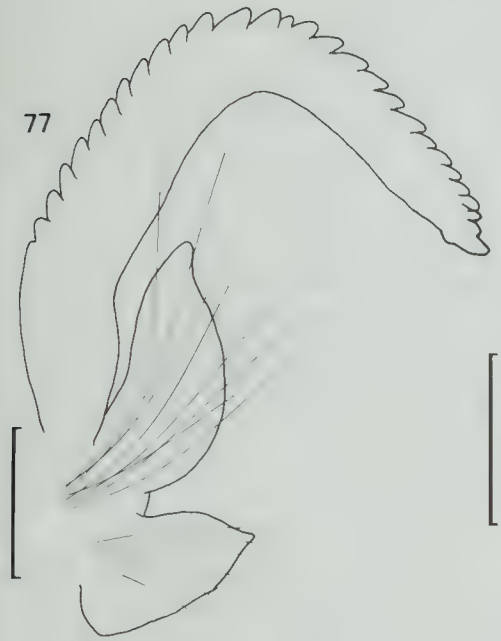
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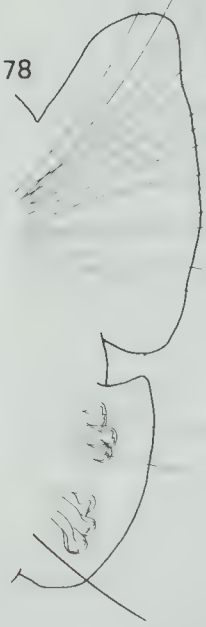
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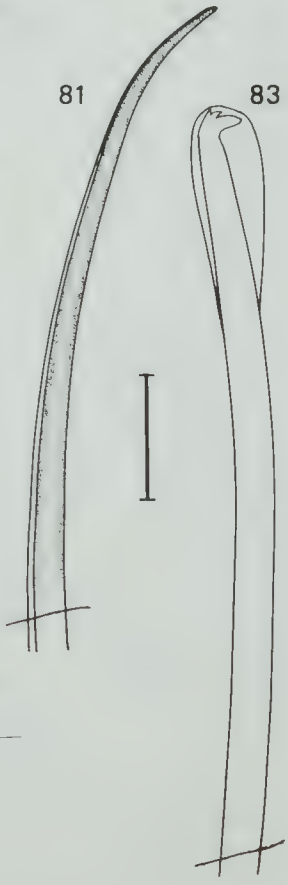
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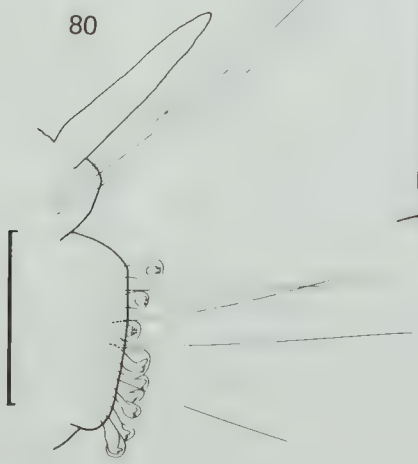
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BSS-S 159, NMV F50434, 1; Stn BSS-G 165, NMV F50435, 2; BSS-S 167, NMV F50436, 3; Stn BSS-G 168, NMV F50437, 1; Stn BSS-G 169, NMV F50438, F50439, 2; Stn BSS-S 175, NMV F50440, 1; Stn BSS-S 209, NMV F50441, 1.

New South Wales: Stockton Bight, 6-9 m, pipe dredge, 9 Jul 1970, N. Ruello, AM W4410, 2 specimens; off Malabar, SBS Stn CA5, 28 m, 22 May 1972, AM W6501, 2; off Malabar, SBS Stn B3 S1, AM W6502, 1 (material of Blake and Kudenov, 1978).

Description. Prostomium rounded anteriorly, spindle shaped, widest at level of eyes, extending posteriorly as low raised ridge almost to setiger 1 (Fig. 76). Two pairs of red to black eyes, anterior pair more widely separated and partly hidden beneath peristomial wings (a few specimens with only 1 pair of eyes or none). Palps ventrally grooved and with basal sheath (palps lost from holotype and many other specimens). Peristomium extending dorsally as pair of lateral wings partly enclosing the prostomium (Fig. 75). Most specimens with orange-brown pigmented patch on each peristomial wing; patch absent in holotype and several other specimens. Posterior margin of each peristomial wing with a small papilla. Muscular gizzard visible between about setigers 6–9 (between setigers 7–8 on holotype). Branchiae on setigers 1–3, first pair usually the largest (many specimens with one or more branchiae missing). First pair of branchiae joined basally by prominent dorsal crest and with several triangular lamellae basally on anterior surfaces. Dorsal crests otherwise absent. Branchiae otherwise bare anteriorly and basally, with closely packed lamellar plates enclosing lateral and posterior surfaces. Branchial lamellae consist of few bifoliate plates basally; therafter all lamellae flabellate and continue to tip of branchiae. Some small specimens, and specimens with apparently regenerating branchiae, with bifoliate lamellae over all or most branchiae; with flabellate lamellae, if present, restricted to extreme distal portion. No slender filament at base of third pair of branchiae. Notopodia anteriorly elongate triangular lobes, longest on setigers 2–4, folded dorsally over the notosetae. Neuropodia of setigers 1–5 sub-ovoid acuminate lobes (Fig. 77). Low presetal ridges in notopodia of about setigers 1–14 and in neuropodia of about setigers 1–8. Notopodia and neuropodia reducing in size posteriorly, notopodia remaining dorsaly acuminate throughout, becoming elongate subulate by about setiger 20, then cirriform from about setiger 35. Neuropodia becoming rounded posteriorly, reducing to low postsetal ridges by about setiger 12 (Figs 78–80).

Anterior notosetae and neurosetae all faintly granulate, unilimbate and bilimbate capillaries. Hooded hooks, one or two granulate unilimbate sabre setae and smooth nonlimbate capillaries appear in neuropodia from setiger 9. Many sabre setae with sharp bend near tip (Fig. 81). Smooth nonlimbate capillaries completely replace granulate limbate capillary neurosetae by about setiger 13. Granulate limbate capillary notosetae persist for several setigers more than in neuropodia but replaced by smooth nonlimbate capillaries by about setiger 24. All neuropodial hooded hooks with 2 pairs of teeth above main fang and distinctly striate secondary internal hoods (Fig. 82). Notopodial hooded hooks, with long straight shafts (Fig. 83), appear at setigers 38–41 (setiger 41 in holotype). Interparapodial pouches in most specimens, appearing between setigers 8/9 for variable number of setigers: to about setiger 13/14 on specimens less than 0.9 mm wide (including parapodia) or to about setiger 20/21 in larger specimens (up to 1.6 mm wide) and to setiger 17/18 in holotype. Dorsum of setigers 13–18 with transverse series of about 13–15 lighter coloured slightly raised ridges, 2 or 3 ridges per setiger. Dorsum otherwise smooth and without transparent areas of cuticle. No ventral bilobed flap on setiger 8. Pygidium with long median cirrus and pair of lateral cirri which may be extremely fine and difficult to see in some specimens.

Remarks. Paraprionospio coora sp. nov. appears to be very close to *Paraprionospio* Form C1 described by Yokoyama and Tamai (1981) from Japan, but has hooded hooks with two rather than three pairs of apical teeth. *Paraprionospio coora* also has a series of transverse dorsal ridges over setigers 13–15; Yokoyama and Tamai made no mention of this character but noted that "The anterior segments are faintly annulated and bear two ciliated bands on the dorsum."

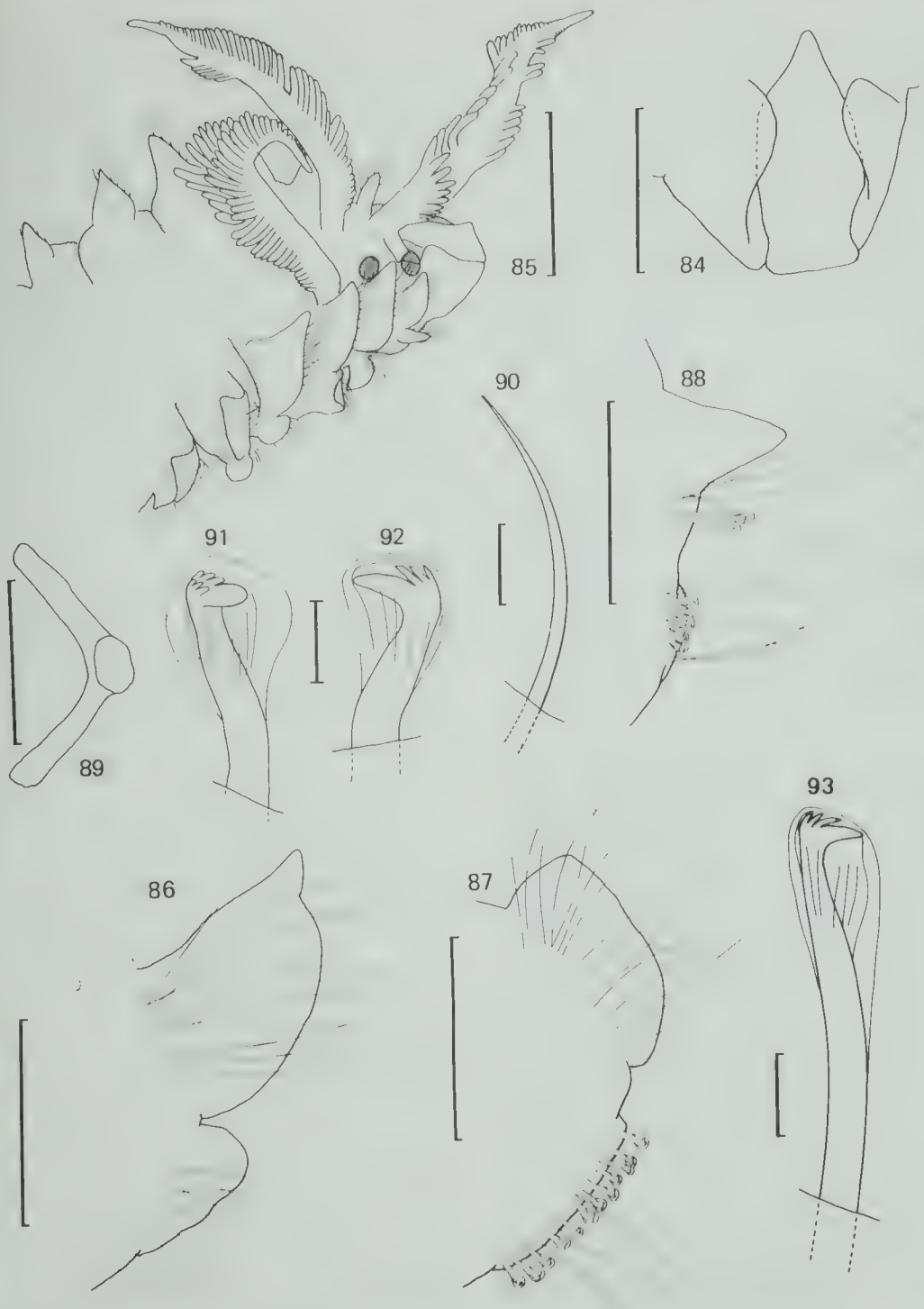
Etymology. The specific name *coora* is not meant to be descriptive; it is derived from an Australian aboriginal word meaning "blue gum tree".

Distribution. Known from Tasmania, central and eastern Bass Strait, and from the continental shelf off Sydney, New South Wales. Collected from a variety of sediment types, 6 to 124 m.

Paraprionospio pinnata (Ehlers, 1901)

Figures 84—93

Prionospio pinnata Ehlers, 1901: 163–164.



Figures 84–93. *Paraprionospio pinnata*: 84–89, lectotype HZM 5814: 84, dorsal view, prostomium; 85, dorsolateral view; 86, setiger 2 parapodium; 87, setiger 9 parapodium; 88, setiger 33 parapodium; 89, median branchial lamella; 90, sabre seta, setiger 15, paralectotype HZM 5814. 91-93, lectotype: 91, neuropodial hooded hook, setiger 9, oblique view; 92, neuropodial hooded hook, setiger 33, lateral view; 93, notopodial hooded hook, setiger 33, lateral view.

All parapodia figured in anterior view. Scale bars represent: 0.5 mm (Figs 84, 86–88); 1.0 mm (Figs 85, 89); 0.1 mm (Fig. 90); 0.02 mm (Figs 91–93).

Material examined. Chile: Talcahuano Talcanaño], 5 fathoms [9.5 m], 4 May 1893, W. Michaelsen, HZM V5814, 5 syntypes, consisting of 5 anterior fragments and 7 middle and posterior fragments. Size range of anterior fragments: 24 setigers, 10 mm long, 2.0 mm maximum width (at setiger 5, including parapodia) to 35 setigers, 16 mm long, 2.0 mm wide.

Redescription. The following redescription relates to the lectotype, designated here, consisting of the longest anterior fragment: 35 setigers, 16 mm long, 2.0 mm wide, a gravid female with many irregular eggs about 120 µm across the largest dimension. Any variation found in the 4 paralectotypes is given in brackets. Colour in alcohol pale yelow with no obvious patterns or markings. Body widest at setiger 5, anterior 10 setigers dorsoventrally flattened and ovoid in cross-section, thereafter roughly circular. Muscular gizzard faintly visible in one paralectotype, between about setigers 6–9. Prostomium truncate to slightly rounded anteriorly, projecting slightly beyond peristomium, continuing as narrow caruncle back to setiger 1 (Fig. 84). No eyes visible. Peristomium enclosing prostomium, with pair of prominent lateral wings without marginal papillae (Fig. 85). Palps missing from all specimens but 2 detached palps present in the vial; these are grooved on one surface and have a sheath enclosing the basal third to half of the palp. Setiger 1 with prominent dorsal crest at base of first pair of branchiae. Lectotype with single branchia intact on each of setigers 1–3 (other material with various combinations of branchiae intact but all specimens evidently originally possessed one pair of branchiae on each of setigers 1–3). Each pair of branchiae of approximately equal length, with densely packed bifoliate lamellae (Fig. 89) over most of the length of the branchiae, decreasing slightly in size distally, branchial shaft bare anteriorly and basally. First pair of branchiae without anterior basal accessory lamellae. Filament absent from base of third pair of branchiae. Notopodia anteriorly elongate triangular lobes, longest over setigers 2–4, reducing quickly in size posteriorly and becoming low rounded lobes back to about setiger 22, thereafter becoming lanceolate back to at least setiger 35. Neuropodia of setiger 1 lanceolate, becoming rounded and reduced over setigers 2–10; reduced to insignificant ridge by about setiger 22 (Figs 86–88). (Posterior fragments with lanceolate notopodial lobes and virtually invisible neuropodial ridges.)

Notosetae and neurosetae anteriorly bilimbate capillaries, faintly granulate over the distal third, faintly striate basally. Capillaries changing to smooth nonlimbate capillaries between about setigers 10 and 15. Neuropodial hooded hooks, with 3 pairs of apical teeth above main fang and striate internal hood (Figs 91, 92), appear at setiger 9; notopodial hooded hooks (Fig. 93) appearing by about setiger 33. Sabre setae apparently broken or missing in lectotype and 3 paralectotypes; 2 sabre setae from single paralectotype (Fig. 90) long curved and granulate but without wings. First appearance of sabre setae could not be determined. Body without dorsal crests interparapodial pouches. Ventral bilobed flap on setiger 8 absent. Semi-transparent patches of dorsal cuticle on about setigers 21–35. Shallow ventral depression running longitudinally over anterior 20 setigers, becoming a deep ventral groove from about setiger 22 and posteriorly (deep groove continuing to pygidium in all posterior fragments). Four posterior fragments with intact pygidia, apparently having only single narrow cirri; no lateral cirri could be found.

Remarks. The above description was framed with particular respect to the new characters used by Yokoyama and Tamai (1981) in describing four new forms of *Paraprionospio* from Japan. Each of the new forms from Japan is distinct from *P. pinnata*. Form A of Yokoyama and Tamai is most similar to *P. pinnata*, but differs in the presence of a papilla on the posterior margins of the peristomial wings, a filament at the base of the third branchia, transverse dorsal crests on setigers 21–35 and lateral anal cirri. All of the above characters are absent in *P. pinnata*. Maciolek (1985) provided many references to *P. pinnata* and suggested a wide distribution, however her brief description made no mention of the new characters recognised by Yokoyama and Tamai and may not be synonymous with *P. pinnata*.

Distribution. The type locality is Chile. Reported to be cosmopolitan (e.g. Maciolek, 1985) but all records require confirmation.

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Appendix

"TAS" station data

TAS 1, 43°11.0′S, 147°16.0′E, Tasmania, D'Entrecasteaux Channel, 2.5 km SE of Birches Bay, 10 m, no sediment retained, lip dredge, 16 Apr 1985, R.S. Wilson.

TAS 2, 43°11.0′S, 147°16.0′E, Tasmania, D'Entrecasteaux Channel, 2.5 km SE of Birches Bay, 10 m, black mud, fine shell, pipe dredge, 16 Apr 1985, R.S. Wilson.

TAS 3, 43°11.0′S, 147°16.0′E, Tasmania, D'Entrecasteaux Channel, 2.5 km SE of Birches Bay, 8 m, no sediment retained, pipe dredge, 17 Apr 1985, R.S. Wilson.

TAS 4, 43°11.0′S, 147°16.0′E, Tasmania, D'Entrecasteaux Channel, 2.5 km SE of Birches Bay, 8 m, pipe dredge, 17 Apr 1985, R.S. Wilson.

TAS 5, 43°10.0′S, 147°17.0′E, Tasmania, Woodbridge, 200 m W of Kinghorne Point, 27 m, fine black mud and shell, pipe dredge, 17 Apr 1985, R.S. Wilson.

TAS 6, 43°10.0′S, 147°16.0′E, Tasmania, D'Entrecasteaux Channel, 2 km ENE of Birches Bay, 17 m, clayey mud, little fine shell, pipe dredge, 17 Apr 1985, R.S. Wilson.

TAS 7, 43°11.0′S, 147°15.0′E, Tasmania, D'Entrecasteaux Channel, 200 m E of Birches Bay, 10 m, fine black clay, no shell, pipe dredge, 17 Apr 1985, R.S. Wilson.

TAS 8, 42°7.0′S, 145°8.0′E, Tasmania, Swansea, pier, 1.5 m, sand and rubble, infauna, airlift, 19 Apr 1985, R.S. Wilson.

TAS 9, 42°7.0′S, 145°8.0′E, Tasmania, Swansea, pier, 1.5 m, sand and rubble infauna, some red algae, airlift, 19 Apr 1985, R.S. Wilson.

TAS 10, 42°7.0′S, 145°8.0′E, Tasmania, Swansea, pier, 0.5 m, pier epifauna, airlift, 19 Apr 1985, R.S. Wilson.

TAS 11, 42°7.0′S, 145°8.0′E, Tasmania, Swansea, pier, 0.5 m, algae epifauna & rubble, airlift, 19 Apr 1985, R.S. Wilson.

TAS 12, 42°7.0′S, 145°8.0′E, Tasmania, Swansea, pier, 0.5 m, algal turf from rocks, airlift, 19 Apr 1985, R.S. Wilson.

TAS 13, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 0 m, scrapings, infauna from granite cobble, hand, 21 Apr 1985, R.S. Wilson.

TAS 14, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 0.1 m, *Zostera* and sediment, hand, 21 Apr 1985, R.S. Wilson.

TAS 15, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 0 m, sediment & infauna from mussels, hand, 21 Apr 1985, R.S. Wilson.

TAS 16, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 1 m, sediment and brown algae, airlift, 21 Apr 1985, R.S. Wilson.

TAS 17, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 1 m, red algae and invertebrates, airlift, 21 Apr 1985, R.S. Wilson.

TAS 18, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 0.5 m, *Zostera* sediment, airlift, 21 Apr 1985, R.S. Wilson.

TAS 19, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 2 m, sediment around rocks, airlift, 21 Apr 1985, R.S. Wilson.

TAS 20, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 2 m, fine silicious sand, airlift, 21 Apr 1985, R.S. Wilson.

TAS 21, 42°7.0′S, 148°17.0′E, Tasmania, Coles Bay, near boatramp, 1 m, sediment from coralline algae, airlift, 21 Apr 1985, R.S. Wilson.

TAS 22, 41°53.0′S, 148°19.0′E, Tasmania, Bicheno, Muirs Rock, 1 km E of Bicheno, 15 m, sponge and bryozoan epifauna, airlift, 21 Apr 1985, R.S. Wilson.

TAS 23, 41°53.0′S, 148°19.0′E, Tasmania, Bicheno, Muirs Rock, 1 km E of Bicheno, 15 m, red algal turf, infauna, airlift, 21 Apr 1985, R.S. Wilson.

TAS 24, 41°53.0′S, 148°19.0′E, Tasmania, Bicheno, Muirs Rock, 1 km E of Bicheno, 10 m, sponge, bryozoan, algal epifauna, airlift, 21 Apr 1985, R.S. Wilson.

TAS 25, 42°14.0′S, 148°15.0′E, Tasmania, Freycinet Peninsula, W of Weatherhaed Point, 17 m, *Zostera* and algal epifauna, lip dredge, 22 Apr 1985, R.S. Wilson.

TAS 26, 42°11.0′S, 148°15.0′E, Tasmania, Freycinet Peninsula, 200 m E of Refuge Is, Promise Bay, 10 m, epifauna from sponge and worm clump, SCUBA, 22 Apr 1985, R.S. Wilson.

TAS 27, 42°35.0′S, 148°2.0′E, Tasmania, Maria Island, 500 m W of Darlington, 30 m, algal and drift holdfast epifauna, trawl, 23 Apr 1985, R.S. Wilson.

TAS 28, 42°35.0′S, 148°2.0′E, Tasmania, Maria Island, 500 m W of Darlington, 30 m, black mud, 23 Apr 1985, R.S. Wilson.

TAS 29, 42°34.0′S, 148°6.0′E, Tasmania, Maria Island, 2 km E of Cape Boulanger, 50 m, fine bryozoa and shell, WHOI epibenthic sled, 23 Apr 1985, R.S. Wilson.

TAS 30, 42°36.0′S, 148°10.0′E, Tasmania, Maria Island, E of Maria Island, 75 m, fine bryozoa and shell, WHOI epibenthic sled, 23 Apr 1985, R.S. Wilson.

TAS 31, 42°37.0′S, 148°12.5′E, Tasmania, Maria Island, 5 km NE Mistaken Cape, 100 m, fine muddy bryozoa, WHOI epibenthic sled, 23 Apr 1985, R.S. Wilson.

TAS 32, 42°33.0′S, 147°55.5′E, Tasmania, Spring Bay, 4.5 km SSE of Triabunna, 5 km NE Mistaken Cape, 15 m, black mud and some fine shell, WHOI epibenthic sled, 23 Apr 1985, R.S. Wilson.

TAS 33, 42°35.0′S, 148°2.50′E, Tasmania, Maria Island, 500 m W of Darlington, 30 m, 23 Apr 1985, R.S. Wilson.

TAS 34, 43°26.0′S, 146°56.5′E, Tasmania, Southport, rock platforms SE of pier, 0.1 m, epifauna from *Zostera*, hand, 27 Apr 1985, R.S. Wilson.

TAS 35, 43°26.0′S, 146°56.5′E, Tasmania, Southport, rock platforms SE of pier, 0.1 m, sediment from seagrass, hand, 27 Apr 1985, R.S. Wilson.

TAS 36, 43°26.0′S, 146°56.5′E, Tasmania, Southport, rock platforms SE of pier, 0.1 m, epifauna from coralline algae turf, hand, 27 Apr 1985, R.S. Wilson.

TAS 37, 43°26.0′S, 146°56.5′E, Tasmania, Southport, rock platforms SE of pier, 0.1 m, infauna from sand and cobble, hand, 27 Apr 1985, R.S. Wilson.

TAS 38, 43°26.0′S, 146°56.5′E, Tasmania, Southport, rock platforms SE of pier, 0.1 m, under rocks and *Galeolaria*, hand, 27 Apr 1985, R.S. Wilson.

TAS 39, 43°19.0′S, 147°1.0′E, Tasmania, Dover Jetty, 3 m, sediment and algae under pier, airlift, 27 Apr 1985, R.S. Wilson.

TAS 40, 43°19.0′S, 147°1.0′E, Tasmania, Dover Jetty, 1.5 m, muddy fine sand under *Zostera*, airlift, 27 Apr 1985, R.S. Wilson.

TAS 41, 43°19.0′S, 147°1.0′E, Tasmania, Dover Jetty, 1.5 m, under rocks on fine sandy bottom, airlift, 27 Apr 1985, R.S. Wilson.

TAS 42, 43°19.0′S, 147°1.0′E, Tasmania, Dover Jetty, 1 m, airlift, 27 Apr 1985, R.S. Wilson.

TAS 43, 43°19.0′S, 147°1.0′E, Tasmania, Dover Jetty, 3 m, *Zostera* epifauna, airlift, 27 Apr 1985, R.S. Wilson.

TAS 44, 43°9.5′S, 147°14.0′E, Tasmania, Woodbridge, 200 m N of Marine Studies Centre, 0 m, fine muddy sand, hand, 28 Apr 1985, R.S. Wilson.

TAS 45, 43°9.5′S, 147°14.0′E, Tasmania, Woodbridge, 200 m N of Marine Studies Centre, 0.1 m, under rocks and algal epifauna, hand, 28 Apr 1985, R.S. Wilson.

TAS 46, 43°14.0′S, 147°15.0′E, Tasmania, Gordon jetty, 2 m, fine sand from rocks and algae, airlift, 28 Apr 1985, R.S. Wilson.

TAS 47, 43°14.0′S, 147°15.0′E, Tasmania, Gordon jetty, 1.5 m, fine sand from *Zostera*, airlift, 28 Apr 1985, R.S. Wilson.

TAS 48, 43°9.5′S, 147°14.0′E, Tasmania, Woodbridge Jetty, 2 m, fine silt, airlift, 28 Apr 1985, R.S. Wilson.

TAS 49, 43°9.5′S, 147°14.0′E, Tasmania, Woodbridge Jetty, 2 m, sponge and bryozoa from pier platform, airlift, 28 Apr 1985, R.S. Wilson.

TAS 50, 43°9.5′S, 147°14.0′E, Tasmania, Woodbridge Jetty, 0.5 m, silty red algal turf from rocks, airlift, 28 Apr 1985, R.S. Wilson.

TAS 51, 43°9.5′S, 147°14.0′E, Tasmania, Woodbridge Jetty, 2 m, silty shell, airlift, 28 Apr 1985, R.S. Wilson.

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MARINE TUBIFICIDAE (OLIGOCHAETA) OF VICTORIA, AUSTRALIA, WITH DESCRIPTIONS OF SIX NEW SPECIES

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Abstract

Erséus, C., 1990. Marine Tubificidae (Oligochaeta) of Victoria, Australia, with descriptions of six new species. *Memoirs of the Museum of Victoria* 50(2): 275–285.

Seven species of marine Tubificidae are recorded from coastal waters of Victoria: *Heronidrilus bihamis* Erséus and Jamieson, 1981, *Bathydrilus munitus* sp. nov., *Limnodriloides triplus* sp. nov., *L. stercoreus* sp. nov., *L. problematicus* sp. nov., *L. cribensis* sp. nov., and *Marcusaedrilus assimilis* sp. nov. The first-mentioned species is widely distributed in the Indo-Pacific, including tropical areas, whereas the new taxa are likely to be members of a temperate fauna of south-eastern Australia. *Limnodriloides stercoreus* and *M. assimilis* are reported also from New South Wales, and *L. problematicus* from New Zealand.

Introduction

Oligochaetes, particularly species belonging to the family Tubificidae, are not uncommon members of the benthic fauna of coastal marine waters, but their small body size and neglected taxonomy have made them escape attention in many parts of the world. The southern coast of Australia is one area, for which the taxonomic knowledge of marine Tubificidae has been very scanty in the past. One comprehensive study was recently made in the southern part of Western Australia (Erséus, in press), but for the other states the documentation has so far been restricted to Brinkhurst's (1986) records of *Tubificoides diazi* Brinkhurst and Baker, 1979, and *T. fraseri* Brinkhurst, 1986, from inshore localities in Victoria. These two species are widely distributed in the world, including the North Atlantic, but the large genus to which they belong is largely confined to the temperate parts of the Northern Hemisphere. It is therefore likely that they are opportunistic species, possibly introduced by man to southern Australia.

The Victoria material of *T. diazi* and *T. fraseri* studied by Brinkhurst (1986) was a part of an oligochaete collection originating from various benthic surveys undertaken in marine or brackish-water embayments on the coast of Victoria by the Marine Studies Group, Ministry for Conservation, Victoria. The collection was borrowed from the Museum of Victoria by the late Dr H.R. Baker (a former student of Dr R.O. Brinkhurst), who made tentative identifications of the specimens. After Dr Baker's decease in 1983, tubificids other than *Tubificoides* from this collection were forwarded to me with the kind approval of the Museum of Victoria. This paper is a taxonomic account describing this material, which includes a number of species that are likely to be endemic to the temperate zone of the Southern Hemisphere.

Materials and methods

Most of the material treated in this paper was part of a loan from the Museum of Victoria to H.R. Baker, transferred to the present author. Additional specimens of *Limnodriloides stercoreus* sp. nov. and *Marcusaedrilus assimilis* sp. nov. from New South Wales localities, were found in material borrowed from the Australian Museum, Sydney, and two lots of *L. problematicus* collected in New Zealand, were kindly placed at my disposal by Dr S.F. Thrush (Hamilton, NZ), and Dr K.A. Coates (Toronto, Canada), respectively.

The worms were stained with paracarmine and mounted whole in Canada balsam, for the most part by H.R. Baker. All measurements were taken on these mounted, somewhat compressed, specimens. Roman numerals in the descriptions refer to segment numbers.

Type series and other reference material have been deposited in (1) the Museum of Victoria (NMV), Melbourne, Victoria, (2) the Australian Museum (AM), Sydney, NSW, and (3) the

National Museum of New Zealand (NMNZ), Wellington.

Systematic descriptions

Rhyacodrilinae

Heronidrilus Erséus and Jamieson

Heronidrilus bihamis Erséus and Jamieson

Heronidrilus bihamis Erséus and Jamieson, 1981: 107–108, fig. 3.—Erséus, 1984: 140, fig. 3.—Erséus, 1989: 272.—Erséus, in press.—Erséus and Davis, 1989: fig. 1A.—Erséus et al., in press: figs 2F–H.

New material. NMV F57366, 2 whole-mounted specimens from off Point Cook, Port Phillip Bay, Victoria, Australia, 38°04.7′S, 144°32.7′E, 7 m, sand, 11 Jun 1971; material from the Port Phillip Bay Environmental Study (Marine Pollution Studies Group, Ministry for Conservation stn PPBES 929).

Distribution and habitat. Victoria (new record), Queensland, Western Australia, Hawaii, China. Intertidal and subtidal sands, to at least 70 m depth.

Remarks. Heronidrilus bihamis, which appears widely distributed in the Indo-Pacific area, has previously been reported from the Great Barrier Reef in Queensland (Erséus and Jamieson, 1981), and Western Australia (Erséus in press). The two new specimens from Victoria conform with the previous descriptions (references above).

Phallodrilinae

Bathydrilus Cook

Bathydrilus munitus sp. nov.

Figure 1

Material examined. Holotype: NMV F57367, whole-mounted specimen from Crib Point, Western Port, Victoria, Australia, 38°21.33′S, 145°13.64′E, 15 m, fine sand and mud, 20 Mar 1967; material from the Crib Point Benthic Survey (Marine Studies Group, Ministry for Conservation, stn CPBS-S 31).

Paratypes: NMV F57368, 3 whole-mounted specimens from type locality. NMV F57369, whole-mounted specimen from near type locality, but 38°21.15′S, 145°13.51′E, 15 m, fine sand and mud, 15 Jul 1969 (stn CPBS 300).

Other material: NMV F57370, whole-mounted specimen from type locality (type date). NMV F57371, whole-mounted specimen from type locality, but 21 Apr 1966. NMV F57372, 7 whole-mounted specimens from off Altona, Port Phillip Bay, Victoria, 37°53.0′S, 144°51.5′E, 8 m, sand, 7 Jun 1971; material from the Port Phillip Bay Environmental Study (Marine Pollution Studies Group, Ministry for Conservation stn PPBES 901).

Description. Length of 2 complete specimens, 10.0 and 16.1 mm, about 85 and 116 segments. Width at XI, 0.20-0.35 mm. Prostomium somewhat elongate, rounded. Clitellum extending over X–½XIII when fully developed. Epidermal glands not observed. Somatic setae slender, 45–55 µm long, 2–2.5 µm thick, 2–5 (generally 4) per bundle anteriorly, (1)2 per bundle in postcli-

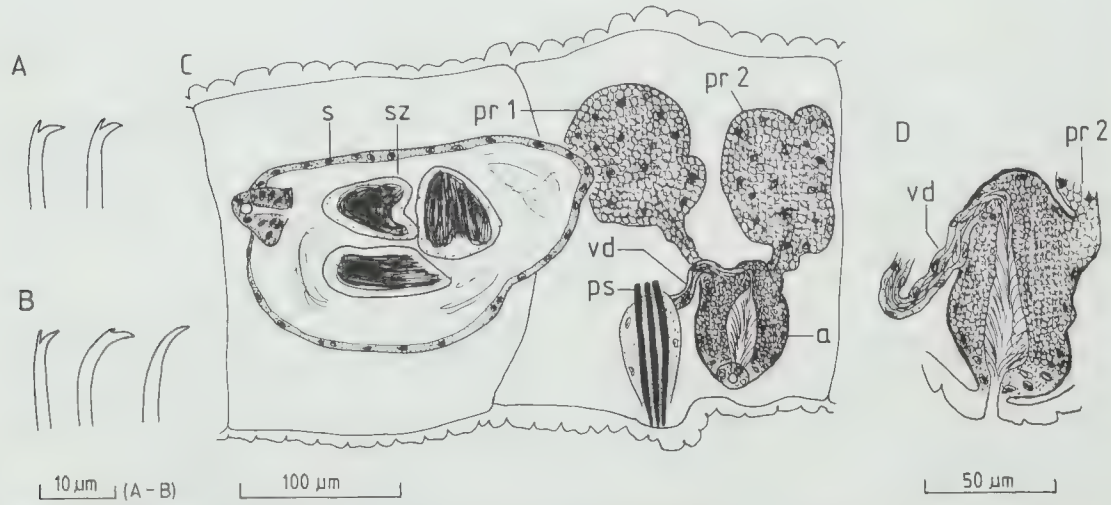

Figure 1. *Bathydrilus munitus* sp. nov. A, anterior setae. B, posterior setae. C, lateral view of spermatheca and male genitalia in segments X–XI (holotype). D, atrium (paratype). a, atrium; pr1, anterior prostate gland; pr2, posterior prostate gland, ps, penial seta; s, spermatheca; sz, spermatozeugma; vd, vas deferens.

tellar segments. Anterior setae (Fig. 1A) with upper tooth thinner and much shorter than lower; lower tooth long, almost perpendicular to setal shaft. Postclitellar setae (Fig. 1B) variable, but generally with upper tooth even shorter than in anterior setae, or completely reduced (particularly in dorsal setae of most posterior segments). Penial setae (Fig. 1C, ps) generally 3–4 per bundle (sometimes fewer, occasionally absent), straight or curved, with single-pointed tips; tips of both bundles near mid-ventral line of worm. Penial setae 70–90 µm long, 3–5 µm thick. Male pores paired, in line with ventral somatic setae, posteriorly in XI. Spermathecal pores paired in lateral lines, anteriorly in X.

Pharyngeal glands in IV–(VII)VIII(IX). A few septa anterior to clitellum thickened, conspicuously muscular. Male genitalia (Figs 1C, D) paired. Vas deferens 7–12 µm wide, not seen in its whole length, but clearly longer than atrium. Vas entering anterior face of atrium, but near apical end (see Fig. 1D). Atrium erect, oval-to-spindle-shaped, 65–110 µm long, 42–60 µm wide, with thin (1–2 µm) muscular lining, and granulated and ciliated inner epithelium; lumen of atrium wide. Atrium ectally opening to exterior through simple pore; copulatory sac absent. Prostate glands large with long stalks; anterior one attached to anterior face of atrium, near entrance of vas deferens; posterior one attached to posterior face of atrium, at some distance from apex, more or less opposite to attachment of anterior prostate. Spermathecae (Fig. 1C, s) with short, triangular ducts, and large, oval ampullae, latter filling a great part of X; round or somewhat triangular spermatozeugmata present in spermathecae of postcopulatory specimens.

Etymology. This species is named *munitus*, Latin for "fortified, walled", referring to the thickened septa in preclitellar segments.

Distribution and habitat. Known only from Victoria, Australia. Subtidal sand and mud, 8–15 m depth.

Remarks. This species belongs to a large complex of shallow-water forms within *Bathydrilus* with (1) large, single-pointed, and almost straight penial setae, generally 2 or 3 per bundle, (2) pharyngeal glands extending as far as into segment VIII or thereabouts, (3) erect, more or less spindle-shaped atria, and (4) characteristic, round-to-triangular spermatozeugmata. The other species in this complex are *B. adriaticus* (Hrabě, 1971), *B. connexus* Erséus, 1988, *B. exilis* Erséus and Davis, 1989, *B. formosus* Erséus, 1986, *B. ingens* Erséus, 1986, *B. litoreus* Baker, 1983, *B. longus* Erséus, 1979, *B. notabilis* Erséus and Milligan, 1988, *B. rohdei* (Jamieson, 1977), and *B. superiovasatus* Erséus, 1981. One additional species, *B. edwardsi* Erséus, 1984, although lacking penial setae, may be a member of this phylogenetic group too. Of these species, four were previously known from Australia: *Bathydrilus rohdei* and *B. superiovasatus* from the Great Barrier Reef in Queensland (Jamieson, 1977; Erséus, 1981), *B. edwardsi* and *B. litoreus* from south Western Australia (Erséus, in press). The new form from Victoria is most similar to *B. superiovasatus* (particularly with regard to the morphology of the atria and the position of the junctions between the vasa deferentia and atria), but differs from that species by its higher number of setae (in *B. superiovasatus*, anterior somatic setae generally only 3 per bundle, penial setae only 1–2 per bundle), and its narrower vasa deferentia (vasa ectally up to 20–23 µm wide in *B. superiovasatus*).

Bathydrilus exilis, from Hawaii, has slender somatic setae, with upper teeth completely reduced in posterior segments, and thickened, muscular septa anterior to clitellar region, features that indicate a close relationship to *B. munitus*. The new species, however, has clearly stouter atria than *B. exilis*, with the posterior prostates subapically attached to the atria (not apically attached as in *B. exilis*; see Erséus and Davis, 1989).

Limnodriloidinae

Limnodriloides Pierantoni

Limnodriloides triplus sp. nov.

Figure 2

Material examined. Holotype: NMV F57373, whole-mounted specimen. Crib Point, Western Port, Victoria, Australia, 38°20.94′S, 145°13.62′E, 15 m, fine mud and sand, 15 Jul 1969; material originating from the Crib Point Benthic Survey (Marine Studies Group, Ministry for Conservation, stn CPBS-N 31).

Description. Length 8.3 mm, about 58 segments (posterior end not completely differentiated). Width at XI 0.24 mm. Prostomium large, rounded. Clitellum extending over XI–XII. Setae (Figs 2A–C) bifid, with upper tooth thinner and shorter than lower, less pronouncedly so in anterior than in more posterior setae. Setae about 45 µm long, 1.5–2.5 µm thick, 2–3 per bundle anteriorly, 2 per bundle in postclitellar segments, absent ventrally from X–XI. Male

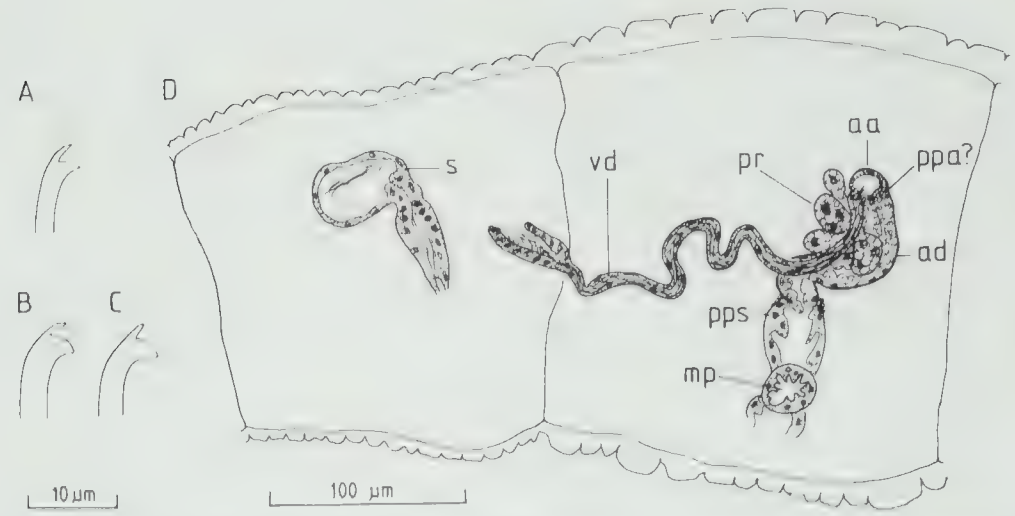

Figure 2. *Limnodriloides triplus* sp. nov. A, anterior seta. B, dorsal seta of segment XI. C, posterior seta. D, lateral view of spermatheca and male genitalia in segments X–XI. aa, atrial ampulla; ad, atrial duct; mp, male pore (unpaired); ppa?, prostatic pad (?; poorly developed); pps, pseudopenial sac; pr, prostate gland; s, spermatheca; vd, vas deferens.

pore unpaired, ventrally in posterior part of XI. Spermathecal pores paired, but close together, ventral, somewhat posterior to middle of X.

Pharyngeal glands in IV–V. Oesophageal diverticula in IX large. Male genitalia (Fig. 2D) paired. Vas deferens narrow (6–8 µm wide), much longer than atrium, entering latter subapically. Atrial ampulla very small, roundish, about 20 µm long, 18 µm wide, with thin walls and, possibly, a small prostatic pad (Fig. 2D, ppa?). Prostate gland small, lobed, but attachment with atrial ampulla not seen. Atrial duct not muscular, about 90 µm long, about 20 µm wide, with ental part heavily granulated; ectal part with somewhat irregular lumen. Atrial duct opening directly into about 35 µm long, 28 µm wide, pseudopenial sac; latter with somewhat folded wall, but no distinct penial or pseudopenial papilla present. Pseudopenial sacs of two sides of worm united mid-ventrally and opening to exterior through unpaired, somewhat star-shaped male pore. Spermathecae (Fig. 2D, s) with distinct ducts, about 65 µm long, 22 µm wide at middle, and oval ampullae, 42–58 µm long, 24–31 µm wide; sperm bundled in spermathecae.

Etymology. The epithet *triplus*, Latin for "threefold, triple", refers to the three genital openings (male pores unpaired, spermathecal pores paired) in this species.

Distribution and habitat. Known only from the type locality, Victoria, Australia. Subtidal muddy sand, 15 m depth.

Remarks. This species is closely related to another species recently described from Perth and Albany in Western Australia (Erséus in press). The two species are unique within *Limnodriloides* in having very short atrial ampullae, with poorly developed (or absent?) prostatic pads, and with vasa deferentia opening into the middle of the ampullae. *Limnodriloides triplus* is, however, easily distinguished from the other species by its unpaired male pore (pores close together, but paired, in the other species). The new species also appear to have longer vasa deferentia, and somewhat more developed pseuopenial sacs, than the Western Australian form.

Limnodriloides stercoreus sp. nov.

Figures 3, 4A–D

Material examined. Holotype: NMV F57374, whole-mounted specimen. Near mouth of Little River, western Port Phillip Bay, Victoria, subtidal, largely sandy sediment, Nov 1975; material from a survey of benthos near an outfall of the Werribee sewage-treatment farm (Marine Studies Group, Ministry for Conservation) (see Poore and Kudenov, 1978).

Paratypes: NMV F57375, 5 whole-mounted specimens from type locality.

Other material: NMV F57376, 14 whole-mounted specimens from type locality. NMV F57377, whole-mounted specimen from Western Port, Victoria, Australia, intertidal, silty sand, 2 Jan 1974; material from the Western Port Bay Environmental Study (Marine Science Group, Ministry for Conservation) (see Shapiro, 1975). AM W203754, whole-mounted specimen from Port Hacking, S of Sydney, New South

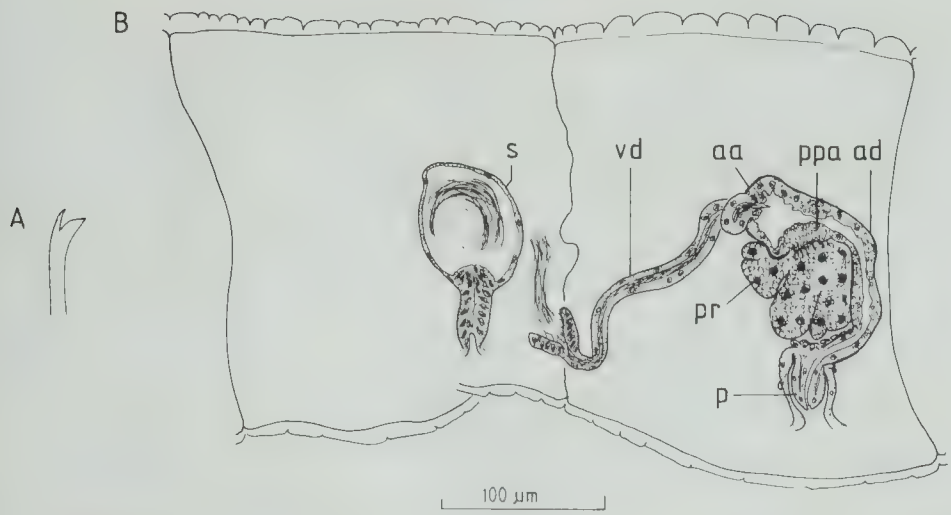

Figure 3. *Limnodriloides stercoreus* sp. nov., holotype. A, free-hand drawing of seta. B, lateral view of spermatheca and male genitalia in segments X–XI. aa, atrial ampulla; ad, atrial duct; p, penis; ppa, prostatic pad; pr, prostate gland; s, spermatheca; vd, vas deferens.

Wales, Australia, mud from artificial reef, 17 Dec 1974 (C. Glasby, NSW Fisheries).

Description. Length (10 specimens) 6.2–9.2 mm, 36–52 segments. Width at XI 0.22–0.36 mm. Prostomium rounded. Clitellum extending over XI–XII. Setae (Fig. 3A) bifid with upper tooth thinner and shorter than lower. Setae 40–65 µm long, about 2.5 µm thick, 2–4 (occasionally 7) per bundle anteriorly, (1)2–3 per bundle in postclitellar segments, but absent ventrally in X and XI. Male pores paired in line with ventral setae posteriorly in XI. Spermathecal pores paired in line with ventral setae posterior to middle of X.

Pharyngeal glands in IV–V. Long and conspicuous oesophageal diverticula present in anterior part of IX. Male genitalia (Fig. 3B) paired. Vas deferens 7–13 µm wide, about as long as atrium, entering apical end of atrium (at middle of small papilla in anterior wall of atrial ampulla). Atrial ampulla more or less pear-shaped, 30–65 µm long, 25–50 µm wide, with hollow ental part. Muscular layer of ampulla thin. Prostatic pad ventral, somewhat cup-shaped, in middle-to-ectal part of ampulla. Prostate gland large, lobed, communicating with pad. Atrial duct 90–130 µm long, 16–26 µm wide, with very thin outer muscular layer, and some scattered granulation in its middle part. Atrial duct terminating in conical penis, 23–35 µm long, 20–25 µm wide at base, pendent within thin-walled penial sac. Spermathecae (Figs 3B, s; 4A–D) with distinct ducts, 35–60 µm long, 20–30 µm, and round-to-oblong ampulla, 70–120 µm long, 35–100 µm wide; when fully developed ampulla thin-walled and in postcopulatory specimens containing bundles of sperm or spermatozeugmata (cf. Figs 4C–D).

Etymology. The species epithet *stercoreus* is Latin for "dirty, filthy"; here alluding to the proximity of the type locality to an outfall from a sewage-treatment farm.

Distribution and habitat. Victoria and New South Wales, Australia. Intertidal and subtidal, muddy and sandy sediments. Depth range unknown.

Remarks. This species appears closely related to *L. atriotumidus* Erséus, 1982 and *L. validus* Erséus, 1982, both from the South Atlantic. It is distinguished from the former by lacking a ventral bulge (containing the prostatic pad in *L. atriotumidus*) on the atrial ampulla, and from the latter by lacking very thick atrial muscles. *Limnodriloides stercoreus* is very similar to *L. problematicus* sp. nov.; see *Remarks* for that species below.

Limnodriloides problematicus sp. nov.

Figures 4E–H, 5–6

Material examined. Holotype: NMV F57379, whole-mounted specimen. Banksia Peninsula, E end of Lake Victoria, Gippsland Lakes, Victoria, Australia, 38°01.3′S, 147°36.6′E, 1 m, sand with seagrass, annual salinity regime approximately 10–25 ppt, 29 Mar 1979; material from the Gippsland Regional Environmental Study, Benthic Surveys (Marine Studies

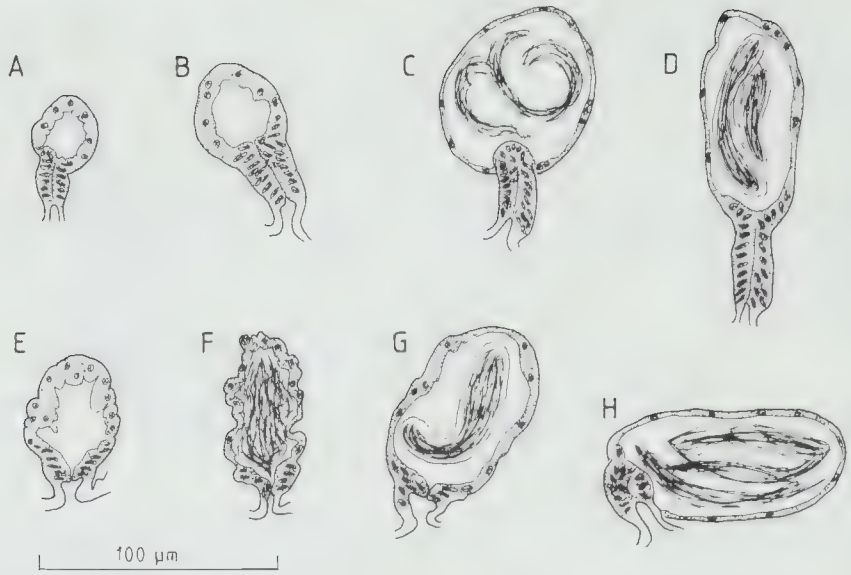

Figure 4. A–D, *Limnodriloides stercoreus* sp. nov., spermathecae from different specimens (all from Victoria). E–H, *Limnodriloides problematicus* sp. nov., spermathecae from different specimens (all from Victoria).

Group, Ministry for Conservation) (Poore, 1982; Bird, 1978).

Paratypes: NMV F57380, 4 whole-mounted specimens from type locality.

Other material: NMV F57381, 8 specimens from type locality (type date). NMV F57382, specimen from type locality, but 26 Jul 1979. NMV F57383, 2 specimens from besides jetty, Lake King, Gippsland Lakes, Victoria, 1 m, sand with seagrass, 1 Mar 1979.

NMNZ ZW1282, 1283, 2 specimens from mudflat at Maungatapu, Tauranga, in Tauranga Harbour (W part of Bay of Plenty), North Island, New Zealand, 37.7°S, 176.3°E, intertidal mud, Jan 1980, K.A. Coates. NMNZ ZW1284, specimen from mudflat in Manukau Harbour, Auckland, North Island, New Zealand, 37°S, 174°35'E, soft mud, Nov 1986, S.F Thrush and D.S. Roper. NMNZ ZW1285, specimen from subtidal slope leading into a 10 m deep channel between Portobello Marine Laboratory wharf and St Martins Island, Otago Harbour, Dunedin, South Island, New Zealand, 45°55'S, 170°40'E, unvegetated muddy sand, 6–8 m, Jul/Aug 1985, S.F. Thrush. Author's collection: 4 specimens from Maungatapu, New Zealand (as above).

Description of material from Australia (Figs 4E–H, 5). Length (5 specimens) 6.8–9.2 mm, 51–55 segments. Width at XI 0.16–0.25 mm. Prostomium rounded. Clitellum extending over XI–XII. Somatic setae (Fig. 5A) bifid, somewhat variable, but with upper tooth thinner, and at least slightly shorter, than lower. Bifids 35–55 µm long, 2–3 µm thick, (1)2–3 per bundle anteriorly, 1–2 (more often 1 than 2) per bundle in postclitellar segments; ventral setae always absent from XI. Ventral setae of X (Fig. 5B, ss) generally modified into 65–80 µm long, 3–3.5 µm thick, single-pointed, more or less straight spermathecal setae, 1 at each side of worm. Ectal one-third of spermathecal setae grooved. Ectal part of this seta enclosed in heavily muscular glandular body, which also bears a large external gland (Fig. 5B, gss). In some individuals, spermathecal setae missing at one side of body or missing completely. Male pores paired in line with ventral setae posteriorly in XI. Spermathecal pores paired in line with ventral somatic setae posterior to middle of X.

Pharyngeal glands in IV–V. Large and conspicuous oesophageal diverticula present anteriorly in IX. Male genitalia (Fig. 5B) paired. Vas deferens 15–21 µm wide, about as long as atrium, entering apical end of atrium (at middle of small papilla in anterior wall of atrial ampulla). Atrial ampulla oblong, 42–60 µm long, 29–37 µm wide, with very thin outer muscular layer. Prostatic pad somewhat cup-shaped, in ventral wall of middle-to-ectal part of ampulla. Atrial duct 80–100 µm long, 14–18 µm wide, with very thin outer muscular layer and some scattered granulation in its middle part. Atrial duct terminating in conical penis, 19–26 µm long, 19–29 µm wide at base, pendent within penial sac. Spermathecae (Figs 4E–H; 5B, s) with indistinct, very short ducts and somewhat oval

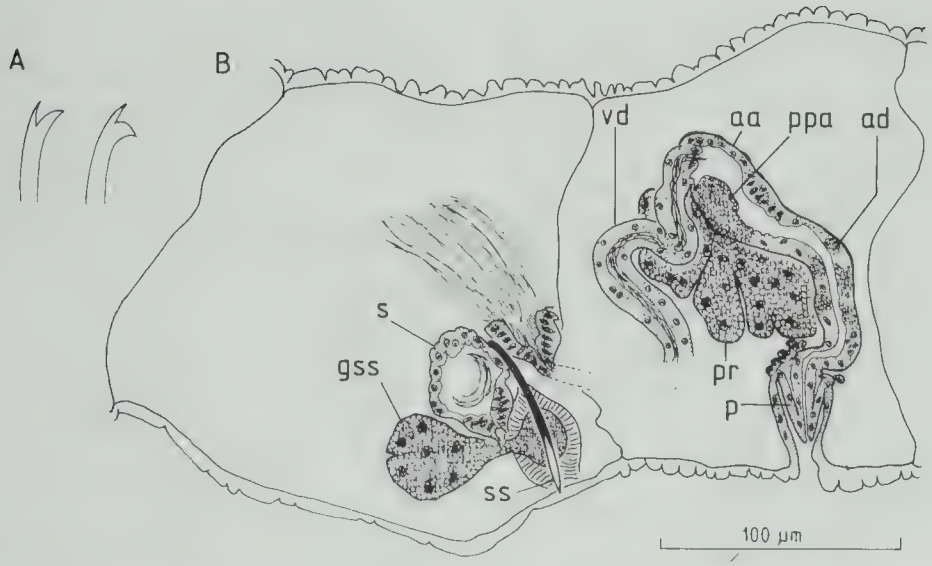

Figure 5. *Limnodriloides problematicus* sp. nov., from Victoria. A, free-hand drawings of setae. B, lateral view of spermatheca and male genitalia in segments X–XI. aa, atrial ampulla; ad, atrial duct; gss, gland associated with spermathecal seta; p, penis; ppa, prostatic pad; pr, prostate gland; s, spermatheca; ss, spermathecal seta; vd, vas deferens.

(often with irregular outline) ampullae. Ampullae 35–100 µm long, 35–55 µm wide, with thick walls in precopulatory specimens; walls much thinner in postcopulatory individuals. When present, sperm random (poor fixation?), in bundles or as spermatozeugmata in ampulla (Figs 4F–H).

Description of material from New Zealand (Fig. 6). Length 4.9–10.9 mm, up to about 48 segments (difficult to count; specimens much coiled and twisted). Width at XI, 0.22–0.36 mm. Bifid

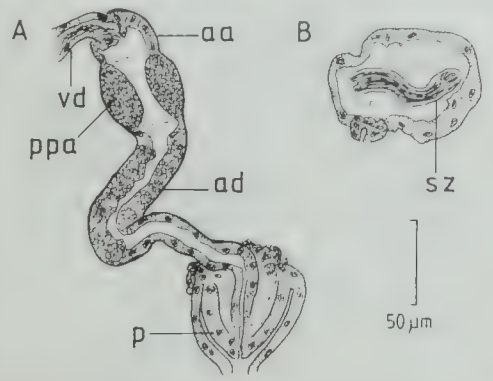

Figure 6. *Limnodriloides problematicus* sp. nov., from North Island, New Zealand. A, part of male duct. B, spermatheca. aa, atrial ampulla; ad, atrial duct; p, penis; ppa, prostatic pad; sz, spermatozeugma; vd, vas deferens.

setae 40–60 µm long, 2–2.5 µm thick, 1–2(3) per bundle anteriorly, 1–2 per bundle in postclitellar segments. Spermathecal setae 70–90 µm long, 2–2.5 µm thick, located either posterior (most common) or anterior to spermathecal pores; these setae present on both sides in all specimens. Vas deferens 14–19 µm wide. Atrial ampulla (Fig. 6A, aa) 60–80 µm long, 25–50 µm wide. Atrial duct (ad) 95–175 µm long (measured in 2 specimens only), 12–30 µm wide. Penis (p) 30–50 µm long, 20–50 µm wide at base. Spermathecae (Fig. 6B) with indistinct, very short ducts, and oval or round ampullae, latter 60–115 µm long, 50–115 µm wide.

Etymology. Named *problematicus* as it is difficult to establish whether this form really is a species separate from *L. stercoreus*.

Distribution and habitat. Victoria, Australia, and both North and South Islands, New Zealand. Intertidal and subtidal, muddy or sandy sediment, to at least about 8 m depth; marine and brackish water.

Remarks. Most of the worms studied (including material from one Australian and three New Zealand populations) have spermathecal setae, at least at one side of the body. A few worms from Australia lack these setae, but the characteristic glandular sacs (otherwise associated with

spermathecal setae) are present ventrally in segment X. This form is described as a new species with some hesitation, as its male ducts are virtually identical to those of *L. stercoreus* described above, and most of the differences between the two forms (absence versus presence of spermathecal setae; slightly different numbers of bifid setae; dimensional differences in vas deferens width, body diameter, etc.) could per se be regarded as intraspecific. One important reason for regarding *L. problematicus* as a separate species is, therefore, its consistently shorter spermathecal ducts as compared to those of *L. stercoreus* (difference illustrated in Fig. 4). However, the most useful diagnostic feature of most specimens of *L. problematicus* is their possession of spermathecal setae.

By possessing spermathecal setae, *L. problematicus* qualifies as a member of the "*winckelmanni* group" within *Limnodriloides* (see Erséus, 1982). This group is not necessarily monophyletic; it has been recognized largely for convenience. *Limnodriloides problematicus* is certainly more closely related to *L. stercoreus* (which always lacks spermathecal setae) than to any of the other species with spermathecal setae.

Limnodriloides cribensis sp. nov.

Figure 7

Material examined. Holotype: NMV F57384, whole-mounted specimen. Crib Point, Western Port, Victoria, Australia, 38°21.15'S, 145°13.51'E, 15 m, fine sand and mud, 15 Jul 1969; material from the Crib Point Benthic Survey (Marine Studies Group, Ministry for Conservation, stn CPBS 300) (see Shapiro, 1975).

Paratypes: NMV F57385, 2 specimens from type locality, but 24 Aug 1967. NMV F577386, 2 specimens from off Altona, Port Phillip Bay, Victoria, 37°53.0'S, 144°51.5'E, 8 m, sand, 7 Jun 1971; material from the Port Phillip Bay Environmental Study (Marine Pollution Studies Group, Ministry for Conservation stn PPBES 901).

Description. Length (only 1 complete specimen) 7.5 mm, 46 segments. Width at XI, 0.22–0.29 mm. Prostomium rounded. Clitellum extending over ½X–XII. Somatic setae (Fig. 7A) bifid, with upper tooth thinner and shorter than lower (but most tips broken off). Bifids about 40–50 µm long, 2–2.5 µm thick, 2–3(4) per bundle anteriorly, 1 seta representing each bundle in postclitellar segments. Ventral setae of X and XI modified into genital setae, one at each spermathecal and male pore. Spermathecal setae (Fig. 7B, ss) single-pointed with ental ends strongly curved, and with groove extending along ectal two-fifths of seta; these setae 110–140 µm long, entally about 3 µm thick. Penial setae (Fig. 7B, ps) very similar to spermathecal setae but with less strongly curved ental ends; these setae 135–160 µm long, entally about 3.5 µm thick. Each spermathecal and penial seta ectally enclosed in an oval glandular sac (whether latter bears an outer glandular body as in related species can

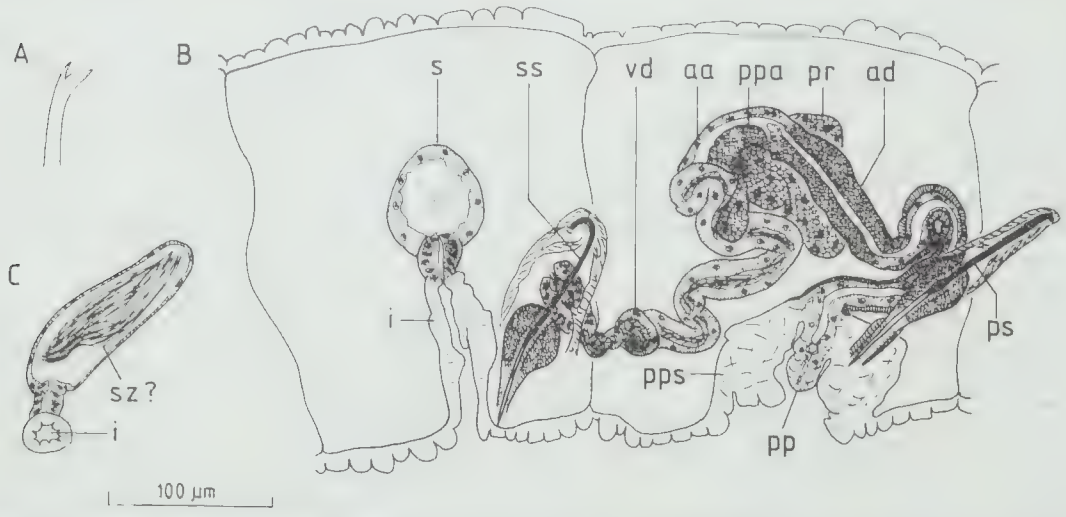

Figure 7. *Limnodriloides cribensis* sp. nov. A, free-hand drawing of somatic seta. B, lateral view of spermatheca and male genitalia in segments X–XI. C, spermatheca of another specimen. aa, atrial ampulla; ad, atrial duct; i, secondary invagination at spermathecal pore; pp, pseudopenis, ppa, prostatic pad; pps, pseudopenial sac; pr, prostate gland; ps, penial seta; s, spermatheca; ss, spermathecal seta; vd, vas deferens.

not be ascertained on basis of available material). Sac of spermathecal setae wider than that of penial setae; both types of setae also supported by muscles. Male pores paired in line with ventral setae somewhat posterior to middle of XI. Spermathecal pores paired in line with ventral setae in middle of X.

Pharyngeal glands in IV–V. Large and conspicuous oesophageal diverticula present, in anterior part of IX. Male genitalia (Fig. 7B) paired. Vas deferens conspicuous, ectally 21–26 µm wide, almost as long as atrium, entering atrium somewhat subapically. Atrial ampulla elongate oval, about 80 µm long, 26–28 µm wide, with very thin outer lining, thin dorsal inner epithelium and elongate ventral prostatic pad, latter bearing lobed prostate gland. Atrial duct 320–340 µm long (measured in 2 specimens only), entally 28–35 µm wide and heavily granulated but lacking outer muscles, ectally 21–32 µm wide and heavily muscular but not granulated. Atrial duct terminating in a papilla-like structure in middle of complex, massive pseudopenial sac (containing both glandular and muscular tissue?). Spermathecae (Figs 7B, s; 7C) consisting of short duct, opening at inner end of deep invagination of body wall (Fig. 7B, i), and an oval or elongate, thin-walled ampulla; each of latter with one large, compact bundle of sperm (probably a poorly preserved spermatozeugma) in postcopulatory specimens (Fig. 7C).

Etymology. Named for the type locality (Crib Point).

Distribution and habitat. Known only from Victoria, Australia. Subtidal, muddy sand, 8–15 m depth.

Remarks. Limnodriloides cribensis belongs to the "*winckelmanni* group", those species of *Limnodriloides* which possess grooved spermathecal setae (see Remarks for *L. problematicus* above). The new species is separated from all other members of this group by its conspicuous, secondary invaginations at the spermathecal pores. Moreover, it has modified slender grooved setae present in X as well as XI, a feature previously known only for *L. fuscus* Erséus, 1984, and certain individuals of *L. victoriensis* Brinkhurst and Baker, 1979.

Marcusaedrilus Righi and Kanner

Marcusaedrilus assimilis sp. nov.

Figure 8

Material examined. Holotype: NMV F57387, whole-mounted specimen. Hobsons Bay (at Melbourne), Port Phillip Bay, Victoria, Australia, 37°52′S, 144°55′E, 8 m, very fine sand, 9-11 Mar 1971; material from the Port Phillip Bay Environmental Study, Hobsons Bay Survey (Marine Pollution Studies Group, Ministry for Conservation stn PPBES 125).

Paratypes: NMV F57388, specimen from Western Port, Victoria, Australia, 38°14.36′S, 145°20.62′E, intertidal, sand, 8 Jan 1974; material from the Western Port Bay Environmental Study (Marine Studies Group, Ministry for Conservation stn WBES 1709) (Shapiro, 1975). NMV F57389, specimen from Port Phillip Bay, Victoria, 38°07.0′S, 144°27.0′E, 9 m, silt

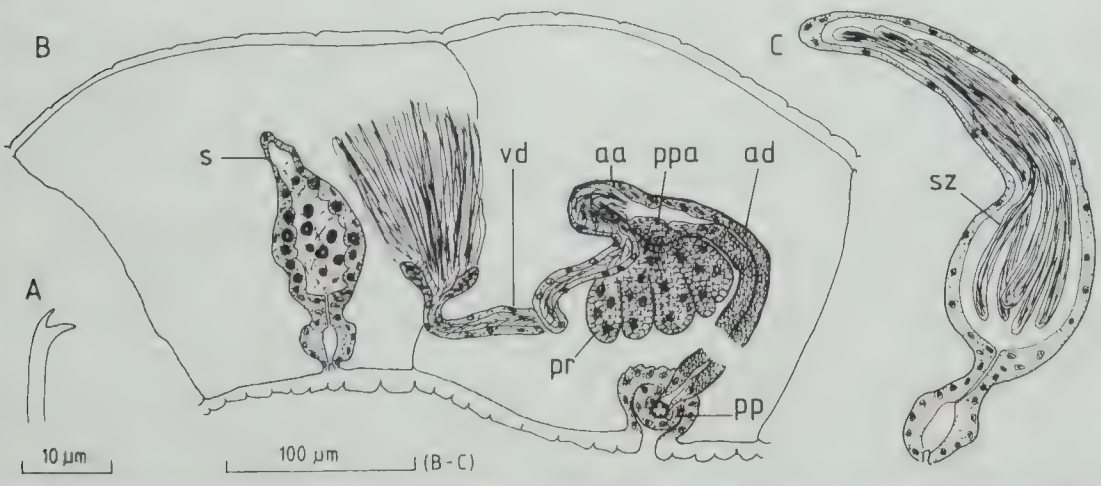

Figure 8. *Marcusaedrilus assimilis* sp. nov. A, somatic seta. B, lateral view of spermatheca and male genitalia in segments X–XI (holotype). C, spermatheca (specimen from Port Hacking, NSW). aa, atrial ampulla; ad, atrial duct; pp, pseudopenis; ppa, prostatic pad; pr, prostate gland; s, spermatheca; sz, spermatozeugma; and, vd, vas deferens.

and clay, 12 Feb 1970; and NMV F57390, specimen from same area and date, but 38°07.0′S, 144°31.0′E, 7 m, silt and clay; both material the Port Phillip Bay Environmental Study (Marine Pollution Studies Group, Ministry for Conservation stns PPBES 941 and 942). AM W11275, specimen from Merimbula, southern New South Wales, Australia.

Other material examined: AM W9656, specimen from Black Neds Cay, L. Macquarie, Newcastle, NSW. AM W195216, specimen from Port Hacking, Sydney, NSW, mud from artificial reef, 17 Dec 1974 (coll. C. Glasby, NSW Fisheries). AM W11329, specimen from seaward end of Merimbula Lake, NSW.

Description. Length 6.8–13.2 mm, 45–75 segments. Width at XI, 0.22–0.38 mm. Prostomium elongate and large, often somewhat pointed. Clitellum extending over XI–⅔XII when developed. Setae (Fig. 8A) bifid, with upper tooth thinner and shorter than lower. Setae 37–50 μm long, 2–3 μm thick, (1)2(3) per bundle anteriorly, 1(2) per bundle in mid-body, generally 2 per bundle in most posterior part of worm. Ventral setae absent from X–XI. Male pores paired, more or less in line with ventral setae, posteriorly in XI. Spermathecal pores paired, more or less in line with ventral setae, immediately posterior to middle of X.

Pharyngeal glands in IV–V. Oesophageal diverticula in IX small. Male genitalia (Fig. 8B) paired. Vas deferens 12–16 μm wide, about as long as atrium, entering apical end of latter. Atrial ampulla cylindrical, 105–140 μm long, 23–40 μm wide, with 1–2 μm thick outer lining of muscles, and with long cilia in its ental part; this part also characteristically folded in all specimens studied (cf. Fig. 8B). Ectal part of atrial ampulla with small, but distinct, ventral prostatic pad. Prostate gland large, lobed. Atrial duct 95–190 μm long, 16–26 μm wide, with very thin outer lining, but with granulation in inner epithelium for most parts. Atrial duct terminating in large papilla inside a roundish pseudopenial sac. Spermathecae (Figs 8B, s; 8C) consisting of (1) ducts, 37–70 μm long, 28–46 μm wide at bulbous ectal swelling, much narrower immediately ental to this swelling, and (2) somewhat pear-shaped ampullae, 100–290 μm long, maximally 35–73 μm wide, with much prolonged, narrow inner ends (particularly in postcopulatory specimens; Fig. 8C). In pre-copulatory specimens, spermathecae with thick walls and droplets of secretion (Fig. 8B, s); in post-copulatory worms, spermathecae with thinner walls and lumen filled with slender spermatozeugmata (Fig. 8C).

Etymology. This species is "similar" (Latin *assimilis*) to two other species of *Marcusaedrilus* (see *Remarks*).

Distribution and habitat. Victoria and New South Wales, Australia. Intertidal and subtidal, muddy or sandy sediments, to at least 9 m depth.

Remarks. Marcusaedrilus assimilis is closely related to *M. grandiculus* Erséus, 1983, from the Great Barrier Reef, and *M. vesiculatus* Erséus, 1984, from southern China. It is, however, easily distinguished from both of these by the characteristically folded, ciliated part of the atrial ampullae. It is further discriminated from *M. grandiculus* by the conspicuous swellings on its spermathecal ducts (such swellings absent in *L. grandiculus*), and from *M. vesiculatus* by its lower number of anterior setae (setae up to 3 or 4 per bundle in *L. vesiculatus*), and its more developed pseudopenes and spermathecae.

Discussion

Of the nine marine species of Tubificidae now known from Victoria, only three, *Heronidrilus bihamis, Tubificoides diazi* and *T. fraseri* are widely distributed outside the southern, temperate part of Australia. *Heronidrilus bihamis* is in fact the only taxon so far known to occur both in Victoria and in southern Western Australia; none of the 22 other tubificid species recorded from the Albany area in the latter state (Erséus, in press) has yet been found in Victoria. Although still scanty, the available information thus seems to indicate that the marine tubificid fauna of Victoria is much different from that of south-western Australia. The occurrence of two species also in New South Wales (*Limnodriloides stercoreus* and *Marcusaedrilus assimilis*), and one also in New Zealand (*L. problematicus*) rather support a truly south-eastern affinity of this fauna.

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NEW RECORDS OF OPHIURIDAE, OPHIACANTHIDAE AND OPHIOCOMIDAE (ECHINODERMATA: OPHIUROIDEA) FROM SOUTH-EASTERN AUSTRALIA

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Abstract

O'Hara, T. D., 1990. New records of Ophiuridae, Ophiacanthidae and Ophiocomidae (Echinodermata: Ophiuroidea) from south-eastern Australia. *Memoirs of the Museum of Victoria* 50(2): 287–305.

Thirty species of Ophiuroidea from three families: Ophiacanthidae, Ophiuridae and Ophiocomidae, are recorded from south-eastern Australia. *Ophiura jejuna* is placed in the subgenus *Ophiuroglypha* and the inclusion of *O. fidelis* in *Ophiacantha* and *O. bispinosus* in *Ophioplocus* are supported. *Ophiomitrella falklandica* is synonymized with *O. conferta, Ophiocten australis* with *O. hastatum* and the possible synonymy of *Ophiacantha sollicita* with *O. aculeata* and *Ophioplinthaca incisa* with *O. plicata* are discussed. Three species: *Ophiomyces grandis, Ophioleuce regulare* and *Ophiomitrella* sp. cf *chilensis,* are new to the Tasman Region and the range of a further seventeen species is extended. Previous reports of *Ophiotreta valenciennesi, Ophialcaea congesta* and *Ophiura fluctuans* from the region are found to be erroneous. *Ophiomitrella conferta* and *Ophioplocus bispinosus* are discovered to be viviparous.

Introduction

Numerous trawling and dredging expeditions over the last decade have vastly increased the ophiuroid collection of the Museum of Victoria, enabling a more accurate assessment of the south-eastern Australian ophiuroid fauna to be undertaken. Predominant in these expeditions were the Bass Strait Benthic Survey (1979–1983) (BSS) and the CSIRO "Soela" cruises (1984–1985). Other cruises included the "Kimbla" East Bass Strait cruise (Nov 1973) and the "Dmitry Mendeleev" cruise (1975–1976) through the Tasman Sea and across southern Australia. Material from the the last expedition has also been deposited in other museums, some of which have been the subject of reports by Baker (1979) and Baker and Devaney (1981).

The ophiuroid fauna of south-eastern Australia is predominantly known from the work of Lyman, (1878–1882), H.L. Clark (1909, 1916, 1928, 1938, 1946), Koehler (1922b, 1930), A.M. Clark (1966) and recently Baker (1979–1982) and Baker and Devaney (1981). A useful key (although now slightly out-dated) to all ophiuroid genera was provided by Fell (1960). This paper deals with three ophiuroid families: Ophiuridae, Ophiacanthidae and Ophiocomidae. Subsequent papers in preparation will deal with remaining families. Seventeen ophiurid, fifteen ophiacanthid and two ophiocomid species are now known from south-eastern Australia from Robe, South Australia to Eden, New South Wales and Tasmania. This region has sometimes been described as a separate, Maugean, biogeographic province, although this was not supported by Rowe and Vail (1982) in a recent biogeographical study of Tasmanian echinoderms. The material refered to herein is restricted to this region unless it is of significant biogeographical, historical or taxonomic importance. Where the numbers of specimens were substantial, only a representative sample is given. Emphasis has been placed upon species new to the area or where new morphological information was available. Omitted species comprise: *Ophiura kinbergi* Ljungman, 1867a, *Ophiura ooplax* (H. L. Clark, 1911) and *Ophiurolepis accomodata* Koehler, 1922b (Ophiuridae); *Ophiocamax applicatus* Koehler, 1922b (Ophiacanthidae); *Clarkcoma canaliculata* (Lütken, 1869) (Ophiocomidae).

The material is lodged in the following institutions: Australian Museum, Sydney (AM); British Museum (Natural History), London (BMNH); Museum of Comparative Zoology, Harvard (MCZ); Museum of Victoria, Melbourne (NMV); South Australian Museum, Adelaide (SAM); Zoologisk Museum, Copenhagen (ZMC). The abbreviation "d.d." is used for disc diameter.

Ophiuridae Lyman, 1865

Ophiurinae Lyman, 1865

Ophiura Lamark, 1816

Ophiura (Ophiura) palliata Lyman

Figure 1a

Ophioglypha palliata Lyman, 1878: 69, pl. IV, figs 98–100.—1882: 43, pl. IV, figs 4–6.—Koehler, 1897: 298.— 1899: 18.

Ophiura fluctuans.—Baker, 1979: 22, figs 1b, d, f, (non *O. fluctuans* Koehler, 1922a).

Material examined (partial list). Tasmania, off north-west coast, 40°54′S, 143°43′E, 520–526 m, 9 May 1984, NMV F52837(6); W of north-west coast, 40°58.2′S, 143°49.0′E, 550-560 m, 26 Jan 1985, NMV F52840(1); 41°03.3′S, 143°53.6′E, 550 m, 26 Jan 1985, NMV F52841(1); 41°02.5′S, 143°53.1′E, 518–520 m, 27 Jan 1985, NMV F52842(1); 40°59.2′S, 143°50.4′E, 542–540 m, 30 Jan 1985, NMV F52843(5); off eastern coast, 42°43′S, 148°25′E, 506 m, 25 Jun 1984, NMV F52844(3); Flinders Canyon, eastern Bass Strait, 39°38.7′S, 148°49.4′E, 770 m, 27 Mar 1979, shell/sand (BSS stn 34), NMV F52849(1 juvenile); eastern Bass Strait, 39°28.2′S, 148°52.4′E, 841 m, 29 Mar 1979, muddy sand (BSS stn 37), NMV F52850 (1).

Victoria, off eastern coast, 38°06.2′S, 150°04.1′E, 640 m, 4 Feb 1985, NMV F52846(2); 38°15.4′S, 149°42.4′E, 662-666 m, 5 Feb 1985, NMV F52847(2); 38°14.9′S, 149°41.6′E, 660 m, 5 Feb 1985, NMV F52848(3).

New South Wales, E of Broken Bay, 744 m, 4 Dec 1979, AM J15960(1); off Broken Bay, 33°32′S, 152°00′E, 823 m, 19 Aug 1975, AM J10110(2).

Description. Disc, 5-17 mm d.d.; arms 2–3 times d.d. Disc fully scaled (noticeable only when dried); scales fine; large oval scale present proximal to radial shields. Radial shields oval, one-eighth d.d., contiguous distally or just separated. Arm comb papillae spiniform. Oral shields pentagonal, lateral edges straight, not notched. Dorsal arm plates quadrangular, 3 times as wide as long, broadly contiguous. Proximolateral borders of second and third plates bear a row of spiniform papillae opposing each arm comb. 3 arm spines, flattened, tapered to blunt point; uppermost as long as segment, lower 2 half that size (fig. 1a). Live colour: disc centre pink/magenta, margin and ventral surface blue, radial shields and arms orange.

Distribution. South-eastern Australia from western Bass Strait to Broken Bay, New South Wales; ?Maldive Is. 506–841 m.

Remarks. Baker (1979: 22) referred two of these specimens (AM J10110) to *Ophiura fluctuans* Koehler, 1922a. The type description, however, indicates that *O. fluctuans* has large uncalcified areas on the disc; small, one-eleventh d.d., widely separated radial shields; no papillae on the basal dorsal arm plates and a middle arm spine that is as large as the uppermost spine. These differences are slight and further research may find *O. palliata* and *O. fluctuans* to be conspecific.

Koehler's (1897, repeated 1899) record from the Maldive Islands (1340 m) needs confirmation as he supplied little morphological information about the 14 mm d.d. specimen, otherwise *O. palliata* has not been reported since the holotype, found off Sydney at 750 m.

Ophiura (Ophiuroglypha) jejuna (Lyman)

Figures 1b–d

Ophioglypha jejuna Lyman, 1878: 78, pl.II, figs 55, 56.—1882: 52, pl. V, figs 4–6.

Ophiura jejuna.—Matsumoto, 1915: 81.—H.L. Clark, 1915: 325.

Material examined. Tasmania, eastern Bass Strait, Flinders Canyon, 39°38.7′S, 148°49.2′E, 770 m, 27 Mar 1979, shell/sand (BSS stn 34), NMV F52703(3); eastern Bass Strait, 39°28.2′S, 148°52.4′E, 841 m, 29 Mar 1979, muddy sand (BSS stn 37), NMV F52704(1).

Description. Disc 2.5–11 mm d.d., arms twice d.d. Disc scales thin, close set, regular, round to polygonal; large oval scale present at each inter-radial margin. Radial shields pentagonal, as wide as, or wider than long, contiguous for distal half of their length. Arm comb papillae short, thick, blunt, meeting on dorsal midline (Fig. 1b). Oral shield large, pentagonal, lateral sides straight. 5 papillae on each jaw side, inner 2 spiniform, outer 3 low, widened. Dorsal arm plates fan-shaped, as wide as long, narrowly contiguous. Ventral arm plates 3 times as wide as long, separate. 3 arm spines, one-fifth length of segment, middle spine modified into hyaline upturned hooklet distally (Fig. 1c). 9 tentacle scales on basal pore of largest specimen; succeeding segments with 6, 4, 2, and no scales respectively. An additional small plate situated at lateral tip of second, third and fourth ventral arm plates (Fig. 1d).

Distribution. South-eastern Australia and Tristan da Cunha. 770-1860 m.

Remarks. Lyman's (1878) description of the holotype (5 mm d.d.) differs from these specimens. He did not mention the modified arm-spine or the additional plate on the ventral arm surface. There are only two tentacle scales on the basal segments and the arm spines are long, two-thirds of a segment long. Otherwise the specimens are very similar. The modification of the second lowest arm spine into an upturned hooklet, indicates that this species belongs in the subgenus *Ophiuroglypha.*

The two smallest specimens (2.5–2.8 mm d.d.) have no arm comb or the additional arm plates,

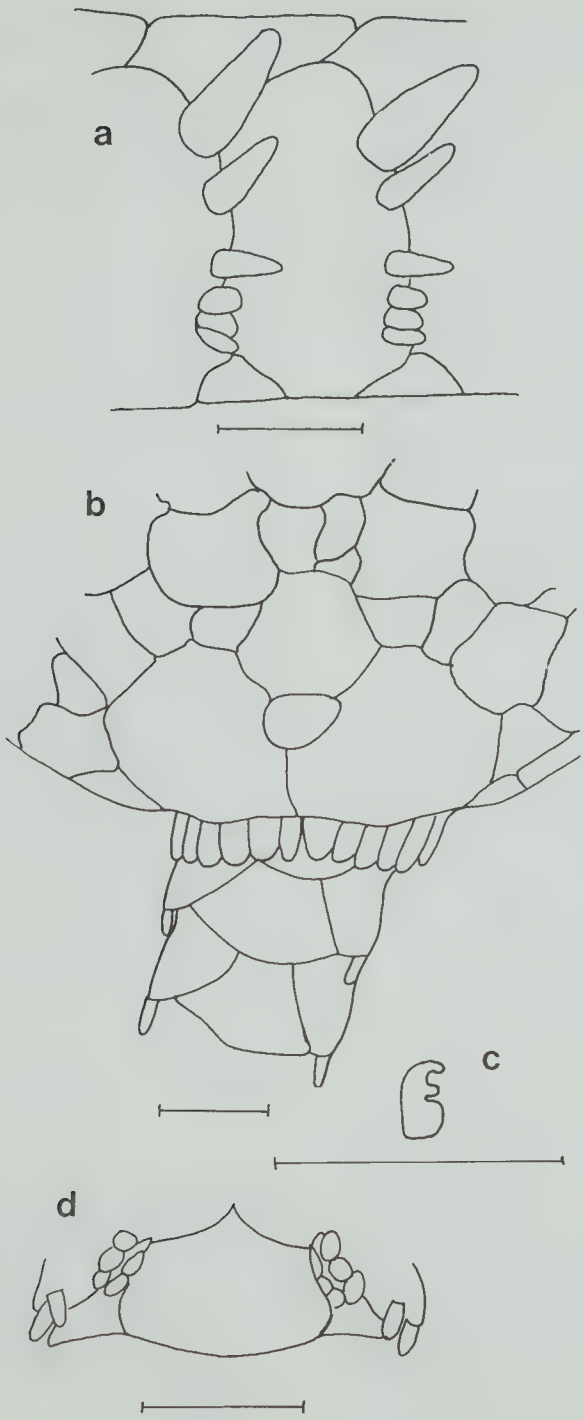

Figure 1. a: *Ophiura palliata* (NMV F52843), lateral view of arm; b–d: *Ophiura* (*Ophiuroglypha*) *jejuna* (NMV F52704), b, dorsal view of disc, c, middle arm spine of 25th segment, d, ventral view of 4th arm segment. Scale line = 1.0 mm.

the dorsal and ventral arm plates are comparatively narrower and the arm spine hooklets are more prominent.

Ophiura (Ophiuroglypha) jejuna is similar to the widespread species, *Ophiura (Ophiuroglypha) irrorata* Lyman, 1878, which has been found off New Zealand (Pawson, 1969: 52, figs 8–13) but not yet from Australian waters. It also has an additional plate adjacent to the ventral arm plate, although they are smaller than on *O. jejuna* and are present on most of the arm segments instead of the basal few. Mortensen (1933a: fig. 48c), who described and figured these plates, interpreted them as enlarged adradial tentacle scales, an interpretation consistent with their position in the present material.The only other species of *Ophiuroglypha* known from the Tasman region is *O. rugosa* (Lyman, 1878), also found off New Zealand (Baker, 1977: 151). *O. jejuna* can be distinguished from both *O. irrorata* and *O.* rugosa by the arm comb, continuous across the dorsal midline, and the angular radial shields, contiguous for most of their length.

Ophiura (Ophiuroglypha) clemens (Koehler, 1904) appears very similar to *O. jejuna*, particularly specimens from the north Atlantic descibed and figured by Paterson (1985: 120, fig. 45). This species has also been reported from Indonesia and the Philippines at depths of between 686 and 1633 m.

The present specimens of *O. jejuna* are the first to be reported since the type series which included a paratype from off Sydney at a depth of 750 m.

Ophiocrossota H.L. Clark

Ophiocrossota multispina (Ljungman)

Ophioglypha multispina Ljungman, 1867b: 307.—Lyman, 1878: 99.—1882: 41.

Ophiocrossota heteracantha H.L.Clark, 1928: 451, figs 136a, b.—1946: 267.

Ophiocrossota multispina.—H.L. Clark,1946: 267.—Baker, 1982: 433, fig. 10:16a.

Material examined (partial list). Tasmania, E of King Island, 40°00.0′S, 144°20.9′E, 48 m, 22 Nov 1981, siliceous sand and shell (BSS stn.200), NMV F52893(1); E of Flinders Island, 40°06.2′S, 148°25.0′E, 22 m, 14 Nov 1981, coarse shell (BSS stn 166), NMV F52895(3 juveniles).

Victoria, western Bass Strait, 39°06.3′S, 142°55.6′E, 84 m, 21 Nov 1981, fine shell (BSS stn 191), NMV F52894(1 juvenile); off eastern coast, 37°50′S, 148°40′E, 26 m, 30 Jul 1983, medium sand (BSS stn 208), NMV F52896(28).

Distribution. South-eastern Australia from the Great Australian Bight to Sydney, New South Wales. 10–84 m.

Remarks. These are the first records of *O. multispina* from Tasmanian waters.

Amphiophiura Matsumoto, 1915

Amphiophiura urbana (Koehler)

Ophioglypha urbana Koehler, 1904: 50, pl. VII, figs 10-12.

Amphiophiura urbana.—Baker, 1979: 25, fig. 1h (partial synonymy).

Material examined (partial list). South Australia, 24 n. mi. off Beachport, 37°45′S, 139°41′E, 390–410 m, 24 Oct 1981, NMV F52884(1).

Tasmania, off north-west coast, 41°05.1′S, 143°56.3′E, 382 m, 27 Jan 1985, NMV F52888(1); E of North Point, Flinders Island, 39°44.5′S, 148°49′E, 421 m, 24 Nov 1973, muddy sand, NMV F52886(1); off Maria Island, 42°43′S, 148°25′E, 506 m, 25 June 1984, NMV F52889(3); 42°41.9′S, 148°25.1′E, 440 m, 15 Aug 1984, NMV F52890(1); 42°40.8′S, 148°25.4′E, 472 m, 16 Aug 1984, NMV F52891(2); off southern coast, 43°38.9′S, 147°49.4′E, 160 m, 16 Feb 1976, NMV F52892(1).

Victoria, eastern Bass Strait, 38°52.6′S, 148°25.2′E, 140 m, 15 Nov 1981, muddy sand (BSS stn 170), NMV F52885(1).

Distribution. South-eastern Australia from the Great Australian Bight to southern New South Wales, including Tasmania; Indonesia. 108–596 m.

Remarks. The largest specimen (NMV F52855), 17 mm d.d, has a split arm with one branch regenerating backward toward the disc.

Haplophiura Matsumoto, 1915

Haplophiura gymnopora (H.L. Clark)

Ophiozona gymnopora H.L. Clark, 1909: 535, pl. LI, figs 1–3.

Haplophiura gymnopora.—Matsumoto, 1915: 76.—H.L. Clark, 1938: 357.—1946: 267.—Rowe and Pawson, 1977: 351.

Material examined. Tasmania, eastern Bass Strait, 39°41.7′S, 148°39.5′E, 115 m, 27 Mar 1979, muddy sand (BSS stn 32), NMV F52859 (10); 39°28.4′S, 148°49.2′E, 110 m, 29 Mar 1979, shell/sand (BSS stn 35), NMV F52860(2); 39°44.8′S, 148°40.6′E, 124 m, 14 Nov 1981, fine sand and mud (BSS stn 167), NMV F52861(20).

Victoria, eastern Bass Strait, 38°54.3′S, 147°13.4′E, 58 m, 18 Nov 1981, coarse shell (BSS stn 176), NMV F52862(6).

Distribution. South-eastern Australia from eastern Bass Strait to Wata Mooli, New South Wales. 40–124 m.

Remarks. The specimens measure 1–4 mm d.d. *H. gymnopora* was previously known only from southern New South Wales.

Ophiocten Lütken, 1855

Ophiocten hastatum Lyman

Ophiocten hastatum Lyman, 1878: 103, pl. 5, figs 133, 134.—Paterson, Tyler and Gage, 1982: 117, figs 5a–e (synonymy).

Ophiocten australis Baker, 1979: 26, figs 3a–c.

Ophiura hastata.—Guille, 1982: figs 6d, e, 7a, b.

Material examined. Tasmania, off south-western coast, 1800-1820 m, 21 Feb 1976, NMV F52773(200).

New South Wales, off Nowra, 34°51.3′S, 151°31.3′E, 1701 m, 16 Jul 1986, NMV F54213(8); 34°58.4′S, 151°23.2′E, 1750 m, 16 Jul 1986, NMV F54214(17).

Distribution. South-eastern Australia, New Zealand, Kerguelen and Prince Edward Island, South Africa, eastern Atlantic and Pacific Oceans. 1130–4700 m.

Remarks. The present material, 4.5–18 mm d.d, confirms Paterson, Tyler and Gage's (1982) suspicion that *O. australis* is synonymous with the widespread species *O. hastatum*. Baker (1979) distinguished *O. australis* from *O. hastatum* by the lack of genital papillae and the lack of papillae on the first dorsal arm plate. However, Paterson, Tyler and Gage found that these papillae, as well as arm comb papillae, are often absent on *O. hastatum* specimens.

The present specimens agree closely with both Baker's (1979) and Paterson, Tyler and Gage's (1982) descriptions. Genital papillae and dorsal arm plate papillae are absent, but a few specimens have one or two rudimentary arm comb papillae. There are three arm spines, the uppermost thickest and longest, as long as 3–4 dorsal arm plates. The oral shields, even on the smallest specimens, are at least twice as wide as long.

Ophiomastus Lyman, 1878 (emend H.L. Clark, 1939)

Ophiomastus tegulitius Lyman

Ophiomastus tegulitius Lyman, 1878: 104, pl. VI, figs 167–169.—1882: 104, pl. VIII, figs 16-18.—Fell, 1958: 31.

Material examined. Victoria, western Bass Strait, 39°06.2′S, 142°28.7′E, 640 m, 9 Oct 1980, yellow mud (BSS stn 66), NMV F52666 (1).

New South Wales, E of Broken Bay, 840–895 m, 6 Dec 1979, AM J16487(3).

Description. Disc, 2.6–3.8 mm d.d.; arms, flattened and widened at the base, 1 d.d. long. Disc high, hemispherical, covered in approximately 20 plates; 6 primaries (1 is occasionally split into 2), 1 or 2 plates at each interradial margin and small, sunken radial shields. Oral papillae fused, jaw margin crenulate. Dorsal and ventral arm plates small, separate, present throughout. 2 opposing tentacle scales on first 3–6 basal pores, large scale on lateral arm plate, smaller rim-like scale on ventral arm plate; only larger scale persists distally. 2 small, conical arm spines. Colour: white.

Distribution. South-eastern and eastern Australia, New Zealand, and north of New Guinea. 510–4840 m.

Remarks. This is the only *Ophiomastus* species known from the Tasman region. Two other species described by Fell from New Zealand: *O. stellamaris* Fell, 1952 and *O. admiral* Fell, 1958, were found by Baker (1977) to be representatives of *Ophiozonella.*

This is the first report of *O. tegulitus* since the type series.

Ophiomisidium Koehler, 1914

Ophiomisidium flabellum (Lyman)

Ophiomusium flabellum Lyman, 1878: 120, pl. V, figs 141–143.—1882: 98, pl. III, figs 4–6.—H.L. Clark, 1909: 539.

Ophiomisidium flabellum.—Koehler, 1914: 32; 1930: 251.—H.L. Clark, 1915: 308.—1938: 357.—1946: 266.—Baker, 1977: fig. 1a.

Material examined. Tasmania, W of Cape Sorrell, 41°50.2′S, 144°33.2′E, 470 m, 20 Oct 1984, NMV F52669(1 juvenile).

Victoria, SE of Halibut Platform, Bass Strait, 38°27′S, 148°24.5′E, 183 m, 23 Nov 1973, coarse sand, NMV F52667(1).

New South Wales, 7 mi. off Port Jackson, 55–65 m, 4 Jun 1874 (Challenger stn 163a), NMV F52668(6).

Philippines, off Jolo Island, 20 m, coll. Th. Mortensen, 17 Mar 1914, identified by Koehler (1930: 252), ZMC(1).

Description. Disc 1.0–4.0 mm d.d.; arms, approximately 1 d.d, considerably widened at base. Approximately 30 disc plates, including 6 primaries, 1 large tubercle-shaped plate at each inter-radial margin, large, a quarter d.d, contiguous radial shields, and several smaller radial and inter-radial plates. Disc margin rampart-like, due to tubercular plates and slightly upraised radial shields. Basal lateral arm plates very wide, dominating ventral surface, meeting distal to small oral shields. First lateral arm plate with up to 4 modified triangular arm spines that fringe the disc; second segment with 2 spines; succeeding segments with 1 short, blunt spine. Tentacle pores only on first 3 segments, each with 1 oval tentacle scale.

Distribution. South-eastern Australia from western Bass Strait to Cape Three Points, New South Wales; ?Philippines. 20–420 m.

Remarks. This material includes six previously unrecorded specimens from Challenger station 163a, the same locality as the solitary type specimen.

The smallest specimen (NMV F52699) differs in having flat marginal inter-radial disc plates and paddle-shaped basal arm spines, relatively longer than on adults.

Koehler's (1930) specimen from the Philippines is very similar to local material, differing only in having slightly smaller basal arm spines. Although some *Ophiomisidium* species are known to be widespread, (Guille, 1982: 73, has reported the Atlantic species *O. speciosum* Koehler, 1914 from off Kerguelen), this solitary record could be due to a confusion of labels, as is possibly the case for a similar aberrant record of *Ophiomusium incertum*, and needs confirmation.

One of the other seven known species of *Ophiomisidium* is from New Zealand: *O. irene* Fell, 1952. Although very similar to *O. flabellum, O. irene* can be distinguished by the presence of an additional tubercle-like plate between the distal ends of the radial shields (Baker, 1977:150).

The increase in the known bathymetric distribution to 420 m is consistent with other members of the genus.

Ophiolepidinae Matsumoto, 1915

Ophiomusium Lyman, 1869

Ophiomusium incertum Koehler

Ophiomusium incertum Koehler, 1930: 245, pl. XVIII, fig. 8, pl. XIX, figs 3, 4.—Baker, 1979: 30 (full synonymy).

Material examined. Tasmania, western Bass Strait, 40°07.9'S, 143°12.9'E, 503 m, 11 Oct 1980, carbonate mud (BSS stn 106), NMV F52676(3); eastern Bass Strait, 39°27.7'S, 148°51.1'E, 293 m, 28 Mar 1979, coarse shell (BSS stn 36), NMV F52671(1); 39°40.3'S, 148°46.5'E, 293–329 m, 27 Mar 1979, rock and coarse sand (BSS stn 33), NMV F52677(3); E of North Point, Flinders Island, 39°44'S, 148°47.5'E, 329 m, 24 Nov 1973, polyzoa bottom, NMV F52674(2); 39°44'S, 148°49'E, 421 m, 24 Nov 1973, muddy sand, NMV F52672(10); off north-eastern coast, 41°32.9'S, 148°35.0'E, 127 m, 10 Oct 1985, NMV F52675(1); E of Maria Island, 42°39'S, 148°26.3'E, 503 m, 25 Jun 1984, NMV F52673(1).

Indonesia, Arafura Sea, Kei Islands, 270 m, coll. Th. Mortensen, 1 May 1922, ZMC(1 syntype).

Distribution. Spencer Gulf or Gulf Saint Vincent, South Australia to eastern Bass Strait and eastern Tasmania; ?Kei Islands. 127–503 m.

Remarks. Two pairs of tentacle pores are present on basal segments of juvenile specimens. A 1.0 mm d.d. specimen (NMV F52671) has two distinct pairs; a 2.4 mm d.d. specimen (NMV F52677) has an indistinct distal pair and a distinct proximal pair; a 3.6 mm d.d. specimen (NMV F52672) has no distal pair and an indistinct proximal pair; larger specimens have no pores.

The discovery of tentacle pores in *O. incertum* is important as it is often quoted as an unusual example of an ophiuroid in which they are absent. I cannot determine from this material whether the pores are functional or vestigial.

In this excellent growth series, the other specific characters can clearly be traced to maturity. The tubercular disc plates as well as the fine granular nature of all the plates, are notable even in the smallest specimens. There are no dorsal or ventral arm plates, two arm spines at 1.0 mm d.d, 3–4 at 3.6 mm d.d. and 5–6 in adults.

Koehler (1930) reported a specimen of *O. incertum* from the Kei Islands. This specimen is identical to local material, however, H.L. Clark (1946: 275) and Madsen (1967: 143) suggested the reported locality may be due to a confusion of labels and therefore needs confirmation.

Ophiomusium australe H. L. Clark

Ophiomusium simplex var. *australe* H.L. Clark, 1928: 449, figs 135a, b.—1946: 274.

Ophiomusium aporum H.L. Clark, 1928: 447, figs 134a, b.—1946: 275.—Baker, 1979: 30.

Ophiomusium australe.—Baker, 1979: 30.—Baker and Devaney, 1981: 158, figs 25–27.

Material examined. Victoria, 18 n. mi. S of Cape Nelson, 38°44'S, 141°33'E, 155 m, 26 Aug 1975, identified by A.N. Baker (Baker and Devaney, 1981: 158), NMV H367(3); 27 n. mi. SSW of Portland, 300–595 m, May 1979, NMV F52771(7).

Distribution. Dirk Hartog Island, Western Australia to Cape Nelson, Victoria. 130–595 m.

Remarks. The present material, 2.6–13 mm d.d, has only two arm spines, the same number as shown on Baker and Devaney's (1981: fig. 27) figure of the type. However, this is one fewer than reported from the holotype of *Ophiomusium aporum*, the only full description of this species available.

Ophiomusium anisacanthum H.L. Clark

Ophiomusium anisacanthum H.L. Clark, 1928: 446, figs 133a, b.—1946: 274.—Baker, 1979: 31.—Baker and Devaney, 1981: 158, figs 22–24.

Material examined. Victoria, W of Cape Nelson, 170–200 m, 6 Jun 1969, NMV F52770(1).

Distribution. Lancelin, Western Australia to Cape Nelson, Victoria. 130–310 m.

Remarks. O. anisacanthum was previously known only from west of Gulf St Vincent, South Australia.

Ophioplocus Lyman, 1861

Ophioplocus bispinosus H.L. Clark

Ophioplocus bispinosus H.L. Clark, 1918: 337, pl. IV, fig. 2.—1946: 276.—Thomas, 1975: 241.

Ophioceres bispinosus.—Baker and Devaney, 1981: 157, figs 1–3, 5, 14–17.—Baker, 1982: 433, figs 10:16e–f.—Rowe and Vail, 1982: 222.

Material examined (partial list): Tasmania, Narracoopa, King Island, 8–9 Mar 1980, rocky shallows, NMV F52767(1); West Cove, Erith Island, Bass Strait, 8 Jan 1982, under a granite boulder, lower intertidal, NMV F52765(1).

Victoria, Glenaire, W of Cape Otway, 16 Dec 1983, rocky shallows, NMV F52768(1); Cape Schanck, 8 Oct 1982, rocky shallows, NMV F52766(1); Cape Paterson, no depth, 20 Jan 1957, NMV F52764 (3).

Distribution. South-eastern Australia from Encounter Bay, South Australia to Wilsons Promontory and eastern Tasmania. 1–50 m.

Remarks. Ophioplocus bispinosus is viviparous, there is 1 bursa to each genital slit, each of which contains 3–4 juveniles. All the juveniles are typically at the same level of maturity, for example a bursa in a 10.5 mm d.d. specimen (NMV F52764) had 3 young: 1.3, 1.4 and 1.5 mm d.d. respectively, all considerably larger than the genital slit, which was only 0.7 mm (2 arm segments) in length.

In 1981, Baker and Devaney transferred *Ophioplocus bispinosus* to the genus *Ophioceres* Koehler, 1922b, apparently unaware that Thomas (1975) had previously shown that both *Ophioceres* and *Ophioceramis* Lyman, 1865, are junior synonyms of *Ophioplocus* Lyman, 1861. *Ophioceramis* was a heterogeneous assemblage that contained species belonging to the Amphiuridae and Ophiactidae as well as two species, *O. januarii* (Lütken, 1856) and *O. declinans* (Koehler, 1904), that are intermediate between the type species of *Ophioplocus* and *Ophioceres,* having a small amount of dorsal arm plate fragmentation (2–5 pieces) and 3–6 tentacle scales.

At least three other *Ophioplocus* species are known to be viviparous: *O. incipiens* (Koehler, 1922b) (see Mortensen, 1936: 307), *O. esmarki* Lyman, 1874 (see Hyman, 1955: 629) and *O. marginata* (Fell, 1953) (see Baker and Devaney, 1981: 158).

Ophiozonella Matsumoto, 1915

Ophiozonella bispinosa (Koehler)

Ophiozona bispinosa Koehler, 1897: 319, pl. VI, figs 32, 33.

Ophiozonella bispinosa.—Baker, 1979: 32 (full synonymy).

Material examined. Tasmania, off north-west coast, 41°05.1′S, 143°56.3′E, 382 m, 27 Jan 1985, NMV F52769(1).

Distribution. South-eastern Australia from the Great Australian Bight to north-west Tasmania, Andaman Islands, Philippines and Japan. 205–382 m.

Remarks. This 10 mm d.d. specimen is the first to be reported in Australia from east of Gulf St Vincent, South Australia.

Two other species of *Ophiozonella* are known from the Tasman region: *O. stellamaris* (Fell, 1952) and *O. stellata* (Lyman, 1878), both from New Zealand. O. *stellamaris* has only one arm spine and both only have one tentacle scale throughout, unlike *O. bispinosa* which has two, basally three, tentacle scales and two arm spines.

Ophioleucinae Matsumoto, 1915

Ophioleuce Koehler, 1904

Ophioleuce regulare (Koehler)

Ophiopyren regulare Koehler, 1901: 26, pl. VIII, figs 52–54.

Ophiopyren regularis.—Koehler, 1922b: 36, pl. LXXXVI, figs 1, 2.

Ophioleuce regulare.—Madsen, 1983: 45, figs 7a–g (full synonymy).

Material examined. Tasmania, eastern Bass Strait, Flinders Canyon, 39°38.7′S, 148°49.4′E, 770 m, 27 Mar 1979, shell/sand (BSS stn 34), NMV F52665(1); eastern Bass Strait, 39°28.2′S, 148°57.4′E, 841 m, 29 Mar 1979, muddy sand (BSS stn 37), NMV F52664(7).

Antarctica, 66°8′S, 94°17′E, 220 m, 27 Jan 1914 (ANARE stn 8), identified by Koehler (1922b: 36), AM J3539(1).

Description. Bass Strait specimens: 1.6–3.1 mm d.d, arms, delicate and slender, 2 times d.d. Disc low, sunken inter-radially, ventral side slightly concave; disc plates large, irregular, mostly bordered by 1 or 2 rows of spherical granules (sparse on smallest specimens). Disc margin tapers to sharp edge, bears several rows of elongated granules. No granules ventrally. Ventral arm plates rhombic or triangular, contiguous until just outside disc margin. Tentacle pores under the disc (first 3–7) elongated, with 2–4 tentacle scales; other pores small, circular with 1 tentacle scale. 2 arm spines. Colour: cream.

Distribution. Eastern Bass Strait and circumpolar antarctic and subantarctic waters. 69–900 m.

Remarks. O. regulare was previously known only from antarctic and subantarctic regions.

One of the other five known species of *Ophioleuce* has been discovered from the Tasman Region: *O. seminudum* Koehler, 1904. This Indo-West Pacific species has been found off the coast of southern Queensland (Baker, 1979: 32 as *O. charischema* (H.L. Clark, 1911), see Madsen, 1983) and South of Norfolk Island in the Tasman Sea (NMV F52701). Only the basal pore is elongated in *O. seminudum*, and the inter-radial disc margin is not sunken, consequently, the ventral disc surface, which is also usually granulated, does not appear concave.

Ophiocomidae Ljungman, 1867b

Clarkcoma Devaney, 1970

Clarkcoma bollonsi (Farquhar)

Ophiocoma bollonsi Farquhar, 1908: 108.

Clarkcoma bollonsi. — Devaney, 1970: 5, figs 4, 5, 10, 12, 14 (partial synonymy). — Rowe, 1985: 67, pl. 2, figs 3–8.

Ophiotreta valenciennesi. — Koehler, 1930: 66. — H. L. Clark, 1946: 187 [non *O. valenciennesi* (Lyman, 1879)]

Material examined. Tasmania, off south-west coast, 43°25.3'S, 145°39.8'E, 160 m, 21 Oct 1984, NMV F52706(2 juveniles); off Maria Island, 42°40'S, 148°27.5'E, 122–174 m, 23 Mar 1931, identified by Madsen (1967: 142) as *Clarkcoma canaliculata* (Lütken, 1869) (BANZARE stn 113), SAM K1347(2).

Victoria, SE of Seaspray, 38°42'S, 147°56.2'E, 69 m, 23 Nov 1973, polyzoa substrate, NMV F52705(2); S of Cape Howe, 38°12'S, 149°40'E, 180–280 m, coll. Mortensen 16 Sep 1911, identified by Koehler (1930: 66) as *Ophiotreta valenciennesi* (Lyman), ZMC(1).

Distribution. South-western Australia from Dongara to Hamelin Bay; eastern Australia, from Tasmania to Mooloolaba, Queensland, and New Zealand. 9–630 m.

Remarks. Rowe (1985) reported this species from Australia for the first time. The present specimens, 2–13 mm, extend the known distribution to Tasmania.

Koehler (1930) recorded a specimen of *Ophiotreta valenciennesi* (Lyman, 1879) from off Cape Howe, Victoria. This specimen, 8 mm d.d, proved upon examination to belong to *Clarkcoma bollonsi* (Farquhar, 1908). Species of *Ophiotreta*, ophiacanthids, are superficially similar to *Clarkcoma* but lack the block-like hylanated teeth. Moreover, *O. valenciennesi*, unlike other species of *Ophiotreta* (see Mortensen, 1933a: 35, fig. 19b) and all *Clarkcoma* species, only has a single apical tooth papillae.

The other two species of *Clarkcoma* are from southern Australia: *C. canaliculata* (Lütken, 1869) and *C. pulchra* (H.L.Clark, 1928), both from depths of less than 50 m. The three specimens from off Maria Island, Tasmania, 122–174 m, that Madsen (1967) recorded as *C. canaliculata*, are referable to *C. bollonsi*. Interestingly, *C. pulchra*, although common on south-western and eastern coasts of Australia, appears to be absent from Victoria and Tasmania.

The only other ophiocomid species known from southern Australia is *Ophiocomina australis* H.L.Clark, 1928. Juvenile *Clarkcoma* specimens can occasionally be mistaken for this species, as they have only one tentacle scale on most pores (there are two on adults) and, in the case of *C. canaliculata* are also crossbanded dark and light along the arms. However, *O. australis* can be distinguished from all the *Clarkcoma* species by the presence of a distinct distal lobe on the oral shields. *O. australis* is restricted to the South Australian Gulf region.

Ophiacanthidae Perrier, 1891

Ophiacanthinae Paterson, 1985

Ophiacantha Muller and Troschel, 1842

Ophiacantha sollicita Koehler

Figures 2h–i

Ophiacantha sollicita Koehler, 1922b: 14, pl. 79, figs 1–3. — Rowe and Pawson, 1977: 355.

Material examined. Tasmania, off Maria Island, 42°48'S, 148°40.75'E, 2420 m, 13 Dec 1912, AM J3557(2 syntypes).

Description. Disc, 8 mm and 13 mm d.d, covered in tall, slender spines, 1.5 mm high, with thorny stems and 2–4 terminal points. Basal dorsal arm plates much wider than long, contiguous for first 3–4 plates, bear some spines similar to those on disc; other plates separate, as wide as long, roughly triangular, distal edge convex, lateral edges concave. Ventral arm plates separate throughout, twice as wide as long, distal edge convex. Oral shields triangular to diamond-shaped (depending on degree of distal angle). Adoral shields 3–4 times as long as wide, separate oral shields from first ventral arm plates. 3 oral papillae, inner 2 spiniform, outer widened, highest and thickest proximally with tapering distal flange (fig. 2h). 7–8 finely rugose arm spines, uppermost longest.

Distribution. Off eastern Tasmania. 2420 m.

Remarks. These specimens are virtually identical to the North Atlantic species *Ophiacantha aculeata* Verrill, 1885 as described and figured by Koehler

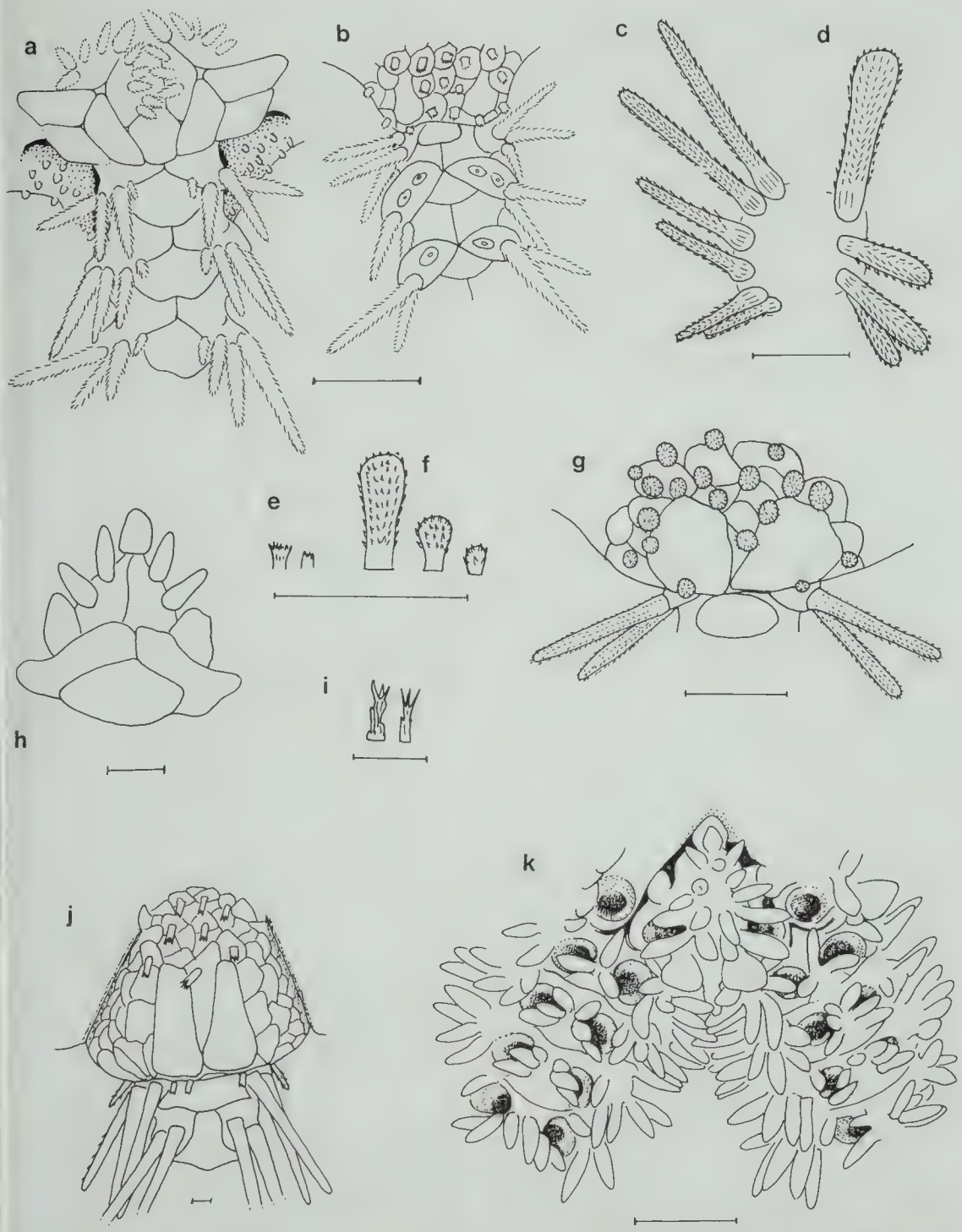

Figure 2, a–b: *Ophiomitrella* sp. cf. *chilensis* (NMV F52700), a, ventral view, b, dorsal view; c–d: *Ophiomitrella conferta*, arm spines, 2nd segment, c, (NMV F52683), d, (SAM K979); e: *Ophiomitrella* sp. cf. *chilensis* (NMV F52700), disc spinelets; f–g: *Ophiomitrella conferta*, f, disc stumps, g, (NMV F52683) dorsal view; h–i: *Ophiacantha sollicita* (AM J3557), h, jaw, i, disc spinelets; j: *Ophioplinthaca incisa* (NMV H361) dorsal view; k: *Ophiomyces grandis* (NMV F52776) ventral view. Scale line = 1.0 mm.

(1914: 74, pl. 11, figs 1, 2), Mortensen (1933a: 28, figs 14c, 15) and Paterson (1985: 38, fig. 17). In particular, the outermost oral papillae and disc spinelets are very similar. If *O. aculeata* proves to have a more widespread distribution, *O. sollicita* should be treated as a synonym.

Some specimens referred to the similar species *O. cosmica* Lyman, 1878 are possibly better placed in *O. aculeata* or *O. sollicita*. *O. cosmica* differs in having 3–4 spiniform oral papillae and stouter disc spinelets (Paterson, 1985, fig. 17) , but Lyman (1878, fig. 269) figured a specimen from off Tristan da Cunha with a widened outer oral papillae and H.L.Clark (1939: 42) unjustifiably synonmymized the two species without mentioning the difference in the number and form of the oral papillae or the disc spinelets.

Ophiacantha yaldwyni Fell

Ophiacantha yaldwyni Fell, 1958: 23, pl. 4, figs F, H, I.—Baker and Devaney, 1981: 173.

Material examined. Tasmania, off north-west coast, 43°45′S, 143°40′E, 930–1210 m, Apr 1986, NMV F52863(1).

Victoria, off Point Hicks, 38°24.5′S, 149°25.5′E, 823 m, 21 Nov 1973, rock/coral, identified by Baker (Baker and Devaney, 1981: 173–mistakenly listed as H361), NMV H362(1).

Description. Disc 4.0–6.5 mm d.d, arms 4 times d.d.. Disc covered in flat, rounded scales; scales bear 1 large cylindrical granule, as high as wide with terminal thorns. Radial shields bar-shaped, concealed. Oral shields rhomboid, wider than long; adoral shields 3 times as wide as long. 1 apical, 3–5 oral papillae, short, stout, club-shaped to spherical, thorny, irregular in size and orientation. Dorsal arm plates fan to bell-shaped, separate, distal edges of basal plates bear some spines similar to those on disc. First ventral arm plate large, longer than wide; second triangular, as wide as long; rest wider than long, distal edge often raised and notched, always separate. 5–6 stout arm spines; uppermost basal spine enlarged; terminally or proximally thorny. Tentacle scale small, pointed. Colour: pale brown or cream.

Distribution. Eastern Bass Strait and New Zealand. 841–1210 m.

Remarks. The two specimens differ slightly in appearance. The largest (NMV H362) has a tumid disc, multifid disc spines and stout arm spines with predominantly terminal thorns and the arms are broken distally. The other has a flat disc, slightly constricted inter-radially, bifid or trifid disc spines and slender arm spines which have a row of thorns on the proximal side. The arms are very slender distally and coiled around an octacorallia upon which it was living.

These specimens also differ slightly from Fell's description of the holotype (11 mm d.d.). It had up to nine oral papillae, adoral shields only 1.5–2 times as wide as long and lacked tentacle scales after the third segment.

Ophiacantha rosea Lyman

Ophiacantha rosea Lyman, 1878: 139, pl. X, figs 267, 268.—Paterson, 1985: 45, fig. 18 (partial synonymy).

Ophioprium rosea.—Baker and Devaney, 1981: 173 (partial synonymy).

Material examined. Tasmania, E of North Point, Flinders Island, 39°45.3′S, 148°54′E, 640 m, 24 Nov 1973, rock/mud, identified by Baker (Baker and Devaney, 1981: 173), NMV H364(13); eastern Bass Strait, 39°20.5′S, 148°46.3′E, 440 m, 2 Feb 1985, NMV F52852(1); 39°18′S, 148°44′E, 448–480 m, 3 May 1984, NMV F52853 (7); S of Cape Howe, 39°11.7′S, 149°48.7′E, 644–650 m, 3 Feb 1985, NMV F52851(3).

Distribution. Eastern Bass Strait, New Zealand, southern Chile, Japan, Marion Island and the Bay of Biscay. 270–1700 m.

Remarks. Paterson (1985) disagreed with Baker and Devaney's (1981) placement of this species in *Ophioprium* H.L. Clark, 1915. This species has a jaw that is wider than long and large tentacle pores that are fully covered by one (first pore one or two) large tentacle scales. There are 3–4 large oral papillae and often some additional, smaller spiniform papillae not particularly associated with the oral tentacle pore. In contrast, *Ophioprium* species have elongate jaws, tall, spine-like oral tentacle scales, 2–4 thin tentacle scales along the arm that do not cover the pores and the jaw is elongate.

The present material measures 3.5–16 mm d.d. with arms 4–5 times d.d.. There are only rarely two tentacle scales on basal pores and few additional oral papillae. Colour (preserved): brown or grey.

Ophiacantha fidelis (Koehler)

Ophiomitrella fidelis Koehler, 1930: 72, pl. VII, figs 4, 5.—Baker and Devaney, 1981: 173.

Ophiacantha fidelis.—H.L. Clark, 1946: 186.

Material examined. Tasmania, off north-west coast, 41°15′S, 144°08′E, 520–480 m, 20 Oct 1984, NMV F52728(1); 41°50.2′S, 144°33.2′E, 420 m, 20 Oct 1984, NMV F52727(1); E Bass Strait, 39°20.5′S, 148°46.3′E, 440 m, 2 Feb 1985, NMV F52723(50); E of Maria Island, 42°39′S, 148°26.3′E, 530 m, 25 Jun 1984, NMV F52721(300); 42°39′S, 148°26.3′E, 415–438 m, 25 Jun 1984, NMV F52724(50); 42°43′S, 148°25′E, 506 m, 25 Jun 1984, NMV F52722 (100); 42°42′S, 148°24′E, 420–490 m, 25 Jun 1984, NMV F52725 (50); 42°41.9′S, 148°25.1′E, 490 m, 15 Aug 1984, NMV F52726(50); 42°40.8′S, 148°25.4′E, 472 m, 16 Aug 1984, NMV F52729(50).

Victoria, 20.5 n. mi. S of Cape Nelson, 403 m, 10 Mar 1977, NMV F52720(1).

Descripton. Disc to 7.0 mm d.d, arms 9–10 times d.d. Disc scales small, overlapping, visible only when dried, overlain by skin. Radial shields bar-like, upraised, long, two-fifths d.d, parallel, widely separate, only small triangular section exposed. Disc granules very small, variable in extent and density but usually confined to central disc region proximal to radial shields. No granules ventrally. Oral shields rhombic, wider than long. 1 apical, 3, rarely 4, oral papillae, outermost widened slightly. Dorsal arm plates bell-shaped, as wide as long, separate; basal plates widened. Ventral arm plates 2–3 times as wide as long, separate. 8 finely serrated arm spines, uppermost 3 times as long as a segment (often broken). Colour: dorsal arm, disc surfaces pale, mottled brown; radial shields, arm spines, ventral surface white.

Distribution. South-eastern Australia from Portland to Cape Howe, Victoria and south to Maria Island, Tasmania. 270–530 m.

Remarks. The thin, rib-like radial shields, mostly overlain by the scales and skin of the disc suface, with only a small distal region exposed, indicates that *O. fidelis* belongs in *Ophiacantha* rather than *Ophiomitrella* Verrill, 1899. In *Ophiomitrella* the radial shields tend to be shorter and wider and integrate with the disc surface. It is not at all similar to the two species of *Ophiomitrella* described below, whereas it is similar to *Ophiacantha brachygnatha* H. L. Clark, 1928. The two species share moniliform arms, bell-shaped dorsal arm plates, wide ventral arm plates, long, upraised radial shields and similar oral frames. However, the arms are less robust and shorter in *O. brachygnatha,* the disc scales are larger and they carry multifid spinelets not granules.

Koehler (1930) listed syntypes from the Kei Islands. This lot, now in Copenhagen, contains 13 specimens (rather than the 3 mentioned by Koehler) which range in size from 4–8 mm d.d. Although similar in general appearance to local specimens, they have multifid spinelets on the disc surface, and so cannot be included in *O. fidelis.*

O. fidelis can evidently live in huge aggregations on the sea floor, one trawl took millions of these animals, filling the entire sorting tray (Dr C.C. Lu, Museum of Victoria, pers. comm.), although only a handful were retained (NMV F52721).

Ophiacantha brachygnatha H.L. Clark

Ophiacantha brachygnatha H.L. Clark, 1928: 420, figs 123a, b.—Baker and Devaney, 1981: 171, figs 40, 93–98 (partial synonymy).—Baker, 1982: 425, fig. 10:12e.

Material examined (partial list). South Australia, 24 n. mi. SW of Beachport, 37°50′S, 139°46′E, 380 m, 24 Oct 1981, NMV F52733(2).

Victoria, 27 n. mi. SW of Portland, 330–595 m, 14–15 May 1979, NMV F52735(20); S of Point Hicks, 38°17′S, 149°25′E, 640 m, 21 Nov 1973, clay , NMV F52740(6).

Tasmania, W of King Island, 40°27.6′S, 143°23.6′E, 560 m, 28 Jan 1985, NMV F52736(1 juvenile); off northwest coast, 41°05.1′S, 143°53.1′E, 520 m, 27 Jan 1985, NMV F52737(10); western Bass Strait, 40°07′S, 143°13′E, 229 m, 11 Oct 1980, carbonate mud (BSS stn 105), NMV F52738(1); eastern Bass Strait, 39°28.2′S, 148°52.4′E, 841 m, 29 Mar 1979, muddy/sand (BSS stn 37), NMV F52743 (1); E of North Point, Flinders Island, 39°44′S, 148°49′E, 421 m, 24 Nov 1973, muddy sand, identified by Baker (Baker and Devaney, 1981: 171), NMV H359(2).

New Zealand, NW of Campbell Island, 51°49.9′S, 169°31′E, 230–276 m, 15 Jan 1976, NMV F52746(10).

Distribution. Cape Naturalist, Western Australia to eastern Bass Strait, New Zealand and Campbell Island. 100–841 m.

Remarks. The specimens measure 1–9 mm d.d. with arms 5-6 times d.d. Large specimens differ slightly from available descriptions, as previously the holotype was the largest known specimen (6 mm d.d.). The arms are not particularly moniliform except at the arm tip and are not twisted or curved under as is characteristic of younger specimens (H.L. Clark, 1928, fig. 123). Dorsal arm plates are contiguous basally and there are up to eight arm spines, often with a row of thorns on their proximal side. The small (0.1–0.3 mm high), slender, multifid disc spinelets are absent from the area around the oral shields (as on the type) and large orange gonads are often visible beneath the thin skin. One apical, three (rarely to five) oral papillae; inner papillae are placed obliquely on the jaw, whereas the outermost lies flat and therefore appears widened.

Juveniles (to 2 mm d.d.) have the apical and oral papillae, tentacle scales and the lowermost arm spines covered in sharp thorns, often to the point of being misshapen.

The specimens from off the Campbell Islands are the first to be reported from the subantarctic Islands of New Zealand.

Ophiacantha alternata A.M. Clark

Ophiacantha alternata A.M. Clark, 1966: 328, figs 4a–c.—Baker and Devaney, 1981: 167, figs 42, 84–87.—Baker, 1982: 425, fig. 10:12d.—Rowe and Vail, 1982: 223.

Material examined (partial list). Tasmania, western Bass Strait, 39°38.2′S, 143°07.2′E, 127 m, 21 Nov 1981, sandy shell (BSS stn 195), NMV F52702(2); 39°28′S, 148°17′E, 103 m, 11 Oct 1980, medium fine sand (BSS stn 81), NMV F52925(3); eastern Bass Strait, 39°14.8′S, 147°31.5′E, 57 m, 18 Nov 1981, muddy shell (BSS stn 174), NMV F52927(10).

Victoria, Port Phillip Bay, Lonsdale Bight, 5.5–11.5 m, 21 May 1961, NMV H15(holotype).

Also extensive collections of 400 specimens from 96 localities from Nuyts Archipelago, South Australia to Eden, New South Wales and the east coast of Tasmania.

Distribution. Cockburn Sound, Western Australia to south Queensland and eastern Tasmania. 1–127 m.

Remarks. The arm spines can be smooth or serrated, as Baker and Devaney (1981: 170) have recorded. *O. alternata* was previously known only from depths of less than 50 m.

Ophiacantha clavigera Koehler

Ophiacantha clavigera Koehler, 1907: 247, figs 1–3.—Baker and Devaney, 1981: 170, fig. 41, 79–83 (full synonymy).

Material examined (partial list). Tasmania, western Bass Strait, 39°38.2′S, 143′07.2′E, 127 m, 21 Nov 1981, sandy shell (BSS stn 195), NMV F52903(1); E of Flinders Island, 40°06.2′E, 148°25.0′E, 22 m, 14 Nov 1981, coarse shell (BSS stn 166), NMV F52902(1); W of Cape Sorell, 42°10.9′S, 144°48.9′E, 160 m, 20 Oct 1984, NMV F52901(3); W of Port Davey, 43°25.3′S, 145°39.8′E, 160 m, 21 Nov 1984, NMV F52900(1); off southern coast, 43°24.6′S, 147°32.5′E, 82 m, 22 Nov 1984, NMV F52899(1).

Victoria, western Bass Strait, 38°58′S, 143°29′E, 67 m, 8 Oct 1980, sand (BSS stn 51), NMV F52906(10); 39°15′S, 143°19′E, 94 m, 10 Oct 1980, fine sand (BSS stn 74), NMV F52905(15); 39°06.3′S, 142°55.6′E, 84 m, 21 Nov 1981, fine shell (BSS stn 191), NMV F52904(10).

Distribution. Broome, Western Australia to eastern Bass Strait, including western and southern Tasmania. 3–160m.

Remarks. The specimens measure 0.5–3.6 mm d.d. The enlarged uppermost basal arm spine, usually smooth, can be noticeably serrated, in a similar manner to the arm spines of *Ophiacantha alternata.*

O. clavigera was previously known only from west of Encounter Bay, South Australia in 3–30 m.

Ophiacantha shepherdi Baker and Devaney

Ophiacantha shepherdi Baker and Devaney, 1981: 163, figs 37, 38, 69–74.

Material examined. Victoria, Shoreham, on algal/sponge material, rocky shallows, 13 Jan 1981, NMV F52909(1); 1 km E of Harmers Haven, 300 m offshore, 4.5–6 m, 6 Mar 1982, NMV F52908(1); 1 km E of Harmers Haven, 500 m offshore, 11 m, 6 Mar 1982, NMV F52907(1).

Distribution. Encounter Bay, South Australia to Wilsons Promontory Victoria. 1–25 m.

Remarks. The specimens measure 2.0–2.5 mm d.d. This rare species was previously known only from west of Cape Northumberland, South Australia.

Ophiacantha heterotyla H.L. Clark

Ophiacantha heterotyla H.L. Clark, 1909: 542, pl. LII, figs 4–6.—1918: 286.—1938: 209.— 1946: 184.—Rowe and Pawson, 1977: 351.—Baker and Devaney, 1981: 167, figs 39, 75–78.

Ophialcaea congesta.—Koehler, 1930: 63.—H. L. Clark, 1946: 186 [non *O. congesta* (Koehler, 1904)].

Material examined (partial list). Tasmania, 2.5 km SE of Birches Bay, 43°11′S, 147°16′E, 10 m, 16 Apr 1985, NMV F52732(3); W of South-west Cape, 43°25.3′S, 145°39.8′E, 160 m, 20 Oct 1984, NMV F52730(1); W of Cape Sorell, 42°10.9′S, 144°48.9′E, 160 m, 21 Oct 1984, NMV F52731(2).

Victoria, western Bass Strait, 39°16.7′S, 143°06.7′E, 95 m, 21 Nov 1981, sandy shell (BSS stn 193), NMV F52747(5); S of Western Port, 38°56.0′S, 145°16.6′E, 70 m, 12 Nov 1981, fine mud (BSS stn 155), NMV F52750(1); eastern Bass Strait, 38°51.8′S, 148°26.5′E, 130 m, 15 Nov 1981, muddy sand (BSS stn 170), NMV F52752(6); 39°02.4′S, 148°30.6′E, 120 m, 15 Nov 1981, sandy mud (BSS stn 169), NMV F52753(2).

New South Wales, E of Merimbula, 37°05′S, 150°05′E, 55–90 m, coll. Mortensen, 30 Sep 1914, identified by Koehler (1930: 63) as *Ophialcaea congesta* (Koehler), ZMC(1).

Distribution. South-eastern Australia from western Bass Strait to Sydney, New South Wales and Tasmania. 9–160 m.

Remarks. The 4.0 mm d.d. specimen, referred to *Ophialcaea congesta* (Koehler, 1904) by Koehler (1930: 63), belongs, as H.L. Clark (1946) suggested, to *Ophiacantha heterotyla.* It has enlarged disc spines at the proximal end of the radial shields and enlarged, smooth, uppermost basal arm spines. The dorsal arm plates are fan-shaped and well separated, unlike on *O. congesta,* where they are broadly contiguous.

The other specimens measure 0.5–4.0 mm d.d. and increase the known distribution of *O. heterotyla* to the western end of Bass Strait and the west coast of Tasmania.

Ophiotominae Paterson, 1985

Ophiopristis Verrill, 1899

Ophiopristis axiologus H.L. Clark

Ophiopristis axiologus H.L. Clark, 1909: 543, pl. LIII, figs 1–3.—Paterson, 1985: 53.

Ophioprium axiologum.—H.L. Clark, 1915: 216.—1946: 188.

Ophioprium axiologus.—Rowe and Pawson, 1977: 350.—Baker, 1979: 39.

Material examined. Tasmania, eastern Bass Strait, 39°16.8′S, 147°33.2′E, 57 m, 18 Nov 1981, muddy shell (BSS stn 174), NMV F52681 (1).

New South Wales, 5 mi. E of Port Hacking, 100 m, 1 Feb 1945, AM J6683(1 specimen plus 1 arm).

Description. Bass Strait specimen: Disc 1.6 mm d.d, arms 10 segments (4 mm) long, slightly arched back above disc. Disc spines short, with ring of 4–5 thorns just short of apex , extending ventrally to oral plates, but diminishing in size until just spherical granules. Jaws elongated, oral plates 3 times as long as wide, broadly parallel. 6–8 oral papillae; 1–2 apical; next 5–6, small, capitate. 3–4 oral tentacle scales on jaw, tall, 1.3–1.5 times as tall as oral papillae, spatulate, confluent with oral papillae, oppose 2–3 smaller scales on ventral arm plate.

Dorsal arm plates small, fan-shaped, separate; distal edge raised, bears a row of spines on basal plates, 5–6 on first plate, similar in size and shape to disc spines, becoming progressively reduced in size and number, until only 1 spherical granule on sixth plate. Ventral arm plates pentagonal, as long as wide, distal edge convex, lateral sides concave. 6 arm spines basally, 4 by sixth segment, uppermost smallest, bottle-shaped, lowest spatulate, as long as ventral arm plate. 2–3 tentacle scales on basal pores, only 1 after sixth segment, covering the pore. Colour: white.

Distribution. Eastern Bass Strait to Wata Mooli, New South Wales. 57–172 m.

Remarks. The specimen from New South Wales (AM J6683) differs slightly from the Bass Strait specimen. The disc spines terminate in 3 thorns , there are no spines on the oral shields, or on the dorsal arm plates, whch instead have minutely serrated edges. The proximal lateral arm plates are swollen, causing the arm to appear widened at the base and the arm spines are long and flatter. It is very similar to the type description and figures. However these differences can be attributed to individual variation and the smaller size of the new specimen.

Paterson (1985: 53) recognized the genus *Ophiopristis,* restricting *Ophioprium* H.L. Clark, 1915 to those species that have oral tentacles that differ markedly from the oral papillae, being more elongate and separate, and open tentacle pores with small thin tentacle scales.

O. axiologus was previously known only from the coast of New South Wales.

Ophioplinthacinae Paterson, 1985

Ophiomitrella Verrill, 1899

Ophiomitrella conferta (Koehler)

Figures 2c–d, f–g

Ophioripa conferta Koehler, 1922b: 19, pl. LXXXV, figs 9–3.—Rowe and Pawson, 1977: 350.

Ophiomitrella conferta.—Madsen, 1967: 127.

Ophiomitrella falklandica Mortensen, 1936: 256, pl. VII, fig. 5, text-figs 8c, d.

Material examined. Tasmania, Flinders Canyon, eastern Bass Strait 39°38.7′S, 148°49.4′E, 770 m, 27 Mar 1979, shell/sand (BSS stn 34), NMV F52685(1 + 3 juveniles); eastern Bass Strait, 39°28.2′S, 148°52.4′E, 841 m, 29 Mar 1979, muddy sand (BSS stn 37), NMV F52684(1 juvenile); off Maria Island, 2340 m, coll. ANARE, 13 Dec 1912, AM J3579(3 syntypes of *O. conferta*); off southern coast, 47°30′S, 148°29′E, 1140–1040 m, 2 Apr 1986, NMV F53761(4).

Victoria, S of Point Hicks, 38°17.3′S, 149°25′E, 640 m, 21 Nov 1973, clay, NMV F52683(6 + juveniles).

Off Falkland Islands, Lively Island, 79 m, 25 Mar 1927 ("Discovery" stn WS85), BMNH 1936.12.30.316–18 (syntypes of *O. falklandica*); 53°52′S, 61°49′W, 368–463 m, 6 Feb 1932 ("Discovery" stn WS840), BMNH 1936.12.30.330–4 (syntypes of *O. falklandica*).

Antarctica, off Enderby Land, 65°48′S, 53°16′E, 193 m, 24 Jan 1934, identified by Madsen (1967: 127) (BANZARE stn 41), SAM K979(1) and SAM K980(9).

Description. South-eastern Australian specimens: disc high, convex, 1.0–7.2 mm d.d.; arms moniliform, 2–3 times d.d. Disc plates coarse, overlapping, 0.2–0.3 mm in diameter, minutely pitted, surrounded by transparent border (only visible when dry). Disc stumps large, of various sizes, smallest stumps 0.1–0.2 mm high and wide, largest 0.3–0.8 mm high (although relatively constant over a specimen), 0.25 mm wide, cylindrical or club-shaped, covered in sharp spikes. Radial shields irregular in shape, one-seventh to one-eighth d.d, as wide as, or wider than, long, generally in contact distally but occasionally separate or fully contiguous. Oral shields diamond-shaped, 3 times as wide as long. 1 apical, 3, rarely 4, oral papillae, 1.5–3 times as long as wide, cylindrical, slightly flattened or slightly club-shaped. Dorsal arm plates small, fan-shaped, as long as wide, widely separate. Ventral arm plates pentagonal, slightly longer than wide, distal edge often notched, separate. Arm spines finely serrated, cylindrical, either gradually tapering to blunt point or club-shaped, 5–6 basally, thereafter 4–5. Uppermost arm spines longest, to 2.4 mm, to 0.35 mm wide at midlength, twice as long as second spine. 1 tentacle scale, slightly curved inward, 0.3–1.0 times as long as ventral arm plate. Colour: white.

Distribution. South-eastern Australia from eastern Bass Strait to south-west Tasmania; Falkland Is, South Shetland Is; Antarctica, off Enderby, Kemp and Wilkes Land. 40–2340 m.

Remarks. The form and size of the arm-spines (figs 2c, d), the larger disc stumps (fig. 2f), the oral papillae and the tentacle scales vary widely in the

material examined, including within each of the separate geographical locations represented.

The syntypes of *Ophiomitrella conferta* examined, 2.4–7.6 mm d.d, have relatively long disc stumps, to 0.8 mm in height; long, tapering arm-spines, the uppermost to 2.4 mm long; comparatively narrow oral papillae, 2.5–3.5 as long as wide and long tentacle scales, almost the length of a ventral arm plate. Other south-east Australian specimens differ in having relatively low disc stumps, to 0.3 mm in height (NMV F52683 fig. 2g, F53761); stout, club-shaped lower arm spines (NMV F53761); stout oral papillae, 1.5–2 times as long as wide (NMV F53761) and short tentacle scales, 0.3–0.5 times the length of a ventral arm plate (NMV F52683, F53761).

The syntypes of *O. falklandica* examined are similar to the south-eastern Australian specimens of *O. conferta* and have the same variation in the height of the largest disc stumps (0.3–0.6 mm long, 0.25–0.3 mm wide). Some have tapered arm spines (BMNH 1936.12.30.330–4). Most, however, have arm spines, including the uppermost, that are stout, club-shaped and often short, the uppermost 1.4–2.5 mm long and 0.30–0.35 mm wide at midlength on specimens 5–6 mm d.d. However, the arm spines are rarely as stout as shown on Mortensen's figures of a 3.5 mm d.d. specimen (1936: figs c, d), which also has shorter than average disc stumps. The oral papillae are usually short and stout.

Antarctic specimens, named as *O. conferta* by Madsen (1967), also have short, stout, club-shaped arm spines (fig. 2d). One 5.5 mm d.d. specimen (SAM K979) has five arm spines basally, the uppermost 1.2 mm in length, 0.25 mm in width at the base and 0.35 mm in width near the tip, and disc stumps, of intermediate height, 0.4–0.5 mm. However, Madsen (1967: 127) reported that other specimens have more slender arm spines. Mortensen (1936) commented on the simularity of his new species, *O. falklandica*, with *O. conferta*, however, he did not attempt to distinguish the two species. Although, no south-eastern Australian specimens have been found with club-shaped upper arm-spines, given the tendency of some (NMV F53761) to develop club-shaped lower arm-spines, the presence of tapered arm-spines on some of the Falkland Island specimens and the variability of other morphological features, it seems unlikely that the *O. falklandica* specimens represent a separate species.

Madsen (1967) has also suggested that *Ophiomitrella ingrata* Koehler, 1908 may be synonymous with *O. conferta*. However, examination of specimens of *O. ingrata* (South Atlantic, off Gough Island, 407 fm, coll. HMS "Scotia", BMNH 1948.11.27.1–2, labelled "Types" but at a different depth than reported by Koehler, 1908: 277, i.e. 100 fm; off Gough Island, 102–141 m, "Discovery" stn 399, BMNH 1936.12.30.301–10) showed that thay differ in having only very small, almost spherical, disc stumps (0.12–0.14 mm high, 0.14 mm wide at 4–5 mm d.d.). The arm spines are short and slender, uppermost 1.2–1.6 mm long, 0.15–0.25 mm wide at midlength, and the arms are often curled and twisted downward. These features, and in particular the disc spines, appear to be outside the range of variation present in the *O. conferta/O. falklandica* material.

Several specimens from Bass Strait (NMV F52683) were found to be viviparous. There are 10 bursa, one to each genital slit. A 6.0 mm d.d. specimen had up to nine juveniles in each bursa, all roughly at the same stage of development, about 0.6 mm d.d, with arms 1.3 mm in length. The young appear to be approximately 1.2–1.7 mm on emergence, as another specimen had two young of that size clinging to the outside of the disc, and have 20–25 very coarse disc plates, the same size as those on adults, relatively long, tapered disc spines, irregularly covered in large thorns and three arm spines. Mortensen (1936: 258) reported that some of his *O. falklandica* specimens were viviparous, also with 10 separate bursae.

Four, or possibly five, other *Ophiomitrella* species are known to be viviparous: *O. clavigera* (Ljungman, 1864), *O. ingrata* Koehler, 1908, *O. corynephora* H.L. Clark, 1923, *O. hamata* Mortensen, 1933b and possibly *O. chilensis* Mortensen, 1951. *Ophiomitrella clavigera*, *O. ingrata* and *O. chilensis* are like *O. conferta* in having 10 separate bursae. However, *O. corynephora* has only five separate bursae, the usual pair on the sides of each arm are united radially, while *O. hamata* has all the bursae joined, creating one large circular space.

O. conferta has been recorded from 640–2340 m off south-eastern Australia but in antarctic and subantarctic regions it has also been found on the continental shelf, 40–603 m. Fell (1961: 42) has reported a similar situation for *Amphiura joubini* Koehler, 1922b, recorded from New Zealand as well as antarctic and subantarctic localities.

Ophiomitrella sp. cf. **chilensis** Mortensen

Figures 2a–b, e

Material examined. Tasmania, Flinders Canyon, eastern Bass Strait, 39°38.6'S, 148°49.4'E, 770 m, 27 Mar 1979, shell/sand (BSS stn 34), NMV F52700(1).

Description. Disc flat, 3.2 mm d.d, weakly constricted at inter-radius; arms moniliform, approximately 14 mm in length. Disc plates small, 0.2 mm

in diameter, irregular. Disc stumps 1 per plate, 0.1 mm high, slightly higher than wide, cylindrical, terminating in crown of small thorns. Radial shields small, 1.5–2 times as long as wide, oval or triangular, tapering proximally, widely separated by 2–3 series of disc plates. Ventral surface with smaller disc plates and less numerous, smaller, almost granular, disc stumps. Oral shields small, roughly diamond-shaped, twice as wide as long, distal angle curved, inner sides slightly concave. Adoral shields larger than oral shields, rhombic, 2.5–3 times as long as wide, meeting broadly within, separated radially by first ventral arm plate. 1 large apical papilla, 3, slightly smaller, primary oral papillae, 1–2 diminutive secondary oral papillae inserted in between. All papillae twice as long as wide, tip covered in sharp thorns; some capitate.

First dorsal arm plate 4 times as wide as long, bears few small granules, overshadowed by protruding disc margin; other plates small, fan-shaped, widely separate. First ventral arm plate large, as long but narrower than succeeding plates, next few plates 1.5–2 times as wide as long, widest proximally, other plates as wide as long, pentagonal, lateral sides parallel, distal edge slightly upraised and notched, proximal angle obtuse; first 2 plates contiguous, rest separate. 5–6 finely serrated arm spines; uppermost often broken, to 1.5 mm long; lowermost 0.3 mm long, just longer than ventral arm plate, slightly hooked shaped with a row of thorns facing downwards. 1 spiniform tentacle scale, quarter as long as ventral arm plate. Colour (dry) white.

Distribution. Eastern Bass Strait. 770 m.

Remarks. This specimen is similar to the South American species *Ophiomitrella chilensis* Mortensen, 1951 which appears from the type description and figures (p. 13, figs 1a–c), to differ only in having contiguous radial shields, non-serrated arm spines and a minute tentacle scale. However, Alarcón (1968: fig. T) figured a 4–5 mm specimen, supposedly of the same species, that also has finer, more numerous, disc scales and stumps. Another 3 mm d.d. specimen (Magellan Strait, South America, 730 m, identified A.M. Clark 1952, BMNH 1877.11.17.2) has separate radial shields and sparsely thorny arm spines but bi-and trifid disc spinelets and minute thorny tentacle scales. Until the range of variation within *O. chilensis* is better known the final placement of this Bass Strait specimen must remain unsettled.

This specimen is also similar to some specimens of *O. conferta,* the other Australian species. The nature of the arm spines, disc scales, dorsal and lateral arm plates are very similar. The disc stumps are similar to the smallest *O. conferta* stumps. However, *O. conferta* specimens, differ in also having much larger disc stumps, wider, usually contiguous radial shields, finer adoral shields and ventral arm plates that are longer than wide. Most *O. conferta* specimens also have a generally coarser appearance.

Ophiomitrella ingrata Koehler, 1908 differs in having contiguous radial shields, smaller, more rounded disc stumps and non-serrated arm spines. *Ophiomitrella hamata* Mortensen, 1933b has denticulate arm spines and similar disc stumps to the present species, but has only four arm spines, a small first ventral arm plate and a triangle-shaped second ventral arm plate.

This specimen is also similar to *Ophiacantha yaldwyni* Fell, 1958. *O. yaldwyni* differs in having bar-like radial shields that are completely obscured, shorter arm-spines with predominatly terminal thorns and smaller tentacle scales.

As there is only one specimen, I have not dissected it. The eventual discovery of its mode of reproduction and the form of the bursae, so important in the genus (see *O. conferta),* will help clarify its relationships.

Ophioplinthaca Verrill, 1899

Ophioplinthaca incisa (Lyman)

Figure 2j

Ophiomitra incisa Lyman, 1883: 263, pl. VI, figs 89, 90.
Ophioplinthaca incisa.—Verrill, 1899: 351.—H.L.Clark, 1915: 211.—Baker and Devaney, 1981: 174.

Material examined. Tasmania, Flinders Canyon, eastern Bass Strait, 39°38.7'S, 148°49.4'E, 770 m, 27 Mar 1979, shell/sand (BSS stn 34), NMV F52755(1).

Victoria, S of Point Hicks, 38°24.5'S, 149°25.5'E, 923 m, 21 Nov 1973, rock/coral, NMV H361(8).

West Indies, off Santa Cruz Island, 1078 m, MCZ 4079(3 paratypes).

Description. Bass Strait specimens: Disc to 17 mm d.d, thick, deeply incised interradially (to third d.d.); arms stout, 5–6 d.d. Disc scales coarse, overlapping; 4–5 large scales flank radial shields. Disc spines stout, terminaly thorny, occasionally smooth. Radial shields roughly rectangular or tapering to acute angle proximally, quarter d.d, 2–3 times as long as wide, usually contiguous distally but occasionally completely separated. Oral shields wider than long, roughly diamond-shaped, distal edge curved or lobed, inner sides slightly concave. 1 apical, 4 oral papillae; inner papillae spiniform, outer thickened, blunt. Group of granules often present above distalmost papillae.

Basal dorsal arm plates wide, quadrangular, contiguous; others roughly triangular, distal edge

slightly convex, proximal angle rounded, inner sides concave or convex (even on same arm), separate. Ventral arm plates wider than long, distal edge convex, wider distally than proximally, separate. 5–7 denticulate arm spines, uppermost to 4 segments, lowermost to 1 segment long. 2–3 stout tentacle scales on first arm pore, thereafter 1 leaf-like, sometimes thorny, scale. Colour: white.

Distribution. Eastern Bass Strait and the West Indies. 610–1572 m.

Remarks. The three paratypes, 8 mm, 9 mm, 12 mm d.d, are very similar to the Bass Strait specimens differing only in having the distal edges of the dorsal and ventral arm plates and of the oral shields thickened or even everted.

The size, density and rugosity of the arm spines, the shape of the arm plates and the size and orientation of the oral papillae varies greatly in the present series of specimens. This range of variation is also exhibited by other species of *Ophioplinthaca* such as the widespread *O. rudis* (Koehler, 1897). Other Indo-West Pacific species could prove synonymous with *O. incisa.* Baker and Devaney (1981) found that *O. vicina* Koehler, 1904 differed only in the shape of the oral shields and oral papillae, features that vary widely in this series of specimens. Examination of the holotype ("Challenger" stn 205, BMNH 1882.12.23.186) and 4 paratypes ("Challenger" stn 214, BMNH 1882.12.23.313 and BMNH 1888.11.24.1–2) of *O. plicata* (Lyman, 1878) showed that they too are very close to *O. incisa.* They have the same thickened outer edges of the arm plates and the oral shields as the paratypes of *O. incisa.* They differ mainly in having dorsal arm plates that are usually hemispherical, having convex inner sides, whereas this shape is present only rarely on the specimens of *O. incisa.* However, this is not true of all the *O. plicata* specimens, one in particular (BMNH 1882.12.23.313, see Lyman, 1878: pl. IX, fig. 234), has triangular plates, the inner sides concave. Future study of *Ophioplinthaca* material from many Indo-Pacific localities will probably find the three forms fall within the range of a single species.

A specimen has what Baker and Devaney (1981) interpret as a dwarf male clinging to the dorsal surface. Dissection did not reveal any viviparous specimens.

Ophiohelinae Perrier, 1891, emend. Paterson, 1985

Ophiomyces Lyman, 1869

Ophiomyces grandis Lyman

Figure 2k

Ophiomyces grandis Lyman, 1879: 46, pl. XIV, figs 383-385; 1882: 240, pl. XIX, figs 13–15. – Paterson, 1985: 75, fig. 31 (full synonymy).

Material examined. Tasmania, eastern Bass Strait, 38°29.5'S, 149°32.4'E, 1630 m, 16 Nov 1981, mud (BSS stn Q638), NMV F52776 (1).

South Atlantic, Tristan da Cunha, 1860 m, coll. H.M.S. "Challenger", 16–18 Oct 1873, rock/shell, BMNH 82.12.23.291 (holotype).

Description. Bass Strait specimen: disc 4 mm d.d, arms to 20 mm, arched dorsally, 2 arms regenerating midlength. Disc dome-shaped, covered in thin scales, sparsely spinose (1:15 scales); spines generally slender, but stouter, shorter and more dense at interradial margins. No radial shields visible. Genital slits conspicuous, continue dorsally, almost meeting above the arms.

3 spiniform apical papillae on dental plate. 4 longitudinal series of erect oral papillae on each jaw. Outer rows (along jaw edge) with 5 papillae; proximal 3 spiniform, increasing in size distally; fourth similar in size to the first but spatulate; fifth large widened, fan-shaped. Inner rows (on outer jaw surface) with 2 tall, slightly flattened papillae.

Dorsal arm plates transversely lens-shaped, 2–3 times as wide as long, widely separate. Second ventral arm plate small, triangular, rest roughly trapezoid, tapering proximally, separate. 9–10 arm spines, upper spines slender, short, becoming longer ventrally, lowermost 3 flattened slightly, half as long as segment. 3 erect spatulate tentacle scales at apex of second ventral arm plate. Third ventral arm plate with 6 scales, 3 on each side, with 2 opposing scales on each lateral arm plate. Innermost of these scales lost by fourth to sixth segment. Inner of ventral arm plate scales lost by fifth segment, middle by ninth, outer by twentieth. Other scale on lateral arm plate, leaf-like, twice as high as wide, continues to the tip. Colour: white.

Distribution. Eastern Bass Strait; North Atlantic from Rockall Trough to south of Gibraltar, off Tristan da Cunha. 1630–1860 m.

Remarks. The holotype (6.5 mm d.d.) is in poor condition, lacking most of the dorsal disc surface and the inner rows of oral papillae. It differs slightly from the Bass Strait specimen in having roughly square-shaped ventral arm plates with concave sides. There is only 1 tentacle scale on the lateral arm plate, which is large, as high as wide and bluntly pointed. The difference in the shape of the ventral arm plate is possibly due to the larger size of the holotype. It is similar to the description and figures given by Paterson (1985).

Only one other species of *Ophiomyces* is known from the Tasman Region: *O. delata* Koehler, 1904

found south of Norfolk Island in the Tasman Sea (Baker, 1979: 36, fig. 5d and NMV F52777 – same locality). *O. delata* differs mainly in the number and shape of tentacle scales and oral papillae. On basal segments there are two small oval tentacle scales on the lateral arm plate and a larger one on each side of the ventral arm plate; only the middle scale persists after the tenth segment. The oral papillae point distally and nearly all are wide and fan-shaped, characteristic of only the outermost papillae in *O. grandis*. The disc spines are also twice as long and stouter in similar sized specimens.

O. grandis was previously known only from the Atlantic Ocean.

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A REVIEW OF THE GENUS *SMILASTERIAS* (ECHINODERMATA, ASTEROIDEA), WITH DESCRIPTIONS OF TWO NEW SPECIES FROM SOUTH-EASTERN AUSTRALIA, ONE A GASTRIC BROODER, AND A NEW SPECIES FROM MACQUARIE ISLAND

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Abstract

O'Loughlin, P.M. and O'Hara, T.D., 1990. A review of the genus *Smilasterias* (Echinodermata, Asteroidea), with descriptions of two new species from south-eastern Australia, one a gastric brooder, and a new species from Macquarie Island. *Memoirs of the Museum of Victoria* 50(2): 307–323.

An emended diagnosis is provided for the genus *Smilasterias* Sladen. Three new species of *Smilasterias* are described. *S. multipara* sp. nov. and *S. tasmaniae* sp. nov. are endemic to south-eastern Australia, and *S. clarkailsa* sp. nov. is from Macquarie Island. The seasonal gastric brooding habit of *S. multipara* sp. nov. is described. Descriptions are given for *S. scalprifera* (Sladen), *S. triremis* (Sladen) and *S. irregularis* H.L. Clark. A key to the species of *Smilasterias* and a distribution map for the three south-eastern Australian species are provided.

Introduction

The type species of the genus *Smilasterias, S. scalprifera,* and an additional species *S. triremis,* were described by Sladen (1889) from material collected by H.M.S. "Challenger" in subantarctic waters. H.L. Clark (1928) described a third species *S. irregularis* from a single specimen in poor condition from South Australia.

Subsequently, H.L. Clark (1938) examined a single specimen from San Remo, Victoria (NMV F52993), and 17 specimens in poor condition in the Museum of Comparative Zoology which were collected in Western Port and Port Phillip Bay, Victoria. He concluded that they were all conspecific and close to *S. irregularis.* Because of inadequate comparative material H.L. Clark (1946) expressed his uncertainty about the number of species of *Smilasterias* from southern Australia, and whether the Australian material was congeneric with that collected by H.M.S. "Challenger".

In her report on the BANZARE asteroids, A.M.Clark (1962) detailed a single specimen from Macquarie Island as *Smilasterias* sp. (cf. *irregularis* H.L. Clark), and one from off Princess Elizabeth Land as *Smilasterias* sp. (cf. *triremis* Sladen). The Macquarie Island specimen and description of *S. irregularis* suggested to her the possibility of a further genus intermediate between *Smilasterias* and *Allostichaster,* but the lack of comparative material inclined her to leave the identity of these specimens unresolved.

Recent collecting has provided an abundance of material from south-eastern Australia, Macquarie Island, and subantarctic and antarctic waters. There is material conspecific with the San Remo specimen examined by H.L. Clark (1938), and with the Macquarie Island specimen examined by A.M. Clark (1962). *S. scalprifera* (Sladen), *S. triremis* (Sladen), and *S. irregularis* H.L. Clark are all represented. And during museum examinations, material representing a new species of *Smilasterias* from south-eastern Tasmania has been found.

A single specimen (NMV F53029) from off the west coast of Tasmania is discussed as it has characteristics of both *Smilasterias* Sladen and *Allostichaster* Verrill.

Abbreviations and Terminology

AM, Australian Museum, Sydney

BMNH, British Museum (Natural History), London

NMV, Museum of Victoria, Melbourne

QVM, Queen Victoria Museum, Launceston, Tasmania

SAM, South Australian Museum, Adelaide
TM, Tasmanian Museum, Hobart
WAM, Western Australian Museum, Perth
R, length of arm from centre of disc
r, radius of disc to interbrachial apex
gbr, greatest breadth of arm
ht, greatest height of arm
l, length of spinelet
w, medial width of spinelet

abactinal plates, plates on the aboral surface extending from the superomarginal plates

dorsolateral plates, skeletal plates between the carinal and superomarginal plates

autotomy, facility for loss of parts of the body under adverse stimulation, generally limited to single arms or parts of arms (A.M. Clark, 1967)

fissipary, restricted form of autotomy in which division takes place across the disc and results in the separation of two approximately equal parts, both of which are capable of regenerating to form a complete specimen (A.M. Clark, 1967)

Asteriidae Gray, 1840

Asteriinae Verrill, 1914

Smilasterias Sladen, 1889

Asterias (Smilasterias) Sladen, 1889: 562, 578.
Smilasterias.—Fisher, 1923: 250, 602.—1930: 239.—1940: 260.—H.L. Clark, 1946: 156.—A.M. Clark, 1962: 85.

Type species. *Asterias scalprifera* Sladen, 1889 (subsequent designation by Fisher, 1923).

Diagnosis (emended). Rays 5, subcylindrical; R up to 82 mm; single madreporite, not fissiparous. Abactinal skeleton finely reticulate; carinal plates small, often irregular, form fine median longitudinal ridge, linked to superomarginal plates by up to 7–16 small dorsolateral plates; dorsolateral area broad, plates frequently transversely elongate creating transverse ribbing, irregular series of longitudinal linkages; both series of marginal plates small but distinct; no actinal papulae. Inferomarginal plates with oblique comb of 2–5 flattened spines; adambulacral plates with 2–4 spines. Abactinal spinelets numerous, spaced or grouped on plates, slightly tapering to clavate, stout to thin. Crossed and straight pedicellariae present; pedicellariae not clustered around or on spines or spinelets on rays.

Distribution. Antarctica: Palmer Archipelago. Subantarctic: off Macquarie, Kerguelen, Heard, Marion, Falkland Islands. SE Australia: from Nuyts Archipelago (SA) to Shellharbour (NSW), Bass Strait Islands, northern and eastern coasts of Tasmania. 0–354 m.

Remarks. Sladen (1889) distinguished his ne subgenus *Asterias (Smilasterias)*, containing t species *A. scalprifera* and *A. triremis*, from oth "*Asterias*" groups by the oblique combs of flatten inferomarginal and adambulacral spines, the "su compact" dorsolateral skeleton, and the numerou grouped abactinal spinelets. However, on the oth four species now described, and even on som specimens of *S. scalprifera* (Sladen, 1889) and *triremis* (Sladen, 1889), the spinelets are spaced an not noticeably grouped together.

In his final re-diagnosis of the genus Fishe (1940) described, amongst other features, th inferomarginal plates as being on the ventrolatera border of the ray, the presence of a series of sma actinal plates, the first pair of postoral adam bulacral plates as longer than the second pair, an straight pedicellariae scattered on all ray surfaces None of these features is consistent across all o the species of *Smilasterias*. The inferomargina plates do not always mark a distinct actinolatera border, variation occurring within species and i the same specimen. Actinal plates may be very reduced in number and size, or lacking, as in the small species *S. tasmaniae* sp. nov. In most cases the first pair of postoral adambulacral plates are contiguous, but they are not always longer than the second pair. In two of the southern Australian species, *S. multipara* sp. nov. and *S. tasmaniae*, there may be a few isolated straight pedicellariae on the actinal interradial surfaces in the former and on the oral spines in the latter, but otherwise straight pedicellariae are present only in the furrow in these species.

The size and form of the pedicellariae in *S. multipara* and *S. tasmaniae* are relatively consistent, but there is considerable variation in the size, form and distribution of straight pedicellariae in *S. scalprifera*, *S. triremis* and *S. clarkailsa* sp. nov., and in the distribution of straight pedicellariae for different populations in *S. irregularis* H.L. Clark, 1928.

To us, the most distinctive diagnostic characteristic for *Smilasterias* is the form of the abactinal skeleton as described. However, in most of the species, there is some variation between similar-sized specimens in the degree of calcification of the skeleton and in the abactinal plate arrangement. This varies from a reticular arrangement, with up to 3 longitudinal linkages and many irregular or Y-shaped dorsolateral plates, to mainly transverse series of elongate plates with one or no longitudinal connections. This was noted by A.M. Clark (1962) for *S. triremis*, but it is also true of *S. scalprifera*, *S. clarkailsa* and *S. tasmaniae*. The form

Table 1. Contrasting characteristics of the species of *Smilasterias*.

Species of *Smilasterias*, distribution, depth range	Maximum R	Dorsolateral plates linking carinals and superomarginals	Inferomarginal spines per plate. Shape of spines	Abactinal spinelet arrangement, shape	Superomarginal beading; spinelets per plate, shape	Actinal series of plates	Straight pedicellariae outside furrow
S. scalprifera Marion, Kerguelen, Heard, Falkland Islands 40(?15)–267 m. (Type species)	82 mm	Up to 16; transverse series with very irregular longitudinal linkages.	Combs of up to 5, mostly 4. Flattened, broad, flared, truncate.	Mostly grouped. Mostly clavate, l/w = 3–4	Not beaded. Up to 10. l/w = 5–6	Up to 3/4 length of a ray; 2 series basally; plates with up to 4, mostly 2–3 spines.	Range of large to small lanceolate and incipient felipedal ones; occur actinally, marginally, in arcs. Rare abactinally.
S. triremis Palmer Archipelago. Heard, and between Heard and Kerguelen Islands. 93–354 m.	61 mm	Up to 8; transverse series with very irregular longitudinal linkages	Combs of up to 5, mostly 3. Flattened, broad, flared, truncate to slightly rounded	Mostly grouped. Semicapitate to slightly tapered. l/w = 3–4	Not beaded. Up to 10. l/w = 4–5	Up to 1/2 length of a ray; plates rarely spiniferous	Small lanceolate ones on all ray surfaces; large felipedal ones may be on some or all ray surfaces
S. clarkailsa sp. nov. Macquarie Island. 69–135 m. (4 specimens only)	35 mm	Up to 7; transverse series with irregular longitudinal linkages.	2 or 3. Flattened, truncate, often flared.	Spaced. Mostly stout and cylindrical. l/w = 2.5	Fine beading. Mostly 2 or 3. l/w = 2.5	Up to 1/2 length of a ray; may be 1–5 plates with spines	Lanceolate, sometimes felipedal; may occur actinally, marginally, abactinally
S. irregularis SA, Vic., NSW, northern Tas. 1–30 m. (readily autotomous)	65 mm	Up to 8; transverse series, with mostly 1 irregular series of longitudinal linkages	Up to 3, mostly 2. Flattened, truncate, not flared	Spaced. Cylindrical to clavate. l/w = 3	Prominent beading. Up to 3, mostly with 1 on the proximal lobe. l/w = 4	May be up to 4 thin plates in a series; may be 1–2 plates with spines	Lanceolate ones may occur actinally, marginally and abactinally on NSW specimens
S. multipara sp. nov. Vic., northern and eastern Tas. 0–3 m (gastric brooding)	38 mm	Up to 7; transverse series, with mostly 2 irregular series of longitudinal linkages	2. Flattened, truncate, not flared.	Spaced. Semicapitate to slightly tapered. l/w = 2.5	Fine beading or striations. Mostly 2, aligned transversely. l/w = 3.5	May be up to 6 thin plates in a series; rarely spiniferous.	May be isolated ones on the actinal interradial surfaces, or very rarely some actinally.
S. tasmaniae sp. nov. Southeastern Tas. 0–8 m. (3 specimens only)	20 mm	Up to 8; transverse series, with up to 3 very irregular series of longitudinal linkages	2. Flattened, truncate, sometimes with slight waist and swollen end	Spaced. Very stout, sometimes flared or semicapitate. l/w = 2	Fine striations. Mostly 2 or 3. l/w = 4	None	A few on the oral spines

of the abactinal skeleton is relatively consistent in *S. irregularis* and *S. multipara* and has been figured (fig. 2).

In their keys to the southern genera of Asteriinae both Fisher (1930) and A.M. Clark (1962) refer to the beading on the superomarginal plates of the related genus, *Allostichaster* Verrill, 1914. A.M. Clark specifically noted the absence of beading for *Smilasterias*. However, the superomarginal plates of *S. irregularis* are prominently beaded. Those of *S. multipara, S. clarkailsa* and the *S.* sp. (cf. *triremis*) specimen sometimes have very fine beading. The other species of *Smilasterias* have no beading. Given the consistency of other characteristics, we do not consider beading to be taxonomically significant for *Smilasterias*.

The aboral disc surface is generally a reticulum of small plates, but in two taxonomically uncertain specimens, the BANZARE specimen described by A.M. Clark (1962) as *S.* sp. (cf. *triremis*), and an "Asteriinae" specimen described herein, there are 10 large radial and interradial plates bordering the disc and giving the disc a distinctly stellar appearance. These plates are also present in *Allostichaster regularis* H.L. Clark, 1928. More specimens are needed before the taxonomic significance of these plates can be properly assessed.

Unlike some *Allostichaster* species, none of the *Smilasterias* species is fissiparous, but one species, *S. irregularis,* is readily autotomous. Museum specimens of this species, including the holotype, are rarely intact.

In each species small specimens differ from large ones by having a more compact skeleton, fewer dorsolateral transverse plates, restricted papular areas, fewer actinal plates, fewer spinelets per plate, and, in the cases of *S. scalprifera, S. triremis* and *S. clarkailsa,* fewer adambulacral and inferomarginal spines. All characters described in this paper refer to larger specimens unless otherwise stated.

Although the greatest depth recorded for the described species is 354 m for *S. triremis,* the *S.* sp. (cf. *triremis*) specimen was collected from 1266 m.

Some of the contrasting characteristics of the species of *Smilasterias* are summarized in Table 1.

Figure 1. Map showing the recorded occurrence of the Australian species of *Smilasterias*. (EGSS—East Gippsland Scallop Survey).

Key to the species of *Smilasterias* Sladen

1 10 distinctly larger radial and interradial plates bordering the disc aborally ..... *Smilasterias* sp. (cf. *triremis*) (Sladen, 1889) (A.M. Clark, 1962)

– Aboral disc a reticulum of small plates only 2

2 Inferomarginal plates with combs of predominantly 3–4 flared spines; actinal series long, up to half the length of a ray or longer; abactinal spinelets often grouped; up to 2 crossed pedicellariae per spinelet on rays abactinally 3

– Inferomarginal plates with 2–3 spines, often flared; actinal series long, up to half the length of a ray; abactinal spinelets not grouped; 3–4 crossed pedicellariae per spinelet on rays abactinally *Smilasterias clarkailsa* sp. nov.

– Inferomarginal plates with predominantly 2 spines, not flared; actinal series short or lacking, up to 6 plates; abactinal spinelets not grouped; up to 2 crossed pedicellariae per spinelet on rays abactinally 4

3 Inferomarginal plates with predominantly 4 spines; adambulacral plates with predominantly 3 spines; straight pedicellariae rare abactinally; actinal plates spiniferous ..... *Smilasterias scalprifera* (Sladen, 1889)

– Inferomarginal plates with predominantly 3 spines; adambulacral plates with predominantly 2 spines; straight pedicellariae abactinally; actinal plates rarely spiniferous ..... *Smilasterias triremis* (Sladen, 1889)

4 Short series of thin actinal plates present on rays; pedicellariae present on upper abactinal surface; oral spines lacking pedicellariae; rays long, with only slight proximal swelling, R/gbr > 4 5

– Series of actinal plates lacking; upper abactinal surface lacking pedicellariae; a few pedicellariae on oral spines; rays short, swollen proximally, R/gbr < 4 ..... *Smilasterias tasmaniae* sp. nov.

5 Superomarginal plates contiguous or imbricating longitudinally, with transverse papular areas very rarely continuous between them; superomarginal plates with mostly 3 spinelets, one on a prominent proximal lobe; mostly one irregular series of longitudinal dorsolateral plate linkages along mid-ray; readily autotomous; live colour mostly mottled reddish-brown and cream ..... *Smilasterias irregularis* H.L. Clark, 1928

– Superomarginal plates often separated longitudinally, with transverse papular areas continuous between them; superomarginal plates mostly with 2 spinelets, aligned transversely; mostly 2 irregular series of longitudinal dorsolateral plate linkages along mid-ray; not readily autotomous; live colour very dark grey over pale cream ..... *Smilasterias multipara* sp. nov.

Smilasterias multipara sp. nov.

Plate 1 a, b, Figures 1, 2, 3

Smilasterias irregularis H.L. Clark, 1928.—H.L. Clark, 1938: 195 (in part).

Smilasterias sp.—Marine Research Group of Victoria, 1984: 138.

Material examined. Holotype. Victoria, Flinders, ocean platform, lower intertidal pool, 12 Jan 1986, M. O'Loughlin, NMV F53036 (dry).

Paratypes. Type locality, NMV F53030(3 specimens), NMV F53033(8), NMV F53037(1), AM J20199(5), BMNH 1986.10.1.1–5(5); Victoria, Cape Bridgewater, 20 Jan 1979, M. O'Loughlin, NMV F53011(12); Bushrangers Bay, lower intertidal pools, 25 Jan 1986, M. O'Loughlin, SAM K1760(5); Flinders, ocean platform, lower intertidal pools, 8 Feb 1986, M. O'Loughlin, WAM 428-86(5); Tasmania, Stanley, 6 Nov 1979, J.R. Penprase, TM H1546 (2 brooding); Greens Beach, 28 Oct 1978, M. O'Loughlin, NMV F53027(1 brooding); Lulworth, 22 Nov 1982, M. O'Loughlin, NMV F53035(1 brooding + 2).

Other material. Victoria, Cape Bridgewater, 20 Jan 1979, NMV F53028(1), NMV F53034(10), NMV F53039(3); Castle Cove, 29 Dec 1986, NMV F53573(53); Bushrangers Bay, 28 Mar 1981, NMV F53020(2); 25 Jan 1986, NMV F53031(7); Flinders, 26 Apr 1935, NMV F52994(1); 16 Jan 1968, NMV F52996(1); 6 Jun 1969, NMV F53000(2); 6 Sep 1969, TM H1594(10); 17 Dec 1969, NMV F53002(5); 8 Mar 1976, NMV F53005(10), AM J9915(5); 26 Feb 1977, NMV F53007(8); 14 Jan 1979, NMV F53008 (1), NMV F53010(8); 10 Mar 1980, NMV F53016(5); 7 Apr 1980, NMV F53017(1); 16 Nov 1980, NMV F53018(3); 22 Jan 1982, NMV F53021(5); 26 Dec

1983, NMV F53025(1); 12 Dec 1985, NMV F53026(11); 8 Feb 1986, NMV F53032(26); 3 Nov 1986, NMV F53046(15 brooding), NMV F53047(31); 2 Aug 1987, NMV F53574(6); 9 Oct 1987, NMV F53575(41 brooding + 61); Western Port, 10 Jan 1970, NMV F53006(1); Crawfish Rock, 15 Feb 1969, NMV F52999(1); Balnarring, 29 Nov 1969, NMV F53001(2); Phillip Island, Cat Bay, no date, NMV F53004(3); Kitty Miller Bay, 7 Apr 1968, NMV F52997(5); 25 Oct 1987, NMV F53571(1 brooding); San Remo, coll., G. Coghill 28 Jan 1909, identified by H.L. Clark as *S. irregularis* (see Clark, 1938: 195), NMV F52993(1); Cape Liptrap, 7 Mar 1982, NMV F53022(2); Walkerville 7 Mar 1982, NMV F53023(2).

Bass Strait islands. King Island, Narracoopa, 30 Sep 1935, NMV F52995(4); 8 Mar 1980, NMV F53012(3); City of Melbourne Bay, Nov 1969, 2–3 m, TM H1646(2); Cape Wickham, 9 Mar 1980, NMV F53013(2); Currie, 10 Mar 1980, NMV F53014(6); Gulchway, 10 Mar 1980, NMV F53015(7); Erith Island, May 1974, NMV F53003(2), AM J16596(2).

Tasmania. West Point, 9 Dec 1977, AM J11401(2); Marrawah, Green Point, 21 Jan 1975, AM J9018(1); Hunter Island, Jan 1954, AM J6843(7); Circular Head, Highfield Point, 1–14 Jan 1983, TM H1768 (23); Jacobs Boat Harbour, 31 Jan 1969, TM H1592(13); Port Latta, Cowrie Beach, 1 Dec 1968, NMV F52998(1); Western Bay, 29 May 1979, TM H1532(3); Burnie, Somerset, 29 Jan 1972, WAM 670-76(2); Ulverstone, Aug 1934, QVM(1); Devonport, east, 24 Nov 1984, TM H1855(1); Coles Beach, 14 Mar 1977, AM J10556(1); 10–13 Dec 1977, TM H1916(1); 1-12 Dec 1982,TM H1752(1); Greens Beach, 24 Jun 1961, QVM(4); 30 Oct 1965, QVM(12); 16 Apr 1975, QVM(3); 24 Mar 1976, QVM(9); 7 Apr 1976, QVM(4); 8 Apr 1976, QVM (21); 28 Oct 1978, NMV F53009(1), NMV F53040(1); 7 Mar 1981, NMV F53019(6); 3 May 1986, NMV F53572(4); Cape Portland, 2 Mar 1969, TM H1121(8), TM H1416(1); 28 Mar 1971, TM H1645(5); Jan 1980, QVM(1); George Rocks, 19 Nov 1977, QVM(4); Bicheno, 21 Nov 1968, TM H794(4); 21 Nov 1981, NMV F53042(1); 12–13 May 1983, TM H1797(1); Coles Bay, 23 Apr 1972, TM H1644(4); 20 Nov 1982, NMV F53024(1); Eaglehawk Neck, 30 Mar 1970, TM H1140(3); Port Arthur, 28 Feb 1971, TM H1641(1); 23 Mar 1971, TM H1642(2); 3 Jun 1971, TM H1643(4); Safety Cove, 28 Apr 1974, TM E1639(2); Point Puer, opposite Dead Island, 13 Dec 1972, TM H1640(1); Bruny Island, Variety Bay, 30 Jan 1967, TM H1593(5).

Distribution (fig. 1). Victorian coast from Cape Bridgewater (38°23′S, 141°25′E) to Walkerville (38°52′S, 146°0′E); Bass Strait Islands; Tasmanian coast from West Point (40°55′S, 144°37′E) to Variety Bay, Bruny Island (43°12′S, 147°26′E). 0–3 m.

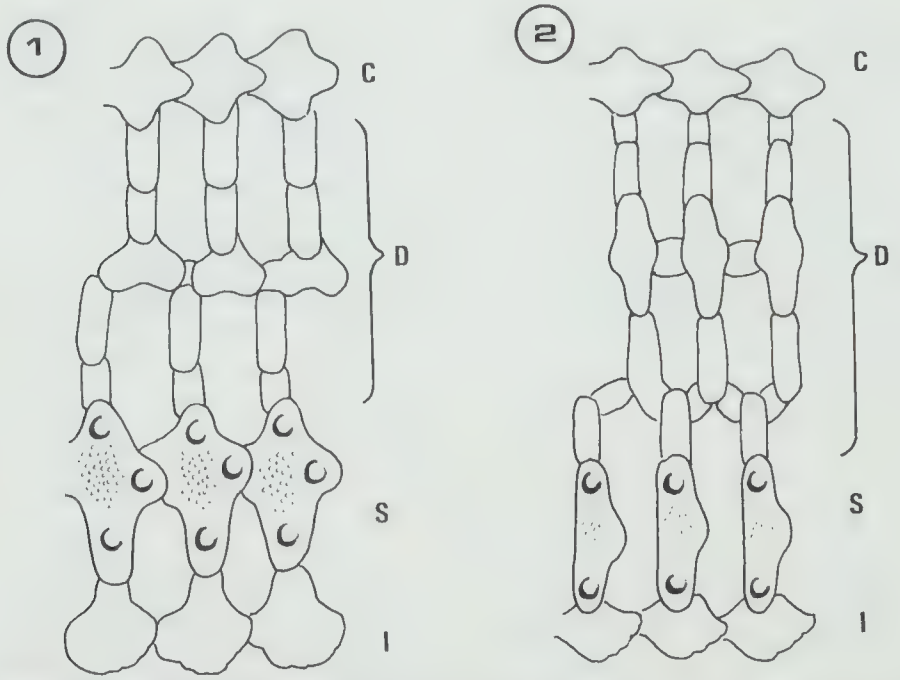

Figure 2. Schematic drawing of the arrangements of the skeletal plates, and the disposition of the spinelets and beading on the superomarginal plates, for proximal sections of the rays of: 1, *Smilasterias irregularis* H.L.Clark (NMV F53048), with 1 series of longitudinal dorsolateral linkages, superomarginals imbricating longitudinally, a spinelet on the proximal lobe of the superomarginal plates, and prominent beading; and 2, *S. multipara* sp. nov. (NMV F53039), with 2 series of linkages, superomarginals not imbricating, spinelets aligned transversely, and fine striations. (C, carinal, D, dorsolateral, S, superomarginal, I, inferomarginal. R.H.S. is adoral.)

Etymology. From the Latin *multus* (many) and *parere* (to bear), in reference to the brooding habit of bearing many young.

Description. Holotype. 5 rays; R = 30, 29, 28, 26, 24 mm; r = 4 mm; gbr = 6 mm; ht = 6 mm; R/r = 7.5; R/gbr = 5. Rays subcylindrical; fine median longitudinal ridge along rays, transverse ribbing; rays constricted basally, slightly swollen proximally, tapered to rounded tip; interbrachial arcs acutely angular. Abactinal skeleton very finely reticulate; disc an irregular reticulum of small plates aborally; smallest ray with irregular plating; single madreporite at aboral apex of interbrachial arc, surrounded by 9 spinelets. Papular areas extensive; irregular on disc, up to 1.0 mm long; transversely elongate on rays, up to 3.0 mm long, often extending between superomarginals; 1–5 papulae per area; no actinal papulae.

Carinal series of mostly regular quadrilobed plates up to 0.8 mm wide, imbricating proximal over distal lobes; series irregular along 1 ray, basally on 2 rays. Carinals linked to superomarginals by regular transverse series of up to 6 rod-like, cruciform or Y-shaped plates; 1 or 2 irregular series of longitudinal dorsolateral linkages; dorsolateral area up to 5 mm wide transversely. Superomarginals alternate in alignment with carinals; narrowly cruciform, up to 2 mm long transversely; imbricate with dorsolaterals and inferomarginals transversely, often separated longitudinally; finely beaded centrally; 32 superomarginals for R = 30 mm. Inferomarginals correspond in number and alignment with superomarginals; up to 1.2 mm longitudinally, imbricating strongly; up to 1.2 mm transversely, with tapering vertical lobe imbricating under superomarginals; inferomarginals form actinolateral ray margin. Short actinal series of 6

Figure 3. Aboral view of the exposed lobes of the cardiac stomach of *Smilasterias multipara* sp. nov., showing some brood juveniles. (Paratype NMV F53027)

thin plates; correspond with marginals. First pair of adoral adambulacrals contiguous, subequal with adjacent plates; 11 adambulacrals for 5 inferomarginals; terminal plate hemispherical, domed, actinally furrowed, up to 1.6 mm wide.

Abactinal and superomarginal plates with small, spaced, slightly tapering to rarely semi-capitate, often slightly curved, terminally spiniferous spinelets; carinals with 1 or 2 spinelets, l = 0.2 mm, l/w = 2.5; superomarginals mostly with 2 spinelets aligned transversely, l = 0.5 mm, l/w = 3.5. Inferomarginals mostly with pairs of slightly flattened, slightly tapered spines, up to 1.3 mm long, aligned obliquely to furrow, more stout than adambulacral spines; 1 small actinal spine on each side of 1 ray; most adambulacrals diplacanthid, spines up to 1.3 mm long, spine nearer furrow mostly smaller. Oral plates with 3 or 4 spines; actinal ones similar to adambulacral spines; terminal oral ones much shorter, on furrow edge of plate, with swollen base and tapering neck.

Small crossed pedicellariae scattered over abactinal and marginal surfaces; less numerous than spinelets on disc and rays proximally, more numerous distally; up to 0.1 mm high. Some small straight pedicellariae on furrow edge of adambulacrals, 0.1 mm high; single larger straight pedicellaria on 1 actinal interradial surface, 0.2 mm high.

Paratypes. Show no evidence of autotomy; inferomarginal plates do not usually form an actinolateral margin to rays; form of rays is consistent, with R/gbr > 4; skeletal form resembles holotype, with up to 7 dorsolateral plates transversely and up to 5 papulae per area in largest specimen (R = 38 mm; NMV F53011); mostly 2 very irregular series of longitudinal linkages across the transverse series of dorsolateral plates; superomarginal plates often separated longitudinally, mostly with fine striations rather than beading; mostly 2 superomarginal spinelets, aligned transversely, all at least twice as long as carinal spinelets; inferomarginal spines mostly more flattened and truncate than in holotype; 1 paratype (NMV F53030) with a few proximal inferomarginal plates with 3 spines; straight pedicellariae lacking on abactinal and marginal surfaces, very rare on actinal interradial surfaces; 1 paratype (NMV F53011) with straight pedicellariae actinally; 1 paratype (WAM 428-86) with spiniferous actinal plates.

Colour (live). White to cream actinally and ends of rays, with dark grey mosaic on pale background abactinally; as growth occurs dark grey increases from disc only, to irregular dark bands through rays, to dark rays with irregular pale bands, to mostly dark abactinally; dark grey may be brownish or greenish; brood juveniles are pink when released; dark grey turns to pinkish red immediately in alcohol.

Reproduction. Specimens of *S. multipara* have been observed to brood young in their cardiac stomachs. Most of the 563 specimens examined have been dissected but only 61, from Stanley, Greens Beach and Lulworth, on the north coast of Tasmania, and from Flinders and Kitty Miller Bay, Victoria, are brooding. All 61 were collected during October and November, although material from all months except July is represented.

Sexes are separate and there is no evidence of protandrism or hermaphroditism. Female gonads are generally small, 0.07-0.1 times the ray length, and cylindrical, occasionally with small lateral outgrowths. Gonads in female specimens collected in August (NMV F53574), however, are much stouter and longer, 0.3 times the ray length, and filled with large eggs, orange when preserved in alcohol. The gonopores open low down on the lateral side of the rays, between, or just above, the basal and second superomarginal plates. Some female specimens collected in early October are brooding, the gonads retracted to their usual size. In one lot (NMV F53575), of the 94 specimens over R = 10 mm, 47 are male, 41 are brooding females and 6 are non-brooding females.

The process of fertilization and ingestion is unknown. One of us (M.O'L., 3 Nov 1986) has observed adults releasing young, and separate broods of recently released juveniles, on the under surface of rocks in shallow pools near low tidemark.

The large cardiac stomach is used for brooding, extending during brooding to up to one third of a ray length (fig. 3). The usually thick and opaque stomach wall is thin and membraneous in these extensions. No juveniles have been found in the small, aboral, pyloric stomach. There is no evidence of food in the stomachs of brooding specimens.

Up to 300 juveniles have been found in one individual (TM H1546), approximately 50 in the disc and in each radial extension of the stomach. The smallest brood females, R = 10-12 mm (NMV F53575), have only 5–20 juveniles. These are often restricted to the disc and 1–2 rays, the other rays having no stomach extension.

The juveniles are up to R = 1.0 mm, r = 0.6 mm, when released. There are 5–10 pairs of tube feet along each ray and a few spinelets on the aboral surface, more numerous at the ray tip and longest in the interradial margins.

The brooding habit of *S. multipara* is similar to that described by Fisher (1930: 48–57, fig. 2) for

the arctic asteriin *Leptasterias groenlandica* (Lütken, 1857). However, Fisher found that in the early stages of development the young are attached to the adult by a larval organ. No such organ has been observed in *S. multipara.*

Remarks. This large series of specimens confirms H.L. Clark's (1938) suspicion that the San Remo specimen (NMV F52993), temporarily placed in *S. irregularis*, belongs to another species. This was recognized by the present authors in Marine Research Group of Victoria (1984), where this species is referred to as *Smilasterias* sp.

S. multipara is mostly found on the relatively bare and smooth undersurface of large pebbles and boulders in the lower intertidal and shallow sublittoral zones of exposed ocean platforms, usually basalt. This habitat preference and the brooding habit possibly account for the Victorian distribution, which, despite an extensive survey of the coast, is rather discontinuous (fig. 1). However, where this species is present it is the most abundant asteroid in the zone around the low tide mark.

In addition to this gastric brooding species there are two southern Australian asteroids which are known to be viviparous: *Patiriella vivipara* Dartnall, 1969, from south-eastern Tasmania, and *Patiriella parvivipara* Keough and Dartnall, 1978, from the west coast of the Eyre Peninsula, South Australia.

Smilasterias tasmaniae sp. nov.

Plate 1 c, d, e, Figure 1

Material examined. Holotype. Tasmania, Bruny Is., Lighthouse Bay, on rocks with brown kelp, 8 m, 13 Dec 1977, C. Short, AM J11395 (dry).

Paratypes. Recherche Bay, Catamaran, under stones at low tide, Oct 1929, M. Ward, AM J19659(1 dry); NMV F54579(1 dry).

Distribution. (fig. 1) SE Tasmania in Lighthouse Bay, Bruny Island (43°30′S, 147°10′E), and at Catamaran, Recherche Bay (43°34′S, 146°54′E). 0—8 m.

Etymology. Named in reference to the south-eastern Tasmanian distribution.

Description. Holotype. 5 rays; R = 19 mm, r = 5 mm, gbr = 7 mm, ht = 6 mm, R/r = 4, R/gbr = 3. Rays subcylindrical, constricted basally, swollen proximally, thin distally, rounded tip; interbrachial arcs acutely angular; longitudinal and transverse series on rays very weakly evident abactinally. Abactinal skeleton reticulate, compact; disc an irregular reticulum of small plates aborally; single madreporite at aboral apex of interbrachial arc, surrounded by 13 spinelets. Papular areas small, rounded to slightly elongate, mostly with 1 papula; no actinal papulae.

Carinal series of quadrilobed plates up to 1.0 mm wide, imbricating proximal over distal lobes; shape and position of plates irregular, especially basally. Carinals linked to superomarginals by irregular transverse series of up to 8 small dorsolateral plates, most transversely elongate; dorsolateral area up to 5 mm wide transversely; up to 3 irregular series of longitudinal linkages across transverse series of dorsolaterals. Superomarginals alternate in transverse alignment with carinals; superomarginal plates irregularly cruciform, sometimes composite, up to 1.5 mm long transversely; imbricate strongly longitudinally, and over dorsolaterals and inferomarginals transversely; plates with fine striations, not beaded; 24 superomarginals for R = 19 mm. Inferomarginals correspond in number and alignment with superomarginals; up to 1.2 mm across, imbricating strongly longitudinally; up to 1.2 mm high with tapering vertical lobe imbricating under superomarginals. Actinal series of plates lacking. First pair of adoral adambulacrals contiguous, subequal with adjacent adambulacral plates; 10 adambulacrals for each 5 inferomarginals; terminal plate hemispherical, domed, actinally furrowed, surface lumpy not beaded, up to 1.0 mm wide.

Abactinal and superomarginal plates with spaced, short, thick, sometimes flared or semicapitate, often slightly curved, terminally spiniferous spinelets; carinals mostly with 3 spinelets on exposed lobes, l = 0.3 mm, l/w = 2; superomarginals mostly with 2 spinelets, aligned transversely, l = 0.7 mm, l/w = 4. Spines on inferomarginals 2, rarely 3, often 1 basally; up to 1.2 mm long; slightly flattened, narrowed waist, slightly swollen end; aligned obliquely to furrow proximally; spine nearer furrow in pair stouter. Adambulacrals predominantly diplacanthid; proximally spine nearer furrow larger; mostly less thick than inferomarginal spines; up to 1.2 mm long. Oral plates with 2 or 3 spines, distal ones subequal with adjacent adambulacral spines; proximal oral spines slightly shorter.

Small crossed pedicellariae on lower dorsolateral, superomarginal and inferomarginal plates, 0.2 mm high; upper abactinal surface lacking pedicellariae; some small straight pedicellariae in furrow, some on proximal oral spines, 0.2 mm high; no pedicellariae on actinal surfaces interradially or between inferomarginals and adambulacrals.

Paratypes. Abactinal skeleton of smaller paratype (NMV F54579, R = 17 mm; pl. 1e) finer, more openly reticulate, papular areas more extensive, transverse series of dorsolateral plates more

evident, many superomarginal plates not imbricating longitudinally; abactinal skeleton of larger paratype (AM J19659, R = 20 mm) similar to holotype; carinal plates in both paratypes more regular than in holotype; superomarginal plates in both paratypes with mostly 3 spinelets.

Colour (preserved). Tan or brown.

Remarks. The south-eastern Tasmanian distribution of *S. tasmaniae* does not overlap with the distribution of *S. multipara* in this region. Both species have been found on Bruny Island, *S. tasmaniae* at Lighthouse Bay on the southern coast and *S. multipara* at Variety Bay on the north-east coast. More collecting is necessary to determine if these species are allopatric.

South-eastern Tasmania has a number of endemic littoral echinoderms. Rowe and Vail (1982) listed five species in this category: two asteroids, *Patiriella vivipara* Dartnall, 1969 (broods) and *Marginaster littoralis* Dartnall, 1970; an echinoid, *Pachycentrotus bajulus* Dartnall, 1972 (broods); and two holothurians, *Psolidium ravum* Hickman, 1962 and *Neoamphicyclus lividus* Hickman, 1962 (broods). However, there are specimens of *Psolidium ravum*, collected near Devonport, in the Tasmanian Museum, and we have found specimens of *Neoamphicyclus lividus* on both sides of Bass Strait.

Smilasterias clarkailsa sp. nov.

Plate 1 f, g

Smilasterias sp. (cf. *irregularis*). – A.M. Clark, 1962: 87, figs 15a, b.

Material examined. Holotype. Macquarie Island, N of Raine Point, 54°43.5′S, 158°53′E, 100–105 m, T. Cochrane, 6 Dec 1986, NMV F53754(wet).

Paratypes. Type locality, NMV F53755(1); Macquarie Island, off Nuggets Point, 54°33.4′S, 158°56.9′E, 108–135 m, 8 Dec 1986, NMV F53753(1); off Lusitania Bay, 54°42.7′S, 158°54.5′E, 69 m, 5 Dec 1930, BANZARE stn 83, identified by A.M. Clark (1962) as *Smilasterias* sp. (cf. *irregularis*), BMNH 1965.8.5.220(1).

Distribution. Macquarie Island. 69–135 m.

Etymology. Named in recognition of the contribution by Ailsa M. Clark.

Description. Holotype. 5 subcylindrical rays, 1 small regenerating; R = 35 mm, r = 5 mm, gbr = 8 mm, ht = 5 mm, R/r = 7, R/gbr = 4.5. Strong median ridge along rays, weaker longitudinal and transverse dorsolateral ribbing; rays slightly constricted basally, tapering to rounded tip; interbrachial arcs not acutely angular. Abactinal skeleton finely reticulate; disc an irregular reticulum of small plates aborally; papular areas extensive, transversely elongate on rays, up to 4 papulae per area; no actinal papulae; single madreporite at aboral apex of interbrachial arc, surrounded by 9 spinelets.

Carinal series regular, raised, quadrilobed plates, imbricating proximal over distal lobes, up to 1.5 mm wide; carinals linked to superomarginals by transverse series of up to 7 small, elongate dorsolateral plates; single irregular series of longitudinal dorsolateral linkages; dorsolateral area up to 5 mm wide. Superomarginals cruciform, imbricating longitudinally and with inferomarginals and dorsolaterals transversely; proximal plates slightly beaded; 30–34 plates for R = 35 mm. Inferomarginals correspond in number, alignment, width with superomarginals; imbricate longitudinally; form an actinolateral margin to ray. Actinal series of up to 15 thin plates, up to half ray length. First pair of adoral adambulacral plates contiguous, subequal with adjacent plates, 14 adambulacrals to every 5 inferomarginals; terminal plate hemispherical, flattened, actinally furrowed.

Abactinal and superomarginal plates with spaced, stout, cylindrical to slightly clavate spinelets, rounded or flattened ends, up to 0.6 mm high, l/w = 2–2.5, only slightly longer marginally than carinally; carinal plates with 2, sometimes 3, spinelets; series of up to 4 dorsolateral and 2, sometimes 3, superomarginal spinelets transversely. Inferomarginal plates with 3 flattened, rectangular or slightly flared spines, up to 0.9 mm long, aligned obliquely to furrow. First 5 actinal plates with 1–2 spines. Adambulacral plates with 2–3 spines; inner and outer spine subcylindrical, slightly clavate; middle spine larger, flattened, up to 1.0 mm long; adoral spines slightly longer, up to 1.2 mm. Oral plate with 3–4 spines; 2 actinally and 1–2 shorter ones proximally.

Dense covering of crossed pedicellariae on abactinal and marginal surfaces, 3–4 times as numerous as spinelets, up to 0.25 mm high; numerous small lanceolate straight pedicellariae actinally, in furrow, a few on inferomarginal and actinal interradial surfaces, up to 0.2 mm.

Paratypes. Smaller, but similar to holotype, with 2–3 inferomarginal spines per plate; 2, sometimes 3, adambulacral spines; crossed pedicellariae 3–4 times as numerous as spinelets.

Largest paratype (NMV F53755, R = 30 mm, r = 5 mm) with 2 longitudinal dorsolateral linkages proximally; up to 7 actinal plates, some spiniferous; proximal superomarginal plates beaded; some superomarginal spinelets widened, flattened, smaller than, but similar in shape to, inferomarginal spines; inferomarginal spines flat-

tened, flared, wider than on holotype; adoral adambulacral spines only slightly longer than proximal adambulacral spines; some felipedal pedicellariae, up to 0.8 mm long, on actinal, marginal, abactinal surfaces; 1 very large felipedal pedicellaria, 1.0 mm high, on an actinal interradial surface.

Smallest paratype (BMNH 1965.8.5.220, R = 20 mm, r = 5 mm) with compact abactinal skeleton of up to 4 dorsolateral plates transversely; middle 2 plates linked obliquely, slightly raised, form 3 dorsolateral lines; dorsolateral plates next to superomarginals rectangular, not lobed; dorsolateral area up to 2.0 mm wide; dorsolateral plates not transversely elongate; up to 9 actinal plates, not spiniferous; carinals,superomarginals, with mostly 3 spinelets.

Third paratype (NMV F53753, R = 26 mm, r = 4 mm, in poor condition with 2 arms missing) with mostly 3 inferomarginal spines per plate.

Colour (preserved). Tan.

Remarks. A.M. Clark (1962), in detailing the compact abactinal skeleton of one of these paratypes (BMNH 1965.8.5.220), suggested that this specimen and the species *Smilasterias irregularis* were possibly generically distinct from *Smilasterias scalprifera* and *S. triremis* with their more open skeletons. We believe this compact skeleton is a juvenile feature. On larger specimens the dorsolateral region is more openly reticulate, with up to 7 elongate plates transversely and 1 (holotype, R = 35 mm) or 2 (paratypes, R = 26–30 mm) longitudinal series of linkages proximally, surrounding large, transversely elongate papular areas. A.M. Clark was also relying on H.L. Clark's (1928) description of *S. irregularis,* which underestimated the number of dorsolateral plates on the holotype.

S. clarkailsa is morphologically and geographically intermediate between *S. scalprifera* and *S. triremis* on the one hand and *S. irregularis* and the other Australian species on the other. *S. clarkailsa* approaches *S. scalprifera* and *S. triremis* in often having more than 2 inferomarginal spines per plate, although they are less flared, and in having a relatively long actinal series, up to half the ray length. It is similar to the Australian species in having relatively few, spaced spinelets on the abactinal surface of the rays and some beading on the superomarginal plates, although the beading is less prominent than on *S. irregularis.* It can be distinguished from all the other *Smilasterias* species in having 3–4 times as many crossed pedicellariae as spinelets on the abactinal surfaces of the rays.

Smilasterias irregularis H.L. Clark

Plate 1 h, Figures 1, 2

Smilasterias irregularis H.L. Clark, 1928: 402, figs 116a, b.—1938: 195 (in part).—Cotton and Godfrey, 1942: 205.—H.L. Clark, 1946: 157.—Shepherd, 1968: 752.—Zeidler and Shepherd, 1982: 417, fig. 10.9a.—Rowe and Vail, 1982: 223.

Material examined. South Australia, Spencer or St Vincents Gulf, no date, no depth, SAM K171 (holotype); Nuyts Archipelago, St Francis Island, Petrel Bay, 3–5 m, 25 Jan 1982, SAM K1777(1); Franklin Island, 6–8 m, 13 Apr 1983, SAM K1781(1); Port Lincoln, no date, SAM K620(1); 10 m, 31 Dec 1963, AM J7538(1); Sir Joseph Banks Group, Marum Island, 7 m, 13 Jan 1984, SAM K1775(1); Lusby Island, 7–8 m, 11 Jan 1984, SAM K1784(2); 3–5 m, 24 Jan 1986, SAM K1783(1); Reevesby Island, 3 m, 13 Jan 1984, SAM K1774(1); 20 Jan 1986, SAM K1786(1); 27 Jan 1986, SAM K1787(1); Winceby Island, 3–5 m, 26 Jan 1986, SAM K1788(4); Hareby Island, 2–5 m, 28 Jan 1986, SAM K1785(3); Langton Island, 2–4 m, 25 Jan 1976, SAM K1789(1); Partney Shoal, 3–8 m, 22 Jan 1986, SAM K1790(1); Yorke Peninsula, Port Turton, 2–5 m, 25 Nov 1985, SAM K1780(2); Port Noarlunga, 7 m, Nov 1970, AM J7995(2); Port Willunga, Nov 1966, SAM K1778(1); 12 Oct 1975, SAM K1779(1); Fleurieu Peninsula, Second Valley, 3–4 m, 31 Jul 1985, SAM K1782(3); Rapid Bay, 10 m, 19 Nov 1976, SAM K1776(3); Kangaroo Island, Penneshaw, May 1978, NMV F53048(3); 5 m, 9 Mar 1978, AM J11812(1); Encounter Bay, Victor Harbour, 2–5 m, 8 Mar 1984, SAM K1773(1); 1 m, 29 Mar 1986, NMV F53060(1); Goose Island, 20 Mar 1971, NMV F53055(1).

Victoria. Portsea, no date, NMV F53038(1); Western Port, Crawfish Rock, 29 Feb 1970, NMV F53058(1); Lakes Entrance, 38°42′S, 149°30′E, 26 m, 9 Feb 1971, EGSS stn 95, NMV F53056(1).

Tasmania. Lulworth, 1 m, 22 Nov 1982, NMV F53059(1); NMV F53061(1); Cape Portland, 6 Jan 1971, AM J8973(1); Jan 1980, QVM(3); Flinders Island, Franklin Sound, 27 Nov 1972, NMV F53057(1).

New South Wales. Merimbula, 10 m, 10 Jun 1981, AM J14655(1); Bermagui, 27 m, 29 May 1981, AM J14654(1); Burrewarra Point, 30 m, 15 Mar 1981, AM J14013(1); 27 m, 16 Mar 1981, AM J13983(1); Batemans Bay, 22 m, 10 Mar 1981, AM J14160(1); AM J14158(1); 27 m, 13 Mar 1981, AM J14163(1); Jervis Bay, 17 m, 19 Mar 1981, AM J14186(1); Shellharbour, 1 m, no date, AM J4510(1).

Distribution (fig. 1). Nuyts Archipelago, South Australia (32°31′S, 133°18′E) to Shellharbour, New South Wales (34°34′S, 150°52′E), including north coast of Tasmania. 1–30 m.

Description. R to 65 mm; ht > gbr; R/gbr > 4; rays frequently separated from disc or regenerating; readily autotomous. Rays constricted basally, slightly swollen proximally, tapered to rounded tip; rays with fine median longitudinal ridge, transverse ribbing, mostly a single longitudinal dorsolateral

ridge; disc round, domed; interbrachial arcs acutely angular. Abactinal skeleton finely reticulate; disc an irregular reticulum of small plates aborally; papular areas extensive, transversely elongate on rays, rarely extending transversely between superomarginal plates, up to 6 papulae per area.

Carinal plates small, quadrilobed, most slightly asymmetrical; most imbricating proximal over distal lobe, some linked by smaller plates; carinal series often irregular, least regular proximally. Carinal plates linked to superomarginals by transverse series of up to 8 small dorsolateral plates; most dorsolateral plates transversely elongate; mostly 1 series of irregular longitudinal linkages across the dorsolateral transverse series. Superomarginal plates asymmetrically cruciform, often with prominent proximal lobe; sometimes a composite of plates proximally; superomarginals alternate in alignment with carinals; superomarginals mostly imbricating or contiguous longitudinally; 34 plates when R = 46 mm; superomarginal plates with prominent beading. Inferomarginals correspond in number, alignment, width with superomarginals; imbricate longitudinally, with superomarginals transversely. Short actinal series of up to 4 thin plates; occasionally 2 plates wide basally. 12 adambulacral plates for each 5 inferomarginals; first pair of adoral adambulacrals contiguous, subequal with adjacent ones.

Abactinal and superomarginal plates with spaced, fairly thick spinelets, barely spiniferous terminally; carinals with 1–4 irregularly placed spinelets, truncate to clavate, l/w = 3; superomarginals with 1–3 spinelets, truncate to slightly tapering, l/w = 4, rarely aligned transversely, very frequently spinelet on prominent proximal lobe of plate, at least twice as tall as carinal spinelets. Inferomarginal plates with predominantly 2, sometimes 3, subequal, flattened, truncate spines; generally taller than adambulacral spines; aligned obliquely to furrow. Often 1–2 actinal plates per series with spines. Adambulacrals diplacanthid; spine nearer furrow generally smaller; adoral adambulacral spines often slightly larger than adjacent adambulacral ones. Oral plates with 3–4 spines; 2 large, flattened, often grooved actinal oral spines; 1–2 shorter basal oral spines, proximal one on furrow edge.

Small crossed pedicellariae on abactinal, marginal surfaces, fewer then 2 per spinelet, most numerous distally; numerous small straight pedicellariae in furrow; single larger straight pedicellariae on some actinal interradial surfaces; straight pedicellariae extremely rare on abactinal, marginal and actinal surfaces of rays except for NSW specimens where straight pedicellariae may be numerous on some or all of these surfaces.

Colour (live). Predominantly mottled red, reddish-brown,cream; no immediate colour change in alcohol; preserved specimens show residual colour.

Remarks. Re-examination of the holotype (R = 37–49 mm) revealed inconsistencies with H.L. Clark's (1928) original description. Clark found two, possibly three, rows of dorsolateral plates, no actinal plates, and did not mention any beading on the superomarginal plates. However, there are up to five transverse dorsolateral plates, at least two actinal plates, and the superomarginals are distinctly beaded. These latter features are typical of *S. irregularis* specimens of this size.

There appears to be a consistent geographical variation in the occurrence of straight pedicellariae within this species. On the holotype, and on other specimens from South Australia, Victoria and northern Tasmania, straight pedicellariae are only very rarely present on the abactinal, marginal and actinal surfaces of the rays. But on material from New South Wales straight pedicellariae are often present and may be numerous on these surfaces. Geographical variation in the form, size and distribution of straight pedicellariae is also found in *S. triremis*.

Most specimens have been collected by divers from subtidal rocky substrates. We have found only three specimens in rocky shallows (Lulworth, Tasmania, NMV F53059, F53061, and Victor Harbour, South Australia, NMV F53060) and these were under boulders about 1 m below low tide mark. Collection by museum divers has been more intensive on the coasts of New South Wales and South Australia, and this is probably reflected in the recorded distribution (fig. 1).

Smilasterias scalprifera (Sladen)

Plate 1 i, j

Asterias (*Smilasterias*) *scalprifera* Sladen, 1889: 578, pl. C, figs 4–6, pl. CIII, figs 1, 2.

Smilasterias scalprifera.—Fisher, 1930: 239.—1940: 261.—A.M. Clark, 1962: 85.—Cherbonnier and Guille, 1975: 620, pl. II, figs h, i.

Material examined. Subantarctic, off Marion Island, 93 m, 28–30 Dec 1873, HMS "Challenger", BMNH 1890.5.7.968 (syntype); Marion Island, Transvaal Cove, ?15 m, Sep 1982, in a *Macrocystis* bed, G. Branch, AM J18138(1); AM J18140(1 juvenile); off Heard Is., 52°55′S, 73°20′E, 177 m, 3 Feb 1967, coll. "Umitaka Maru", NMV F52678(1); 53°07.6′S, 73°49′E, 40–50 m, 3 Oct 1985, M. Norman on "Nella Dan", NMV F52679(1); 53°11.7′S,

73°04.5'E, 200 m, 4 Oct 1985, ?black silt sediment, M. Norman on "Nella Dan", NMV F53576(30).

Distribution. Falkland, Marion, Kerguelen and Heard Islands. 40(?15)–267 m.

Description. On largest specimen (AM J18138), R = 82 mm, r = 10 mm, gbr = 16 mm, ht = 12 mm, R/r = 8, R/gbr = 5. Rays often widened basally, attenuate distally; strong transverse dorsolateral ribbing; 6–7, rarely up to 12, papulae per area. Disc surface a reticulum of small plates aborally; carinal plates small, series irregular; carinals linked to superomarginals by up to 16, generally elongate, dorsolateral plates; usually 1, up to 3, irregular longitudinal series of linkages proximally; superomarginals not beaded; inferomarginal plates not always forming actinolateral border to ray; actinal plates up to three-quarters ray length, sometimes 2 series proximally.

Dense cover of abactinal spinelets, usually grouped on plates; spinelets clavate or tapering, smooth or slightly spiniferous, l/w = 3–6, longest on superomarginals, in arcs, up to 0.8 mm high; some superomarginal spinelets flattened, flared, similar in shape but smaller than inferomarginal spines; carinal plates with 3–5 spinelets, 1–5 on dorsolaterals, 3-6, rarely up to 10, on superomarginals. Inferomarginal plates with oblique combs of 2–5, mostly 4, flattened, flared, truncate spines; 1–3, rarely 4, actinal spines, often confluent with inferomarginal spines; 2–4, mostly 3, adambulacral spines, shorter, thinner, less flared than inferomarginal spines; oral plates with up to 6 spines.

Crossed pedicellariae numerous on abactinal, marginal ray surfaces, on disc, 0.5–1.5 times as numerous as spinelets, smaller than spinelets;small straight pedicellariae in furrow, actinally, marginally, occasionally on abactinal surface, larger than crossed pedicellariae; larger straight pedicellariae, up to 1.2 mm, usually in arc, actinally, usually much smaller than spines, with rounded or acute tips, sometimes slightly hooked, opposing valve tip crossed, sometimes incipiently felipedal, 1 small tooth set back on each side of valve tip.

Smallest specimen (R = 16 mm, NMV F53576) with 5–6 transverse dorsolateral plates proximally; up to 6 actinal plates, extending up to one third ray length; 2–3 inferomarginal, no actinal, 2–3 adambulacral spines per plate.

Remarks. A.M. Clark (1962) found that specimens from the Falkland Islands had some large, incipiently felipedal straight pedicellariae, whereas those on specimens from off Marion, Kerguelen and Heard Islands were solely lanceolate in shape. However, some of the specimens we have examined (NMV F53576) from off Heard Island also have incipiently felipedal straight pedicellariae.

Smilasterias triremis (Sladen)

Asterias (*Smilasterias*) *triremis* Sladen, 1889: 579, pl. CI, figs 5, 6, pl. CII, figs 5, 6.

Smilasterias triremis.—Fisher, 1930: 239.—1940: 262.—A.M. Clark, 1962: 85, fig. 15c.

Material examined. Subantarctic, between Kerguelen and Heard Islands, 52°4'S, 71°22'E, 279 m, 2 Feb 1874, coarse gravel, "Challenger" stn 150, BMNH 1890.5.7.971(2 syntypes); off Heard Island, 53°11.7'S, 73°04.5'E, 200 m, 4 Oct 1985, ?black silt sediment, M. Norman on "Nella Dan", NMV F53756(9).

Antarctic, Palmer Archipelago, Schollaet Channel, 160–335 m, 12 Mar 1927, mud, "Discovery" stn 181, BMNH 1948.3.16.773(1); Neumayr Channel, 259–354 m, 18 Mar 1927, mud, "Discovery" stn 187, BMNH 1948.3.16.774(1); Bismarck Strait, 93–130 m, 24 Mar 1927, stones and mud, "Discovery" stn 190, BMNH 1948.3.16.775(1).

Distribution. Antarctic, Palmer Archipelago. Subantarctic, off Heard and between Kerguelen and Heard Islands. 93–354 m.

Description. On largest specimen (BMNH 1948.3.16.773), R = 61 mm, r = 7 mm, gbr = 8 mm, ht = 7 mm, R/r = 9, R/gbr = 7.5. Rays tapering; median longitudinal ridge; transverse ribbing usually evident; 2, sometimes 3, papulae per area. Aboral disc a reticulum of small plates; carinal series irregular or regular; carinals linked to superomarginals by up to 8 generally elongate dorsolateral plates; 1–2 irregular longitudinal linkages; superomarginals not beaded; up to 24 thin, narrow, actinal plates, up to half ray length.

Dense cover of spinelets abactinally, usually grouped on plates; spinelets tapering to slightly clavate; l/w = 2.5–5, longest on superomarginals, in arcs; superomarginal spinelets sometimes flattened, flared, similar in shape but smaller than inferomarginal spines; carinals with 4–6, dorsolaterals with 3–5, superomarginals with 4–6, rarely up to 10, spinelets. Inferomarginal plates with oblique combs of 2–5, mostly 3, flattened, widely flared, truncate spines; actinal plates, sometimes with 1, usually no spines; 2–3, usually 2, adambulacral spines, shorter, less flared than inferomarginal spines.

Crossed pedicellariae on abactinal, marginal ray surfaces, on disc; 0.5–1.0 times as numerous as spinelets; smaller than spinelets. Small, lanceolate or incipiently felipedal, straight pedicellariae in furrow, actinally, marginally, abactinally; subequal with crossed pedicellariae. Larger, felipedal pedicellariae sometimes present, up to 1.2 mm, slightly smaller than spines, usually with 3–5 teeth on

widened valve tip; often in arcs, actinally, sometimes also in furrow, marginally, abactinally.

Small specimen (R = 25 mm, NMV F53756) with up to 5 transverse dorsolateral plates proximally; 2–3 flared inferomarginal spines; up to 7 actinal plates, extending up to one fifth ray length; large felipedal straight pedicellariae actinally, in arcs, abactinally.

Remarks. In his description of the Palmer Archipelago "Discovery" material, Fisher (1940) noted about 10 actinal plates in a series, the series extending up to one-fifth the length of the ray. To our observation there are 24 plates in a series on one cleared ray of the largest of these specimens, the series extending approximally half the length of the ray.

The specimens from off Heard and Kerguelen Islands differ from the Palmer Archipelago material in having large felipedal pedicellariae scattered on most ray surfaces, but particularly actinally and in the arcs. Some Palmer Archipelago specimens have larger incipiently felipedal pedicellariae in the arcs but otherwise they are all of the small type. Some of the specimens from off Heard Island (NMV F53756) also differ in having a spine on nearly all of the actinal plates. Usually these spines, when present, are restricted to a few proximal plates.

The Heard Island specimens were found at the same location as 30 specimens of *S. scalprifera* (NMV F53576). Examination of this new material confirms Fisher's (1940) and A.M. Clark's (1962) distinction between the two species. On *S. triremis* the inferomarginal and adambulacral spines are longer, wider but less numerous; the actinal series is less extensive and often lacks spines. The smaller straight pedicellariae are larger on *S. scalprifera* and are also usually larger than the crossed pedicellariae. On *S. triremis* the two forms are subequal. The larger felipedal straight pedicellariae, almost as long as the adambulacral spines, found on the syntypes and the Heard Island specimens, are never found on *S. scalprifera.* Larger straight pedicellariae, when present on *S. scalprifera,* are lanceolate or incipiently felipedal, with one central and two rudimentary teeth, and are much smaller than the spines.

Smilasterias sp. cf. **triremis** (Sladen)

Smilasterias sp. (cf. *triremis* (Sladen).—A.M. Clark, 1962: 85, figs 15 d–f.

Material examined. Antarctica, off Princess Elizabeth Land, 66°28′S, 72°41′E, 1266 m, 22 Dec 1929, BANZARE stn 29, BMNH 1965.8.5.219(1).

Remarks. This specimen has been detailed and discussed by A.M. Clark (1962). It is small, R = 21 mm, and in a poor condition and so is not fully described here.

A further observation which supports a unique identity for this specimen is the presence of 10 large plates which border the disc aborally. These plates are up to 2.0 mm wide transversely, with 5 situated radially and 5 interradially, and give the aboral disc surface a stellar appearance. *Allostichaster regularis* H.L. Clark, 1928 has the same characteristic, but in all of the described species of *Smilasterias* the whole aboral disc plating is an irregular reticulum of small plates.

A.M. Clark (1962) noted the presence of small incipient felipedal pedicellariae actinally, up to 0.25 mm in length. We have observed straight pedicellariae abactinally, in the interbrachial arcs, where they are up to 0.4 mm long and have a felipedal form similar to that in the *S. triremis* syntypes.

A.M. Clark (1962) also noted the presence of the tubercles on the abactinal plates of this specimen, and contrasted this characteristic with the relatively smooth abactinal plates of *S. scalprifera* and *S. triremis.* However, specimens of *S. scalprifera* examined here (AM J18138, NMV F53576) do have prominent tubercles and ridges on the abactinal plates. This is another characteristic which is subject to marked variation within a *Smilasterias* species.

The BANZARE specimen has beading on the superomarginal plates. The inferomarginal plates form a distinct actinolateral margin to the rays, but the actinal surface is slightly narrower than the greatest breadth of the rays. The interbrachial arcs are acutely angular, and the rays are slightly swollen proximally. There are up to 7 dorsolateral plates linking the carinal and superomarginal plates, and 4, occasionally 5, tall, thin, tapered, very slightly flattened inferomarginal spines per plate.

Given the aboral disc plating and the tapered inferomarginal spines, this specimen may be better placed in another genus.

Asteriinae sp. cf. *Allostichaster* Verrill and *Smilasterias* Sladen

Material examined. Tasmania, 160 km off the west coast, 570 m, P. Wilson on "Margaret Philippa", 9 Sep 1982, NMV F53029(1).

Description. 5 rays; R = 17 mm, r = 3 mm, gbr = 4 mm, ht = 2 mm; rays not swollen proximally, long thin taper distally; interbrachial arcs not acutely angular; single madreporite; terminal plate flattened; inferomarginal plates tend to form an

actinolateral margin to rays. Abactinal skeleton compact, solidly reticulate; papular areas very reduced; 5 radial and 5 interradial large plates bordering disc aborally; carinal plates subequal with dorsolateral plates, quadrilobed, up to 1.2 mm wide; dorsolateral area narrow, 1 longitudinal series of plates between carinals and superomarginals, plates not transversely elongate; superomarginal plates cruciform, prominently beaded, 1.8 mm long transversely, imbricating or contiguous longitudinally; actinal series of plates extending more than half length of ray; adoral adambulacral plates subequal with adjacent adambulacrals.

Abactinal and superomarginal plates with spaced, semi-capitate, close to granuliform spinelets, l = 0.2–0.3 mm, l/w = 1.5–2; carinal and superomarginal spinelets subequal, carinal plates with up to 6 centrally and irregularly placed spinelets; superomarginal plates with up to 6 spinelets along proximal margin of plate. Inferomarginal plates with predominantly 3 rounded, slightly flattened spines, up to 1.0 mm long; actinal plates spiniferous; adambulacral plates with 2 or 3 rounded, slightly tapered spines, slightly smaller than inferomarginals; oral plates with 4 thin, rounded, slightly flattened spines, 2 actinally, 2 on side of plate proximally.

Numerous small crossed pedicellariae on abactinal and marginal plates; small lanceolate and large felipedal straight pedicellariae present actinally, a few abactinally in interbrachial arcs; series of large felipedal pedicellariae in furrow on adambulacral and oral plates, up to 1.0 mm long.

Remarks. This specimen is small and in poor condition. The subcylindrical rays, lack of evidence of fissipary, up to 3 inferomarginal and adambulacral spines, and numerous large felipedal straight pedicellariae suggest an affinity with *Smilasterias* Sladen. The narrow dorsolateral area with its single longitudinal series of plates, relatively long and spiniferous series of actinal plates at this small size, and close to granuliform spinelets suggest an affinity with *Allostichaster* Verrill.

In having 10 large plates bordering the disc aborally it is similar to both *Smilasterias* sp. (cf. *triremis*) (Sladen) (A.M. Clark, 1962) and *Allostichaster regularis* H.L. Clark, 1928.

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Explanation of Plate

Plate 1

Figures a, b. *Smilasterias multipara* sp. nov. Holotype, NMV F53036, R = 30 mm. a, abactinal view, R.H. ray cleared. b, actinal view.

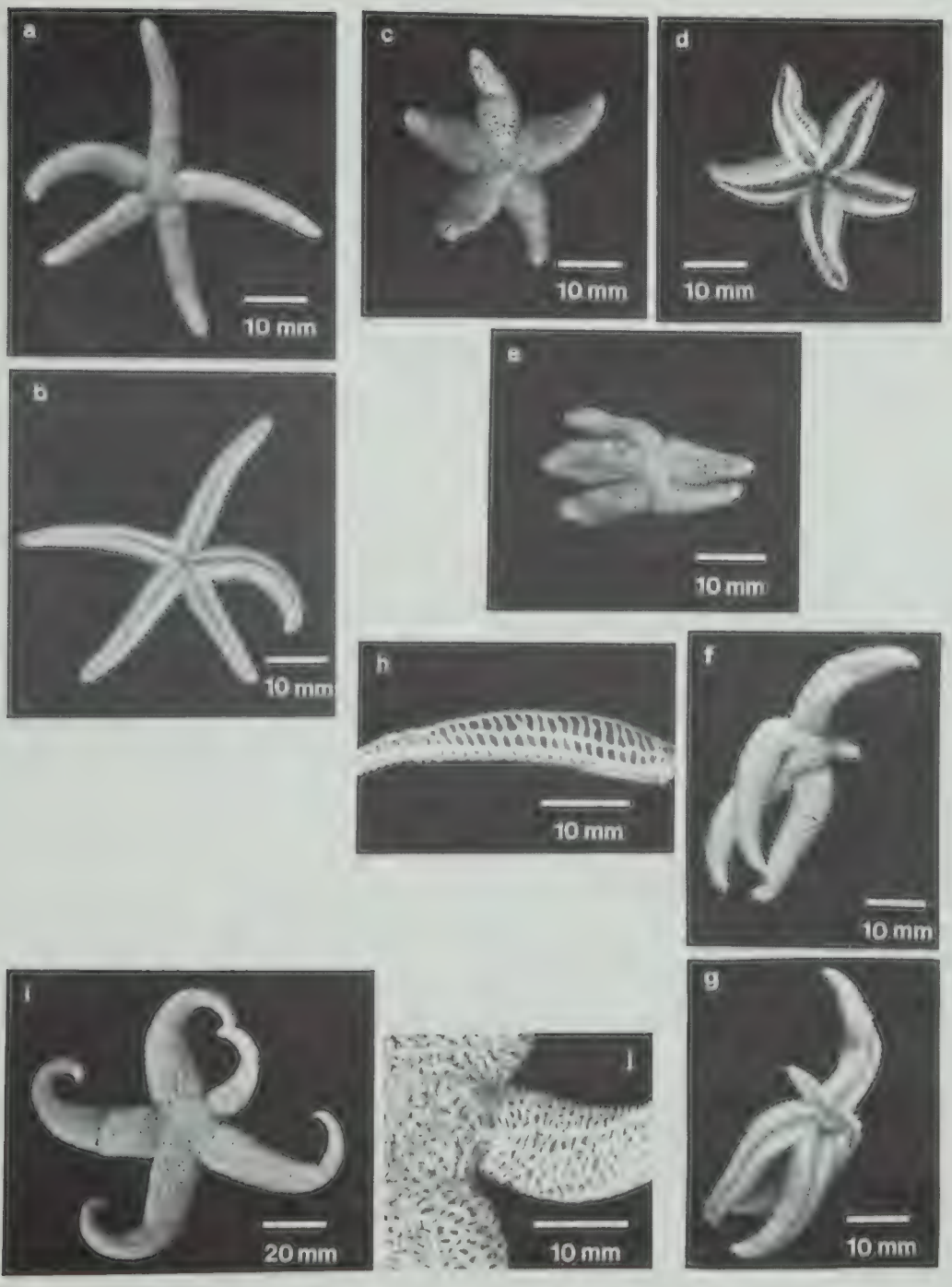
Figures c, d. *Smilasterias tasmaniae* sp. nov. Holotype, AM J11395, R = 19 mm. c, abactinal view, top ray cleared. d, actinal view.

Figure e. *S. tasmaniae* Paratype, NMV F54579, R = 17 mm, abactinal view.

Figures f, g. *Smilasterias clarkailsa* sp. nov. Holotype, NMV F53754, R = 35 mm. f, abactinal view. g, actinal view.

Figure h. *Smilasterias irregularis* H. L. Clark NMV F53038, R = 40 mm, lateral view of cleared ray.

Figures i, j. *Smilasterias scalprifera* (Sladen) AM J18138, R = 82 mm. i, abactinal view, R.H. rays partly cleared. j, abactinal view of part of disc and bases of cleared rays.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NEW PSEUDOSCORPIONS OF THE GENERA *AMERICHERNES* MUCHMORE AND *CORDYLOCHERNES* BEIER FROM AUSTRALIA (PSEUDOSCORPIONIDA: CHERNETIDAE)

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Abstract

Harvey, M.S., 1990. New pseudoscorpions of the genera *Americhernes* Muchmore and *Cordylochernes* Beier from Australia (Pseudoscorpionida: Chernetidae). *Memoirs of the Museum of Victoria* 50(2): 325–336.

Six new Australian chernetids, *Americhernes muchmorei*, *A. orestes*, *A. mahnerti*, *A. paluma* (all from Queensland), *A. neboissi* (Victoria) and *Cordylochernes dingo* (Western Australia), are described. *Lamprochernes kanaka* Chamberlin and *L. samoanus* Chamberlin are transferred to the genus *Americhernes*. A key to the Australian species of *Americhernes* is presented.

Introduction

The Chernetidae is by far the largest pseudoscorpion family with over 500 named species. Although only 20 species have been described to date from Australia (excluding the island territories, Lord Howe Island and Norfolk Island) (Harvey, 1985), many undescribed species are represented in museum collections (Harvey, unpublished observations). This paper deals with six unusual new species that represent the first known records of the genera *Americhernes* Muchmore and *Cordylochernes* Beier from Australia.

Specimens are lodged in the following institutions: Australian National Insect Collection, CSIRO, Canberra (ANIC), Museum of Victoria, Melbourne (NMV), Queensland Museum, Brisbane (QM), and Staatliches Museum für Naturkunde, Stuttgart (SMNS). Many specimens are mounted on microscope slides in Euparal.

Chernetidae

Americhernes Muchmore

Americhernes Muchmore, 1976: 151. (Type species *Chelifer oblongus* Say, 1821, by original designation.)

Diagnosis. Leg IV with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 medially and 1 distally; and 1 sub-proximally on tarsus. Trichobothrium *it* farther from finger tip than the distance between *isb* and *ist*. Females with spermathecae consisting of 2 separate curved tubes, terminating in cylindrical sacs. Carapace with 1 furrow.

Remarks. Although the species described below are the first reported species of *Americhernes* outside of the Americas, two Pacific species previously described in the genus *Lamprochernes* Tömösváry, *L. kanaka* Chamberlin (1939) (Marquesas Islands) and *L. samoanus* Chamberlin (1938) (Samoa), appear to belong to this genus: *Americhernes kanaka* (Chamberlin), comb. nov., *A. samoanus* (Chamberlin), comb. nov.

Each of the species described below is currently known from only single specimens, despite the large number of chernetids that I have examined from all major Australian collections. The known Australian species of the genus may be distinguished with the following key.

Key to Australian species of *Americhernes*

1	Cheliceral hand with 5 setae (*sbs* present)	2
—	Cheliceral hand with 4 setae (*sbs* absent)	4
2	Pedipalpal tibia smooth	3
—	Pedipalpal tibia finely granulate medially	*A. muchmorei*

3	Movable chelal finger approximately same length as chelal hand; pedipalpal femur smooth ..... *A. orestes*
—	Movable chelal finger much shorter than chelal hand; pedipalpal femur finely granulate antero-laterally ..... *A. mahnerti*
4	Interno-lateral margin of chelal hand finely granulate ..... *A. neboissi*
—	Interno-lateral margin of chelal hand smooth ..... *A. paluma*

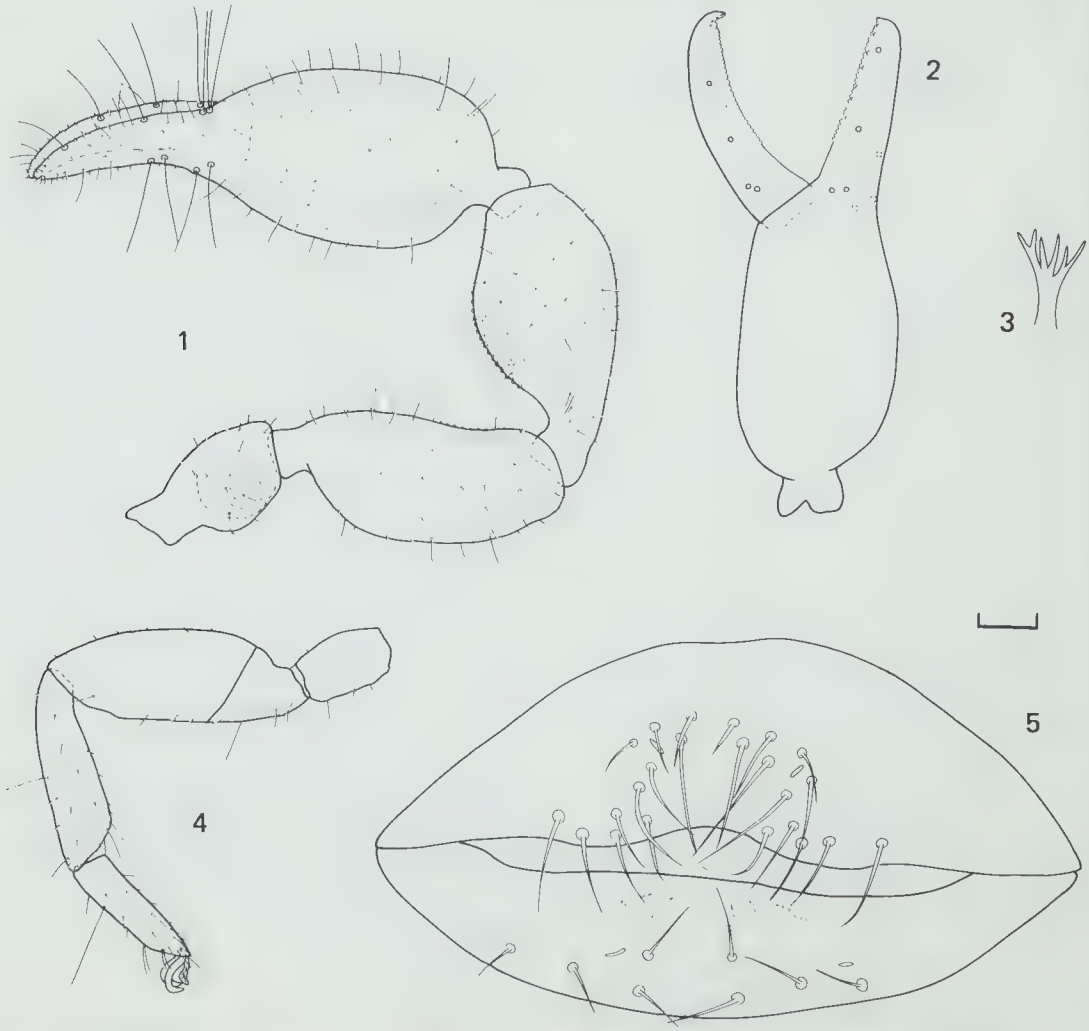
Americhernes muchmorei sp. nov.

Figures 1–5

Type material. Holotype male, 1.5 km W of Cape Tribulation (site 3), 16°05′S, 145°28′E, Queensland, 150 m, rainforest, sieved litter, berlesate no. 458, 7 Oct 1982, Monteith, Yeates and Thompson (QM S6098).

Diagnosis. Cheliceral seta *sbs* present. Chela (with pedicel) 0.84 mm (♂) in length, 2.80 (♂) × longer than broad. Pedipalps with fine granulations on antero-lateral surface of femur and medial surface of tibia; chelal hand virtually smooth. Movable chelal finger with 4 trichobothria.

Description. Male: Colour yellow-brown, pedi-



Figures 1–5. *Americhernes muchmorei* sp. nov. Holotype male: fig. 1, right pedipalp; fig. 2, left chela; fig. 3, galea; fig. 4, left leg IV; fig. 5, genital opercula. Scale line = 0.1 mm (figs 1, 2, 4), 0.025 mm (figs 3, 5).

palps and carapace slightly darker. Derm generally smooth and glossy, that of pedipalps with fine granulations on postero-dorsal surface of trochanter, antero-lateral surface of femur, and medial surface of tibia; chela virtually smooth, with 5–6 small granulations. Pleural membrane longitudinally striate. Pedipalps (Fig. 1): trochanter with dorsal protuberance, 1.88 ×, femur distinctly pedicellate, 2.45 ×, tibia 2.17 ×, chela (with pedicel) 2.80 ×, chela (without pedicel) 2.60 ×, hand 1.47 × longer than broad. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 2); *it* adjacent to *ist*, *est* opposite *it*. Venom apparatus present in movable finger with nodus ramosus midway between *st* and *t*. Fixed finger with 27 marginal teeth, plus 7 external and 3 internal accessory teeth; movable finger with 33 marginal teeth, plus 2 external and 2 internal accessory teeth. Several sense spots present basally on both faces of fixed finger. Chelicera with 5 setae on hand, *es*, *sbs* and *bs* terminally denticulate; serrula exterior with 16 lamellae; galea (Fig. 3) with several rami. Carapace with 7 setae on posterior margin, 1.22 × longer than broad; 1 pair of eye spots present; single, median transverse furrow present. Tergites III–IX imperfectly divided; sternites IV–VIII divided, sternite IX imperfectly divided. Tergal chaetotaxy: 10: 10: 12: 11: 14: 12: 13: 13: 14: 14: 10: 2. Sternal chaetotaxy: 23: (3)8[5](3): (1)8(1): 17: 16: 15: 16: 15: 13: 8: 2. Tergite XI and sternite XI with several tactile setae. Genital opercula (Fig. 5) with many large setae; anterior operculum with 1 pair of slit sensilla. Genitalia not unusual. Leg IV (Fig. 4): femur 2.81 × longer than broad; with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 submedially and 1 distally; and 1 sub-proximally on tarsus, TS = 0.33. All tarsi with a proximal slit sensillum. Claws simple.

Dimensions (mm): body length 2.7. Pedipalps: trochanter 0.30/0.16, femur 0.54/0.22, tibia 0.52/0.24, chela (with pedicel) 0.84/0.30, chela (without pedicel) 0.78, movable finger length 0.38, hand length 0.44. Chelicera 0.20/?, movable finger length 0.14. Carapace 0.56/0.46. Leg I: entire femur 0.34/0.12, tibia 0.24/0.08, tarsus 0.19/0.05. Leg IV: entire femur 0.45/0.16, tibia 0.35/0.10, tarsus 0.24/0.06, distance of tarsal tactile seta from proximal margin 0.08.

Etymology. This species is named for Dr W.B. Muchmore who described the genus *Americhernes*.

Remarks. Americhernes muchmorei shares with four other species of the genus the following combination of characters: cheliceral seta *sbs* present, chelal hand smooth or virtually so, and pedipalpal femur and tibia partially granulate. It may be distinguished as follows: from *A. puertoricensis* Muchmore by its larger size [pedipalpal femur length of *A. muchmorei* 0.54 mm (♂), of *A. puertoricensis* 0.35–0.38 mm (♀)]; from *A. bethaniae* Mahnert by its smaller size [pedipalpal femur length of *A. bethaniae* 0.61–0.64 mm (♂), 0.68–0.75 mm (♀)]; and from *A. andinus* (Beier) and *A. perproximus* (Beier) in possessing a much stouter chelal hand [hand ratio of *A. andinus* 1.8 × (♀), of *A. perproximus* 1.7–1.8 ×, of *A. muchmorei* 1.47 × (♂)].

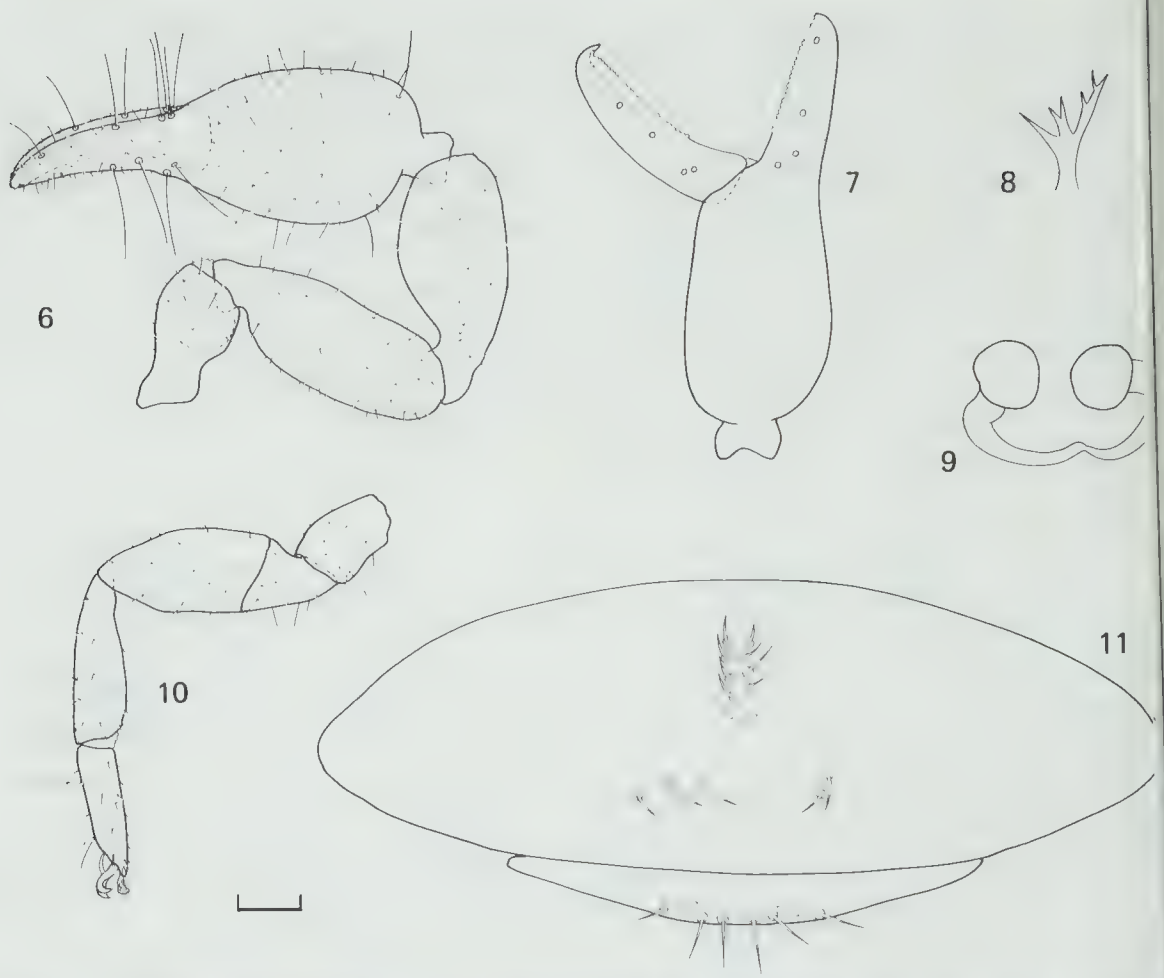
Americhernes orestes sp. nov.

Figures 6–11

Type material. Holotype female, Thornton Peak via Daintree, Queensland, 1000–1300 m, 20–22 Sep 1981, G.B. Monteith and D.C. (QM S6099).

Diagnosis. Cheliceral seta *sbs* present. Chela (with pedicel) 0.70 mm (♀) in length, 2.92 (♀) × longer than broad. Pedipalps smooth. Movable chelal finger with 4 trichobothria.

Description. Female: Colour yellow-brown, pedipalps and carapace slightly darker. Derm generally smooth and glossy, that of pedipalps smooth. Pleural membrane longitudinally striate. Pedipalps (Fig. 6): trochanter with dorsal protuberance, 1.92 ×, femur distinctly pedicellate, 2.42 ×, tibia 2.35 ×, chela (with pedicel) 2.92 ×, chela (without pedicel) 2.75 ×, hand 1.42 × longer than broad. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 7); *it* adjacent to *ist*, *est* opposite *it*. Venom apparatus present in movable finger with nodus ramosus midway between *st* and *t*. Fixed finger with 25 marginal teeth, plus 3 external and 1 internal accessory teeth; movable finger with 30 marginal teeth, plus 4 external and 1 internal accessory teeth. Several sense spots present basally on both faces of fixed finger. Chelicera with 5 setae on hand, *es*, *sbs* and *bs* terminally denticulate; serrula exterior with 16 lamellae; galea (Fig. 8) with several rami. Carapace with 8 setae on posterior margin, 0.98 × longer than broad; 1 pair of eye spots present; single, median transverse furrow present. Tergites II–X and sternites IV–IX imperfectly divided. Tergal chaetotaxy: 8: 10: 11: 16: 14: 17: 17: 16: 16: 10: 15: 2. Sternal chaetotaxy: 13: (3)7(3): (1)6(1): 15: 15: 17: 19: 18: 16: 11: 2. Tergites X–XI and sternite XI with several tactile setae. Genital opercula (Fig. 11) with few large setae; 1 pair of slit



Figures 6–11. *Americhernes orestes* sp. nov. Holotype female: fig. 6, right pedipalp; fig. 7, left chela; fig. 8, galea; fig. 9, spermathecae; fig. 10, right leg IV; fig. 11, genital opercula. Scale line = 0.1 mm (figs 6, 7, 10), 0.025 mm (figs 8, 9, 11).

sensilla on anterior operculum situated close to central patch of setae. Spermathecae (Fig. 9) consisting of two elongate tubes with cylindrical terminal sacs (although Fig. 9 depicts somewhat circular terminal sacs, this is due to the spermathecae lying at an unusual angle). Leg IV (Fig. 10): femur 2.92 × longer than broad; with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 sub-medially and 1 distally; and 1 sub-proximally on tarsus, TS = 0.29. All tarsi with a proximal slit sensillum. Claws simple.

Dimensions (mm): body length 1.6. Pedipalps: trochanter 0.25/0.13, femur 0.42/0.16, tibia 0.40/0.17, chela (with pedicel) 0.70/0.24, chela (without pedicel) 0.66, movable finger length 0.33, hand length 0.34. Chelicera 0.19/0.10, movable finger length 0.15. Carapace 0.45/0.46. Leg I: entire femur 0.27/0.10, tibia 0.20/0.07, tarsus 0.18/0.05. Leg IV: entire femur 0.38/0.13, tibia 0.28/0.08, tarsus 0.21/0.04, distance of tarsal tactile seta from proximal margin 0.06.

Etymology. The specific epithet refers to the presence of this species on one of Queensland's tallest mountains (*orestes*, Greek, mountaineer).

Remarks. The only other *Americhernes* species with completely smooth pedipalpal segments are *A. chilensis* (Beier) and *A. plaumanni* (Beier), both from South America. *Americhernes orestes* is much smaller than *A. chilensis* [pedipalpal femur length of *A. orestes* 0.42 mm (♀), of *A. chilensis* 0.72 mm (♂)], and the chelal hand is more slender in *A. plaumanni* [hand ratio 1.9 × (♂), 1.7 × (♀) in *A. plaumanni*, 1.42 × (♀) in *A. orestes*].

This species is very similar to *A. mahnerti*, and may be distinguished as discussed below.

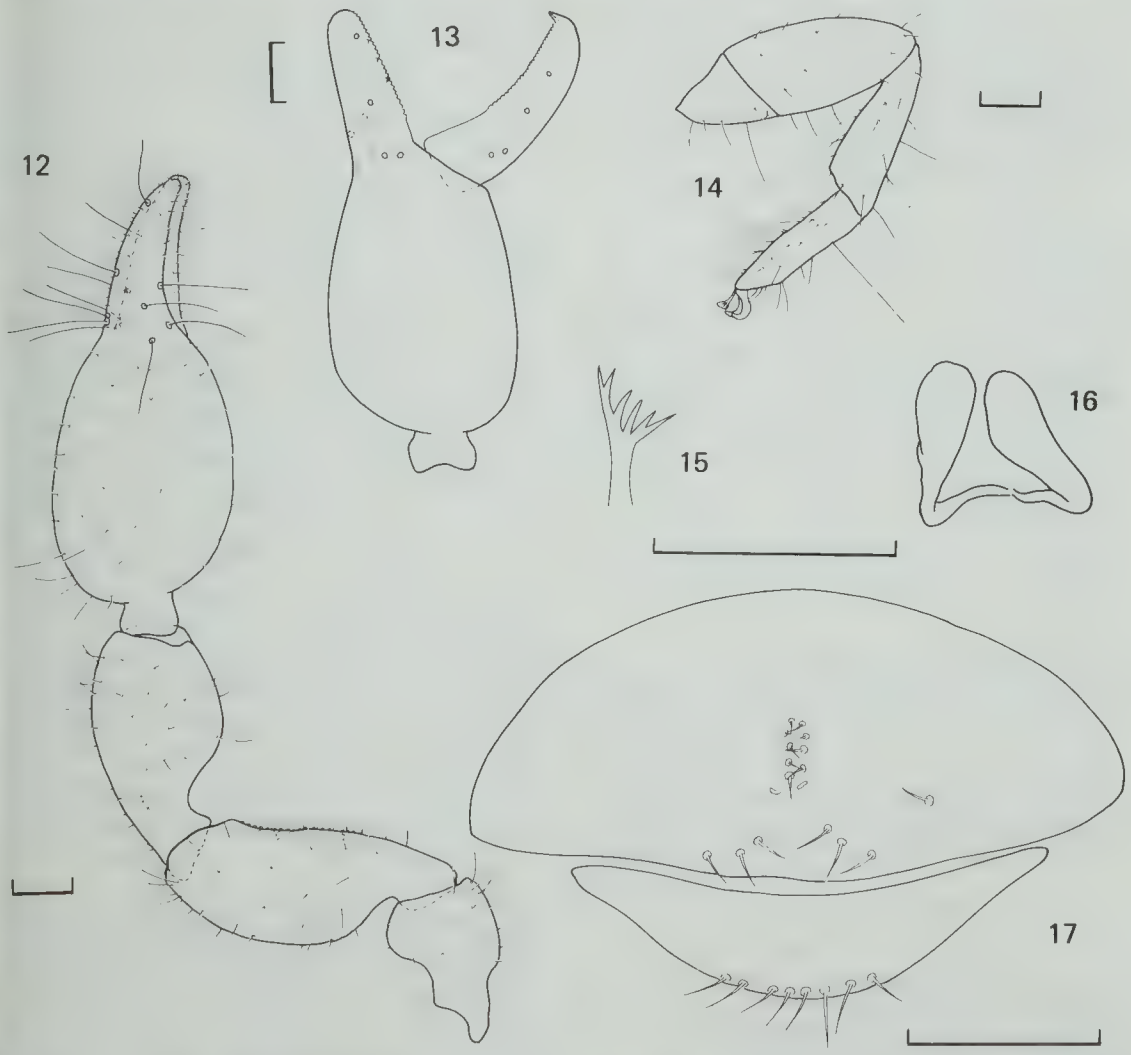
Americhernes mahnerti sp. nov.

Figures 12–17

Type material. Holotype female, Mt Finnigan, 1050 m, 37 km S of Cooktown, Queensland, rainforest pitfall traps, 19–22 Apr 1982, Monteith, Yeates and Cook (QM, S6100).

Diagnosis. Cheliceral seta *sbs* present. Chela (with pedicel) 0.75 mm (♀) in length, 2.50 (♀) × longer than broad. Pedipalpal femur granulate antero-laterally; tibia and chela smooth. Movable chelal finger with 4 trichobothria.

Description. Female: Colour yellow-brown, pedipalps and carapace slightly darker. Derm generally smooth and glossy, that of pedipalps smooth, except for antero-lateral margin of femur, which is granulate. Pleural membrane longitudinally striate. Pedipalps (Fig. 12): trochanter with dorsal protuberance, 1.39 ×, femur distinctly pedicellate, 2.61 ×, tibia 2.00 ×, chela (with pedicel) 2.50 ×, chela (without pedicel) 2.27 ×, hand 1.37 × longer than broad. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 13); *it* adjacent to *ist*, *est* opposite *it*. Venom apparatus present in movable finger with nodus ramosus midway between *st* and *t*. Fixed finger with 26



Figures 12–17. *Americhernes mahnerti* sp. nov. Holotype female: fig. 12, left pedipalp; fig. 13, right chela; fig. 14, left leg IV; fig. 15, galea; fig. 16, spermathecae; fig. 17, genital opercula. Scale lines = 0.1 mm.

marginal teeth, plus 4 external and 2 internal accessory teeth; movable finger with 24 marginal teeth, plus 3 external and 1 internal accessory teeth. Several sense spots present basally on both faces of fixed finger. Chelicera with 5 setae on hand, *es*, *sbs* and *bs* terminally denticulate; serrula exterior with 17 lamellae; galea (Fig. 15) with several rami. Carapace with 8 setae on posterior margin, 1.15 × longer than broad; 1 pair of eye spots present; single, median transverse furrow present. Tergites II–IX and sternites IV–IX imperfectly divided. Tergal chaetotaxy: 10: 11: 12: 13: 11: 16: 18: 16: 16: 14: 11: 2. Sternal chaetotaxy: 16: (2)8(2): (1)6(1): 13: 15: 16: 18: 16: 16: 12: 2. Tergites X–XI and sternite XI with several tactile setae. Genital opercula (Fig. 17) with no large setae; 1 pair of slit sensilla on anterior operculum situated close to central patch of setae. Spermathecae (Fig. 16) consisting of two elongate tubes with cylindrical terminal sacs. Leg IV (Fig. 14): femur 2.93 × longer than broad; with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 sub-medially and 1 distally; and 1 sub-proximally on tarsus, TS = 0.25. All tarsi with a proximal slit sensillum. Claws simple.

Dimensions (mm): body length 2.1. Pedipalps: trochanter 0.25/0.18, femur 0.47/0.18, tibia 0.42/0.21, chela (with pedicel) 0.75/0.30, chela (without pedicel) 0.68, movable finger length 0.33, hand length 0.41. Chelicera 0.20/?, movable finger length 0.13. Carapace 0.54/0.47. Leg I: entire femur 0.30/0.10, tibia 0.21/0.07, tarsus 0.23/0.05. Leg IV: entire femur 0.41/0.14, tibia 0.30/0.09, tarsus 0.24/0.07, distance of tarsal tactile seta from proximal margin 0.06.

Etymology. This species is named for Dr V. Mahnert, in recognition of his work on pseudoscorpions.

Remarks. Americhernes mahnerti is quite similar to *A. orestes*, but differs in the fine granulations on the antero-lateral margin of the pedipalpal femur, and in the relative lengths of the chelal hand and chelal fingers. These two species are also geographically related as they occur on mountains in northern Queensland that are only 38 km apart.

Americhernes paluma sp. nov.

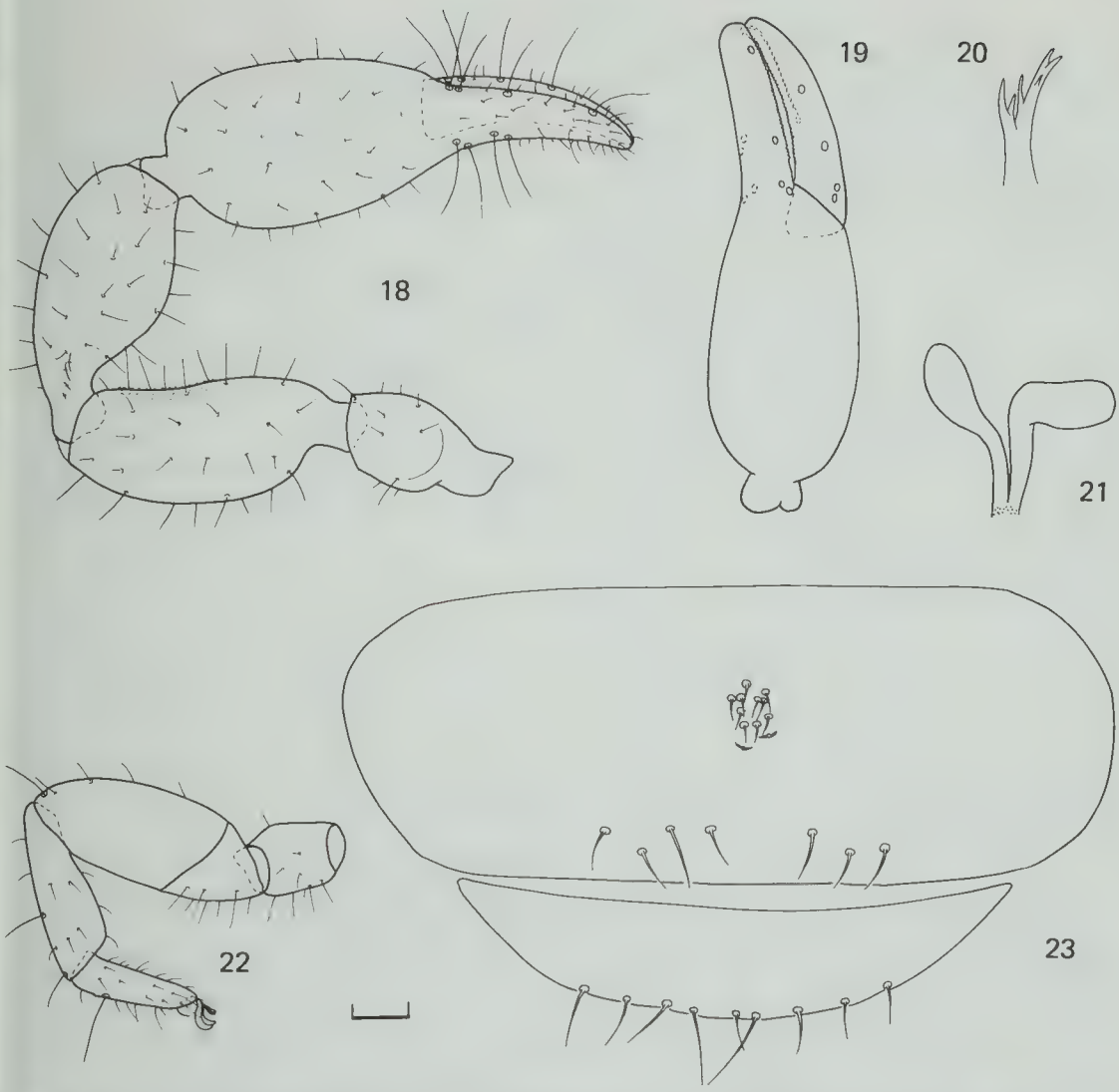
Figures 18–23

Type material. Holotype female, Black Friar's Parish, Paluma, Queensland, in litter or on bird, 10 Oct 1982, B. King (ANIC Type No. 10020).

Diagnosis. Cheliceral seta *sbs* absent. Chela (with pedicel) 0.86 mm (♀) in length, 3.07 (♀) × longer than broad. Pedipalps with fine granulations on antero-lateral surface of femur; medial surfaces of tibia and chelal hand smooth. Movable chelal finger with 4 trichobothria.

Description. Female: Colour yellow-brown, pedipalps and carapace slightly darker. Derm generally smooth and glossy, that of pedipalps with fine granulations on postero-dorsal surface of trochanter and antero-lateral surface of femur, other pedipalpal segments smooth. Pleural membrane longitudinally striate. Pedipalps (Fig. 18): trochanter with dorsal protuberance, 1.82 ×, femur distinctly pedicellate, 2.57 ×, tibia 2.13 ×, chela (with pedicel) 3.07 ×, chela (without pedicel) 2.91 ×, hand 1.51 × longer than broad. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 19); *it* adjacent to *ist*, *est* opposite *it*. Venom apparatus present in movable finger with nodus ramosus midway between *st* and *t*. Fixed finger with 31 marginal teeth, plus 5 external and 2 internal accessory teeth; movable finger with 36 marginal teeth, plus 3 external and 1 internal accessory teeth. Several sense spots present basally on external face of movable finger and on both faces of fixed finger. Chelicera with 4 setae on hand, *sbs* absent, *es* terminally denticulate, *bs* broken, but probably denticulate; serrula exterior with 17 lamellae; galea (Fig. 20) with several rami. Carapace with 6 setae on posterior margin, 1.02 × longer than broad; 1 pair of eye spots present; single, median transverse furrow present. Tergites II–IX and sternites IV–IX imperfectly divided. Tergal chaetotaxy: 11: 10: 11: 13: 14: 17: 16: 16: 16: 17: 12: 2. Sternal chaetotaxy: 17: (2)9(3): (1)7(1): 15: 16: 19: 18: 18: 19: 12: 2. Tergite XI and sternite XI with several tactile setae. Genital opercula (Fig. 23) with few large setae; 1 pair of slit sensilla on anterior operculum situated close to central patch of setae. Spermathecae (Fig. 21) consisting of two elongate tubes with cylindrical terminal sacs. Leg IV (Fig. 22): femur 2.44 × longer than broad; with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 submedially and 1 distally; and 1 sub-proximally on tarsus, TS = 0.30. All tarsi with a proximal slit sensillum. Claws simple.

Dimensions (mm): body length 2.5. Pedipalps: trochanter 0.31/0.17, femur 0.54/0.21, tibia 0.49/0.23, chela (with pedicel) 0.86/0.28, chela (without pedicel) 0.83, movable finger length 0.40, hand length 0.43. Chelicera 0.18/0.11, movable finger length 0.13. Carapace 0.59/0.58. Leg I: entire femur 0.31/0.11, tibia 0.23/0.08, tarsus 0.18/0.05. Leg IV: entire femur



Figures 18–23. *Americhernes paluma* sp. nov. Holotype female: fig. 18, left pedipalp; fig. 19, right chela; fig. 20, galea; fig. 21, spermathecae; fig. 22, left leg IV; fig. 23, genital opercula. Scale line = 0.1 mm (figs 18, 19, 22), 0.025 mm (figs 20, 21, 33).

0.44/0.18, tibia 0.32/0.11, tarsus 0.23/0.07, distance of tarsal tactile seta from proximal margin 0.07.

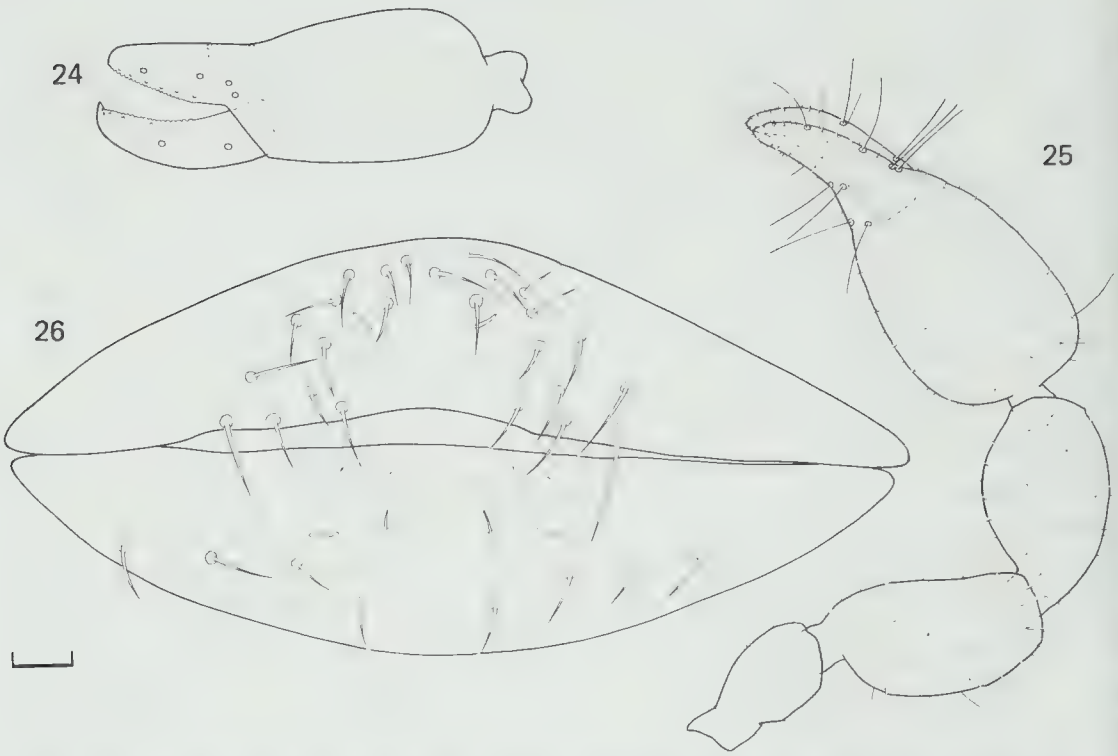
Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. Only two other species of the genus *Americhernes* lack cheliceral seta *sbs*: *A. reductus* Muchmore (from Florida, USA and Belize) and *A. neboissi* sp. nov. They differ as follows: *A. neboissi* differs by the finely granulate internolateral margin of the chelal hand (smooth in *A. reductus* and *A. paluma*); and *A. paluma* differs from *A. reductus* by the smooth medial margin of the pedipalpal tibia (finely granulate in *A. reductus*).

Americhernes neboissi sp. nov.

Figures 24–26

Type material. Holotype male, west branch of King River, 10 km NE of Tolmie, Victoria, attached to leg of ♀ *Cheumatopsyche* sp. (Trichoptera: Hydropsychidae), 2 Feb 1984, A. Neboiss (NMV K252).



Figures 24–26. *Americhernes neboissi* sp. nov. Holotype male: fig. 24, left chela; fig. 25, right pedipalp; fig. 26, genital opercula. Scale line = 0.1 mm (figs. 24, 25), 0.025 mm (fig. 26).

Diagnosis. Cheliceral seta *sbs* absent. Chela (with pedicel) 0.67 mm (♂) in length, 2.39 × longer than broad. Pedipalps with fine granulations on interno-lateral surface of chela at base of fingers; medial surfaces of femur and tibia smooth. Movable chelal finger with 2 trichobothria.

Description. Male: Colour yellow-brown, pedipalps and carapace slightly darker. Derm smooth and glossy, that of pedipalps with course granulations on postero-dorsal surface of trochanter and interno-lateral surface of chela at base of fingers, other pedipalpal segments smooth. Pleural membrane longitudinally striate. Pedipalps (Fig. 25): trochanter with dorsal protuberance, 1.86 ×, femur distinctly pedicellate, 2.16 ×, tibia 1.86 ×, chela (with pedicel) 2.39 ×, chela (without pedicel) 2.29 ×, hand 1.29 × longer than broad. Fixed chelal finger with 8 trichobothria, movable chelal finger with 2 trichobothria (Fig. 24); *it* adjacent to *ist*, *est* opposite *it*. Venom apparatus present in movable finger with nodus ramosus proximal to *t*. Fixed finger with 25 marginal teeth, plus 2 external and 1 internal accessory teeth; movable finger with 22 marginal teeth, plus 2 external accessory teeth. Several sense spots present basally on external face of movable finger and on both faces of fixed finger. Chelicera with 4 setae on hand, *sbs* absent, *es* and *bs* terminally denticulate; serrula exterior with 15–16 lamellae; galeae broken. Carapace with 6 setae on posterior margin, 1.04 × longer than broad; 1 pair of eye spots present; single, medial transverse furrow present. Tergites III–X and sternites IV–X imperfectly divided. Tergal chaetotaxy: 8: 9: 8: 9: 10: 10: 10: 12: 12: 13: 12: 2. Sternal chaetotaxy: 25: (3)11[6](3): (1)6(1): 13: 12: 16: 15: 17: 15: 10: 2. Tergite XI and sternite XI with several tactile setae. Genital opercula (Fig. 26) with several pairs of large setae; anterior operculum with 1 pair of slit sensillae, posterior operculum with 2 pairs of slit sensillae. Genitalia not unusual. Leg IV: femur 2.40 × longer than broad; with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 sub-medially and 1 distally; and 1 sub-proximally on tarsus, TS = 0.25. All tarsi with a proximal slit sensillum. Claws simple.

Dimensions (mm): body length 1.6. Pedipalps: trochanter 0.26/0.14, femur 0.41/0.19, tibia 0.39/0.21, chela (with pedicel) 0.67/0.28,

chela (without pedicel) 0.645, movable finger length 0.30, hand length 0.36. Chelicera 0.20/0.10, movable finger length 0.15. Carapace 0.49/0.47. Leg I: entire femur 0.25/0.10, tibia 0.18/0.07, tarsus 0.17/0.06. Leg IV: entire femur 0.36/0.15, tibia 0.26/0.09, tarsus 0.20/0.07, distance of tarsal tactile seta from proximal margin 0.05.

Etymology. This species is named for Arturs Neboiss, collector of the holotype.

Remarks. See the discussion under *Americhernes paluma* for characters which distinguish this species from others of the genus. Although the holotype of *A. neboissi* possesses only two trichobothria on the movable chelal finger, this may not be characteristic of the species; Mahnert (1979) reported extreme variation in the number of such trichobothria in *A. incertus* Mahnert from Brazil.

Cordylochernes Beier

Cordylochernes Beier, 1932a: 265; Beier, 1932b: 99. (Type species *Chelifer macrochelatus* Tömösváry, 1884, a junior subjective synonym of *Acarus scorpioides* Linnaeus, 1758, by original designation).

Diagnosis. Leg IV with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 medially and 1 distally; and 1 sub-proximally on tarsus. Trichobothrium *it* closer to finger tip than the distance between *isb* and *ist* in most species (in *C. dingo it* is farther to finger tip than the distance between *isb* and *ist*). Females with spermathecae consisting of 2 separate tubes terminating in inflated sacs. Males with medio-dorsal protuberance on pedipalpal tibia. Carapace with 1 furrow.

Remarks. The genus *Cordylochernes* contains eight presently recognized species from central and South America, and one species, *C. octentoctus* (Balzan), apparently from South Africa (see Vachon, 1942), but the only known specimen is probably mislabelled (W.B. Muchmore, pers. comm.). *Cordylochernes dingo* is the only species of the genus in which chelal trichobothrium *it* is situated closer to *ist* than to the tip of the fixed finger, but I do not feel that generic status is warranted until a review of those New World "*Lustrochernes*-like" chernetids with a protuberance on the pedipalpal tibia (e.g. *Cordylochernes* spp., *Odontochernes* spp.) is completed.

Cordylochernes dingo sp. nov.

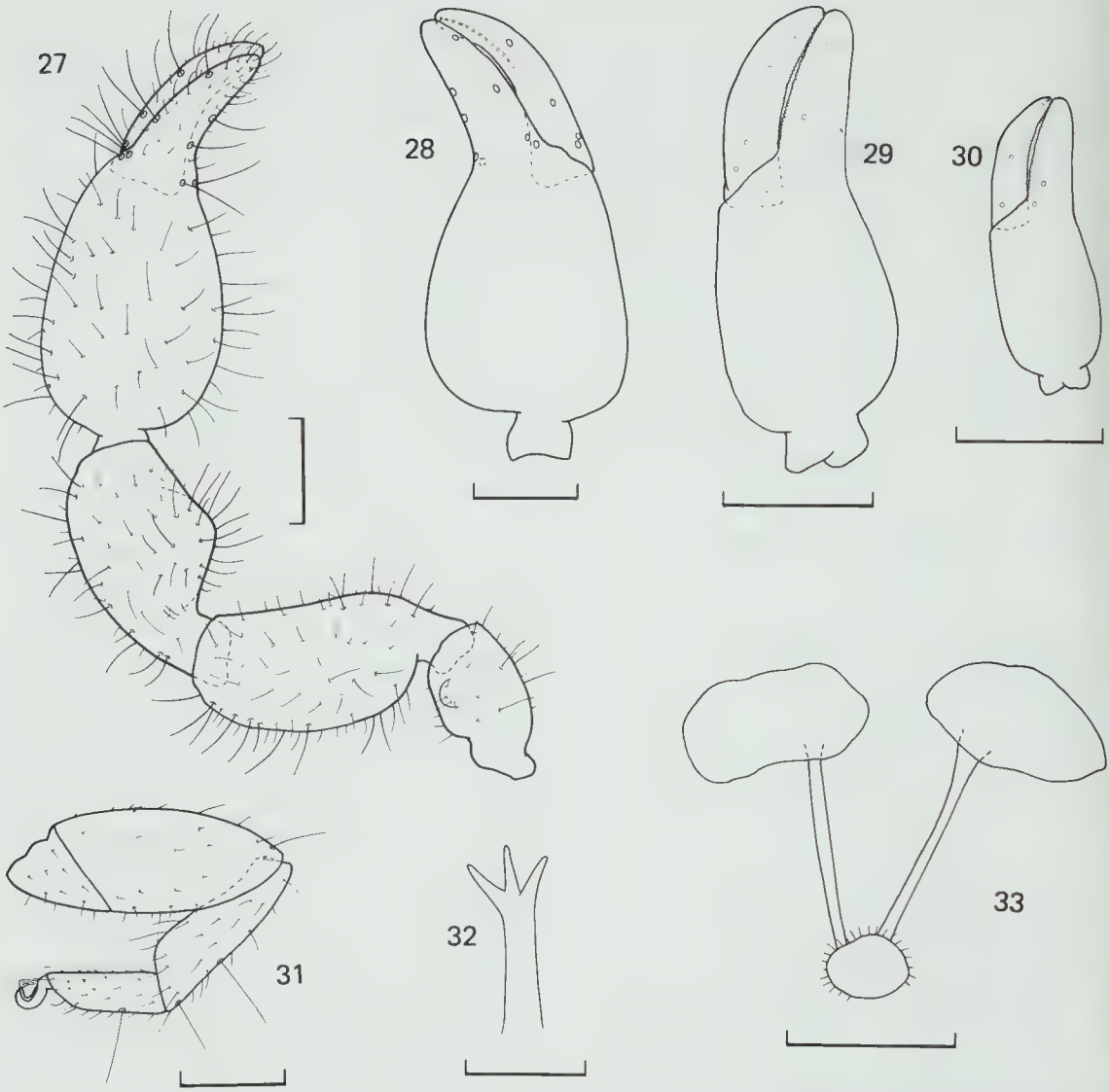
Figures 27–35

Type material. Holotype male, Lone Dingo, 11 km SW of Walsh Point, Admiralty Gulf, Western Australia, 14°35'S, 125°45'E, under bark of *Eucalyptus* sp., 10 May 1983, D.C.F. Rentz and J. Balderson (ANIC Type No. 10024).

Paratypes: 1 male, 1 female, 12 tritonymphs, 2 deutonymphs, Frog Hollow Creek, 135 km N of Halls Creek, Kimberley Plateau, Western Australia, no date, M. Baehr (SMNS 2013). 1 male, 2 tritonymphs, Dales Gorge, 70 km SE of Wittenoom, Hamersley Range, Western Australia, 30 Nov 1984, M. Baehr (SMNS 2016).

Diagnosis. Trichobothrium *it* closer to *ist* than to tip of fixed chelal finger.

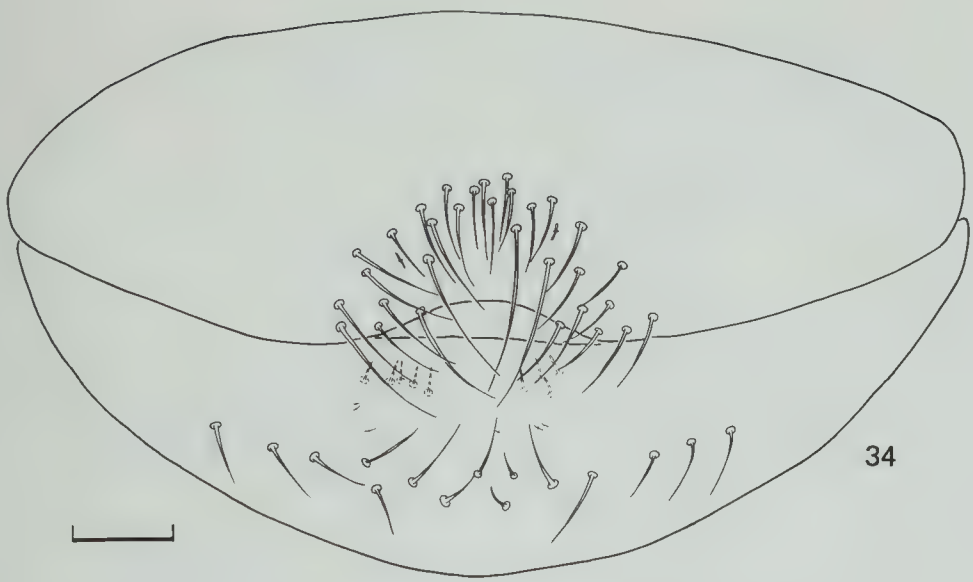
Description. Adults: Colour generally yellow-brown, pedipalps and anterior portion of carapace dark red-brown. Derm not particularly shiny; carapace finely granulate, pedipalps with fine granulations on posterior margin of trochanter and antero-lateral surface of femur. Pleural membrane longitudinally striate. Pedipalps (Fig. 27): trochanter with dorsal protuberance, 1.39–1.63 (♂), 1.62 (♀) ×, femur abruptly pedicellate, 1.99–2.20 (♂), 2.09 (♀) ×, tibia with medio-dorsal protuberance surmounted by setae slightly longer than usual, pedicel not quite as narrow as in most other species, 1.85–1.95 (♂), 1.59 (♀) ×, chela (with pedicel) 2.42–2.45 (♂), 3.89 (♀) ×, chela (without pedicel) 2.23–2.29 (♂), 3.62 (♀) ×, hand 1.26–1.28 (♂), 1.85 (♀) × longer than broad. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 28); *it* closer to *ist* than to tip of finger, *est* slightly distal to level of *it*. Venom apparatus present in movable finger with nodus ramosus slightly proximal to *t*. Fixed finger with numerous marginal teeth, plus 16 external and 4 internal accessory teeth; movable finger with numerous marginal teeth, plus 18 external and 5 internal accessory teeth. Sense spots present on both chelal fingers. Chelicera with 5 (occasionally 6) setae on hand, *sbs*, *b* and *es* terminally denticulate; serrula exterior with 28–30 (♂, ♀) lamellae; galea of male (Fig. 32) terminally trifurcate, of female with 6–7 rami, but these broken. Carapace with 14–15 (♂), 20 (♀) setae on posterior margin, 1.25–1.27 (♂), 1.14 (♀) × longer than broad; 1 pair of eye spots; single, median transverse furrow. Tergites III–X and sternites IV–IX imperfectly divided. Tergal chaetotaxy: ♂, 21: 20–23: 20–26: 31–33: 34–38: 40: 42–45: 42: 38–51: 40–42: 36: 2; ♀, 36: 32: 28: 37: 45: 54: 57: 59: 60: 56: ?: 2. Sternal chaetotaxy: ♂, 31–33: (6)14–15[9](6): (4)9–10(3): 26–31: 28–30: 34–37: 34–40: 35–42: 38–42: 24: 2; ♀, 40: (6)17(6): (3)10(4): 40: 55: 57: 60: 57: 58: ?: 2. Tergites IX–XI and sternites X–XI with several tactile setae. Genital opercula of male (Fig. 34) with several pairs of large setae; 1 pair of slit sensilla on anter-

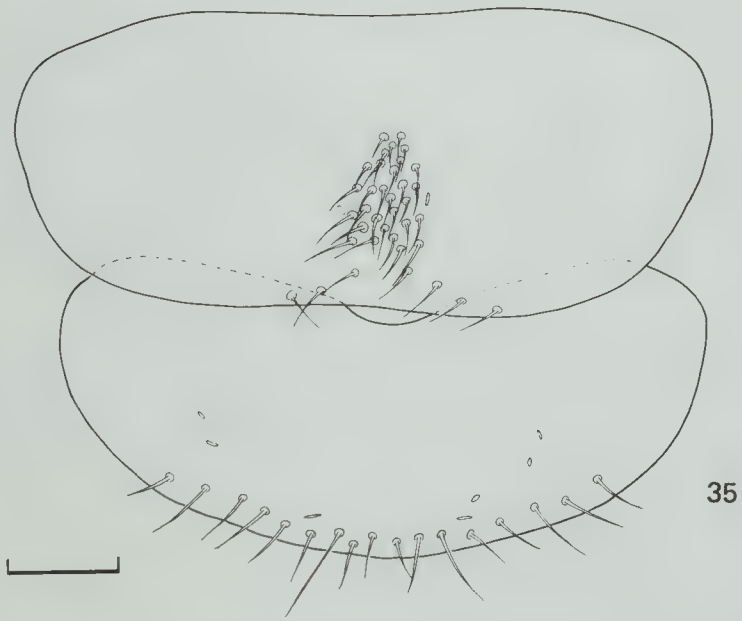


Figures 27–33. *Cordylochernes dingo* sp. nov. Holotype male unless stated otherwise: fig. 27, left pedipalp; fig. 28, right chela; fig. 29, left chela, tritonymph paratype from Frog Hollow Creek; fig. 30, left chela, deutonymph paratype from Frog Hollow Creek; fig. 31, left leg IV; fig. 32, galea; fig. 33, spermathecae, female paratype. Scale line = 0.5 mm (figs 27–31), 0.005 mm (fig. 32), 0.1 mm (fig. 33).

ior operculum, smaller sensillae present on posterior operculum; opercula of female (Fig. 35) without large setae, slit sensillae much as in male. Male genitalia not unusual; female genitalia with spermathecae (Fig. 33) consisting of 2 separate slender tubes terminating in inflated sacs. Leg IV (Fig. 31): femur 2.34–2.59 (♂), 2.75 (♀) × longer than broad; with 4 tactile setae: 1 distally on telofemur; 2 on tibia, 1 sub-medially and 1 distally; and 1 sub-proximally on tarsus, TS = 0.36 (♂, ♀). All tarsi with a proximal slit sensillum. Claws simple.

Dimensions (mm): body length 5.1–5.7 (5.5). Pedipalps: trochanter 0.76–0.80/0.49–0.55 (0.81/0.50), femur 1.37–1.41/0.61–0.69 (1.42/0.68), tibia 1.23–1.35/0.63–0.73 (1.10/0.69), chela (with pedicel) 2.07–2.35/0.84–0.97 (2.57/0.66), chela (without pedicel) 1.94–2.16 (2.39), movable finger length 0.90–1.08 (1.21), hand length 1.08–1.22 (1.22).





Figures 34–35. *Cordylochernes dingo* sp. nov. Genital opercula: fig. 34, holotype male; fig. 35, paratype female. Scale lines = 0.1 mm.

Chelicera 0.45–0.53/0.20–0.23 (0.55/0.26), movable finger length 0.36–0.42 (0.44). Carapace 1.41–1.54/1.11–1.23 (1.59/1.40). Leg I: entire femur 0.82–0.92/0.35–0.39 (0.94/0.40), tibia 0.59–0.64/0.23–0.26 (0.68/0.26), tarsus 0.44–0.47/0.15–0.16 (0.54/0.17). Leg IV: entire femur 1.27/0.49 (1.54/0.56), tibia 0.91/0.16 (1.03/0.30), tarsus 0.57/0.19 (0.66/0.22), distance of tarsal tactile seta from proximal margin 0.21 (0.24).

Tritonymphs: Colour paler than adults. Pedipalp: trochanter 1.63–1.65 ×, femur 2.00–2.02 ×, tibia 1.86–1.95 ×, chela (with pedicel) 2.64–2.68 ×, chela (without pedicel) 2.44–2.50 ×, hand 1.43–1.45 × longer than broad. Fixed chelal finger with 7 trichobothria, movable chelal finger

with 3 trichobothria (Fig. 29): *ist* and *sb* absent. Carapace 1.27–1.30 × longer than broad.

Dimensions (mm): Body length 5.2–5.4. Pedipalps: trochanter 0.51–0.52/0.31–0.32, femur 0.84–0.85/0.42, tibia 0.80–0.84/0.43, chela (with pedicel) 1.45–1.50/0.55–0.56, chela (without pedicel) 1.34–1.40, hand length 0.80, movable finger length 0.67. Carapace 1.08–1.09/0.83–0.86.

Deutonymphs: Colour paler than adults. Pedipalp: trochanter 1.70–1.73 ×, femur 2.11–2.12 ×, tibia 1.80–1.89 ×, chela (with pedicel) 2.76–2.80 ×, chela (without pedicel) 2.63 ×, hand 1.42–1.49 × longer than broad. Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Fig. 30): *esb*, *isb*, *st* and *sb* absent. Carapace 1.45 × longer than broad.

Dimensions (mm): Body length 3.7–3.8. Pedipalps: trochanter 0.34–0.38/0.20–0.22, femur 0.53–0.59/0.25–0.28, tibia 0.51–0.54/0.27–0.30, chela (with pedicel) 0.98–1.05/0.35–0.38, chela (without pedicel) 0.92–1.00, hand length 0.52–0.54, movable finger length 0.47–0.51. Carapace 0.77/0.53.

Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. *Cordylochernes dingo* has a wide distribution in north-western Australia. I have examined numerous females from northern Australia that may belong to this genus or species, but without males, their status remains uncertain.

Males of *C. dingo* differ from all other known species of the genus by the position of trichobothrium *it* which is closer to *ist* than to the tip of the finger.

Acknowledgments

Drs A.J. Dartnall, M.R. Gray, R.B. Halliday, A. Neboiss, R.J. Raven and W. Schawaller kindly provided the specimens that formed the basis for this project which was partly supported by an Australian Biological Resources Study grant.

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Memoirs of the Museum of Victoria 50(2): 337–340 (1990) ISSN 0814-1827

TWO NEW SPECIES OF *PARTIDOMOMONIA* COOK FROM SOUTH-EASTERN AUSTRALIA (ACARINA: MOMONIIDAE)

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Abstract

Harvey, M.S., 1990. Two new species of *Partidomomonia* Cook from south-eastern Australia (Acarina: Momoniidae). *Memoirs of the Museum of Victoria* 50(2): 337–340.

Adult males of *Partidomomonia blythi* sp. nov. and an adult female of *P. cabanandra* sp. nov. are described from specimens collected in eastern Victoria. The generic diagnosis is amended, and a key to the three known species of the genus is presented.

Introduction

The water mite genus *Partidomomonia* Cook has a short history and only two specimens have been reported in the literature. The first was the male holotype of the type species, *P. polyplacophora* Cook, 1983 from New Zealand. The second, a deutonymph from Queensland, was described but not named by Cook (1986) and remains *species inquirenda* until adults are collected. The discovery of six further specimens representing two undescribed species from eastern Victoria in the collections of the Museum of Victoria, Melbourne (NMV) and the Canadian National Collection, Ottawa (CNC) is of interest, especially as one is a female, the first to be reported in the genus.

Methods follow Harvey (1987); abbreviations for the glandularia follow Harvey (1988).

Partidomomonia Cook

Partidomomonia Cook, 1983: 118. Type species: *Partidomomonia polyplacophora* Cook, 1983, by original designation.

Diagnosis. Dorsal shield divided into a number of platelets. Three pairs of genital acetabula, lying free in gonopore in males, and on separate lateral sclerites in gonopore in females.

Remarks. The discovery of the female of *P. cabanandra* described below, allows expansion of the generic diagnosis given by Cook (1983), which was based on male characters only, and reassessment of the generic affinities of *Partidomomonia*. Species of six momoniid genera have the genital acetabula of both sexes lying within the gonopore: *Momonia* Halbert, *Momoniella* K. Viets, *Neomomonia* Cook, *Notomomonia* Cook, *Partidomomonia* Cook and *Momonides* Lundblad. In males of the remaining three momoniid genera (*Stygomomonia* Szalay, *Xenomomonia* Orghidan, Gruia, Georgesco and Bayés and *Momonisia* Petrova) the acetabula lie in the ventral shield. [The descriptions of *Cladomomonia* Orghidan and Gruia given by Orghidan and Gruia (1980, 1983), conclusively show that the genus is not a momoniid as the type species lack the characteristic leg I typical of the family.] *Partidomomonia* clearly differs from the other five genera with acetabula of both sexes in the gonopore by the nature of the dorsal shield which is divided into a number of platelets, and on the basis of current knowledge does not appear to possess particularly close affinities to any of these genera.

Key to adults of *Partidomomonia*

1. Dorsal shield less than 450 μm in length, 1.47–1.66 × longer than broad ..... *P. blythi*
— Dorsal shield greater than 600 μm in length, 1.15–1.36 × longer than broad 2
2. Tibia I much longer than tarsus I ..... *P. cabanandra*
— Tibia I approximately same length as tarsus I ..... *P. polyplacophora*

Partidomomonia blythi sp. nov.

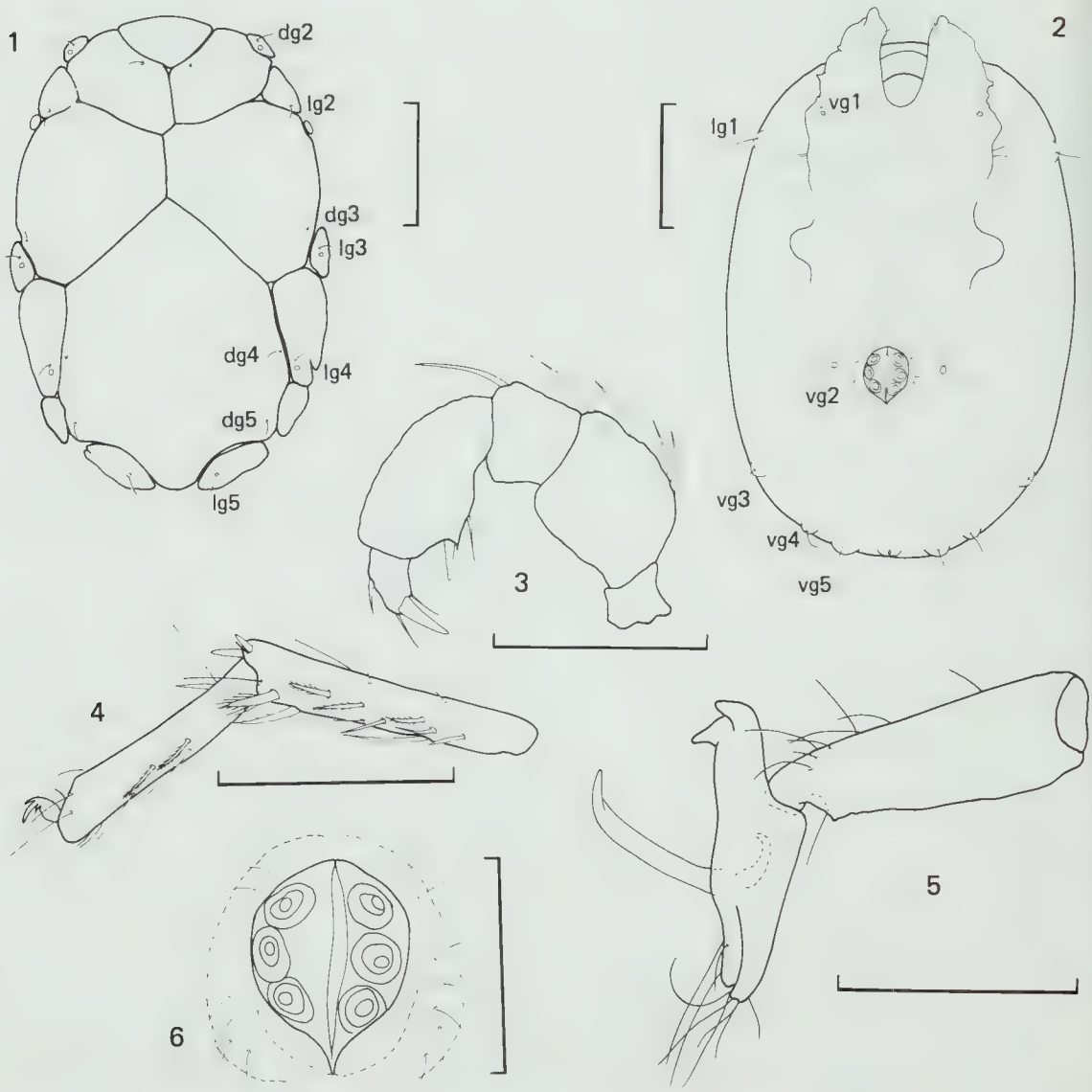
Figures 1–6

Types. Holotype male, Thomson River at Thomson-Jordan Divide Road, Victoria, 12 Mar 1987, R. Marchant (NMV K866).

Paratypes: Victoria: 1 male, same data except 12 Dec 1985, from frozen core, 10–20 cm level (NMV K867); 1 male, same data except 9 Mar 1980, staff of Biological Survey Department (NMV K868); 1 male, same data except Mar 1981 (NMV K869); 1 male, same data except 9 Mar 1979 (CNC).

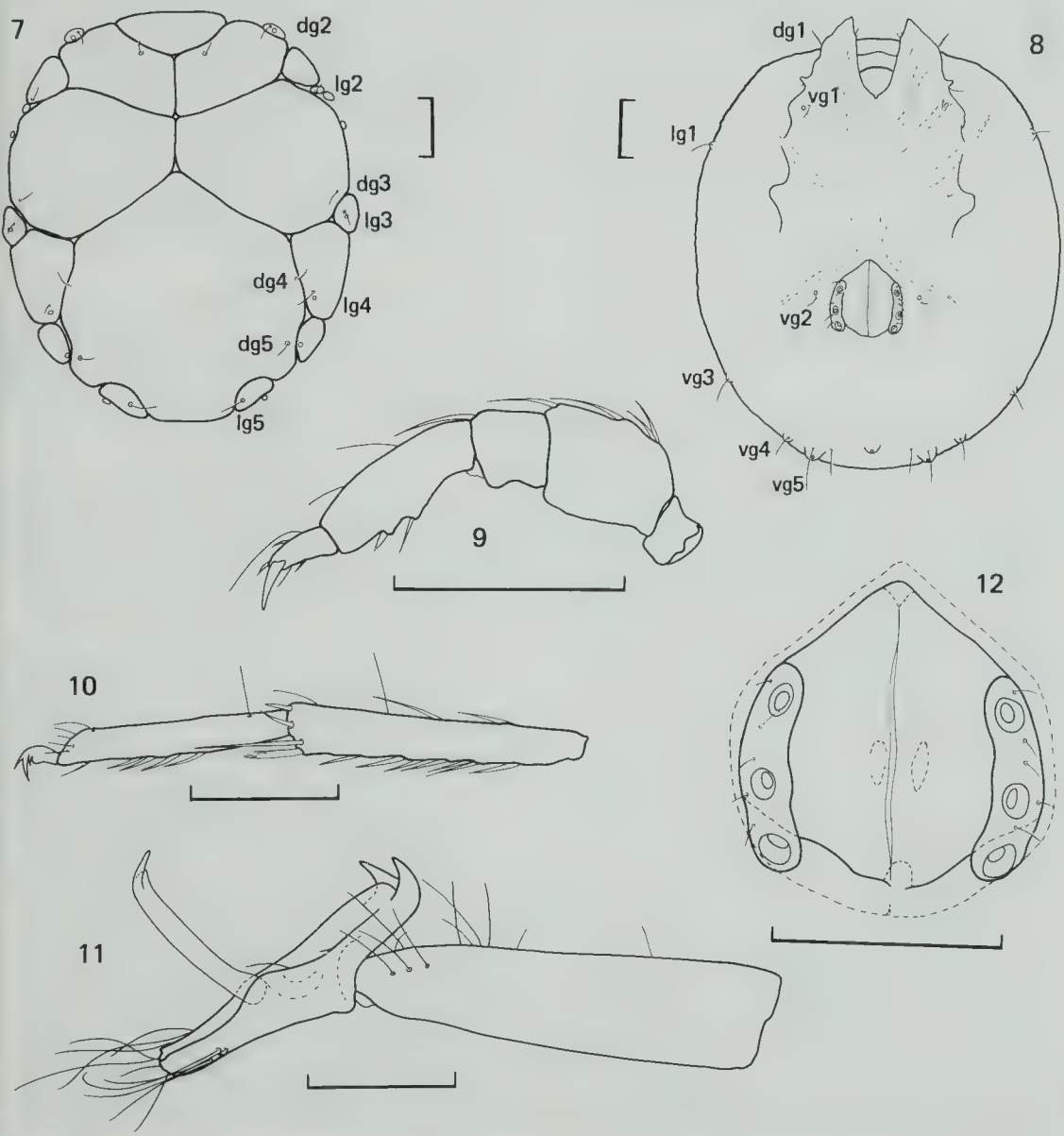
Diagnosis. Dorsal shield relatively narrow, dorsal shield less than 450 μm in length. Tibia I only slightly longer than tarsus I. Glandularium associated with dg5 absent.

Description. Adult male: Dorsal and ventral shields present. Dorsal shield (Fig. 1) divided into many close-fitting platelets (the irregular intersection of the medial platelets shown in Fig. 1 is not typical of the species); with postocularia, 3 pairs of dorsoglandularia, and 5 pairs of setae that lack associated glands (dg3–5, lg2, 5); dorsal



Figures 1–6. *Partidomomonia blythi* sp. nov., holotype male. Fig. 1, dorsal shield; fig. 2, ventral shield; fig. 3, right pedipalp; fig. 4, tibia and tarsus of left leg IV; fig. 5, tibia and tarsus of left leg I; fig. 6, genital field. Scale lines, 100 μm; except figs 3, 6, 50 μm.

shield 1.47–1.66 × longer than broad. Ventral shield (Fig. 2) entire; anterior coxae projecting beyond idiosoma; suture lines between coxae poorly defined; suture lines between coxae I absent; foramina of legs IV covered by large condyles; capitular bay rounded; with 7 pairs of glandularia (dg1, lg1, vg1–5); dg1 on anterolateral margin (not visible in ventral view); vg1 situated at junction of coxae II and III; vg3–5 set in low tubercles on posterior margin; anus situated at posterior margin of ventral shield. Genital field (Fig. 6) with 3 pairs of acetabula situated within gonopore, not on separate sclerites; posterior margin pointed; surrounded by 6–7 pairs of small setae. Pedipalp (Fig. 3) not uncate; tibia with 1 large ventral seta on tubercle and 1 smaller ventral seta; tarsus with 1 large distal setae, and several smaller setae; all setae acumi-



Figures 7–12. *Partidomomonia cabanandra* sp. nov., holotype female. Fig. 7, dorsal shield; fig. 8 ventral shield; fig. 9, right pedipalp; fig. 10, tibia and tarsus of left leg IV; fig. 11, tibia and tarsus of left leg I; fig. 12, genital field. Scale lines, 100 μm.

nate. Legs (Figs. 4, 5): tarsus I with proximodorsal extension; distal portion of tarsus I bifurcate; claw enlarged, proximally directed; tibia I greatly enlarged, tubular, slightly longer than tarsus I; without swimming setae.

Dimensions (μm): Dorsal shield 390–416/243–281; ventral shield 411–442/262–306. Capitulum length 48–65; chelicera length 71–75. Genital field 49–55/37–41. Pedipalp: trochanter 15–16, femur 38–41, genu 21–25, tibia 46–49, tarsus 28–29. Leg I: trochanter 32–38, basifemur 48–56, telofemur 64–67, genu 58–62, tibia 138–153, tarsus 126–130. Leg IV: trochanter 59, basifemur 63–65, telofemur 69–72, genu 88–98, tibia 129–138, tarsus 114–119.

Etymology. This species is named for John Blyth, coordinator of much of the early ecological work conducted on the Thomson River.

Partidomomonia cabanandra sp. nov.

Figure 7–12

Type. Holotype female, Bowen Creek, 2 km SW of Cabanandra, Victoria, interstitial sample, 9 Apr 1985, D.R. Cook, M.S. Harvey and A.J. Boulton (NMV K870).

Diagnosis. Dorsal shield somewhat round, 698 μm in length. Tibia I much longer than tarsus I. Glandularium associated with dg5 present.

Description. Adult female: Dorsal and ventral shields present. Dorsal shield (Fig. 7) divided into many close-fitting platelets; with postocularia, 4 pairs of dorsoglandularia, and 4 pairs of setae that lack associated glands (dg3–4, lg2, 5); dorsal shield 1.15 times longer than broad. Ventral shield (Fig. 8) entire; anterior coxae projecting beyond idiosoma; suture lines between coxae poorly defined; suture lines between coxae I absent; foramina of legs IV covered by large ventral lobes; capitular bay rounded; with 7 pairs of glandularia (dg1, lg1, vg1–5); dg1 situated on anterolateral margin (not visible in ventral view); vg1 situated at junction of coxae II and III; vg3–5 set in low tubercles on posterior margin; anus removed from posterior margin of ventral shield. Genital field (Fig. 12) with 3 pairs of acetabula situated on separate lateral sclerites within gonopore; each sclerite with 5 small setae. Pedipalp (Fig. 9) not uncate; tibia with 1 large ventral seta on tubercle and 1 smaller ventral seta; tarsus with 1 large distal setae and several smaller setae; all setae acuminate. Legs (Figs. 10, 11): tarsus I with proximodorsal extension; distal portion of tarsus I bifurcate; claw enlarged, proximally directed; tibia I greatly enlarged, tubular, much longer than tarsus I; without swimming setae.

Dimensions (μm): Dorsal shield 698/607; ventral shield 731/632. Capitulum length 90; chelicera length 119. Genital field 136/133. Pedipalp: trochanter 25, femur 62, genu 38, tibia 78, tarsus 46. Leg I: trochanter 47, basifemur 83, telofemur 111, genu 102, tibia 292, tarsus 212. Leg IV: trochanter 92, basifemur 114, telofemur 109, genu 147, tibia 199, tarsus 106.

Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. This relatively large, somewhat rounded species differs from *P. polyplacophora* and *P. blythi* in several respects, most notably in the relative lengths of the tibia and tarsus of leg I, and in the presence of a gland associated with dg5.

Acknowledgments

This work was funded by a grant from the Australian Biological Resources Study. Dr I.M. Smith kindly returned a collection of Thomson River mites for my studies.

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Memoirs of the Museum of Victoria 50(2): 341–346 (1990) ISSN 0814-1827

TWO NEW WATER MITE GENERA FROM SOUTH-WESTERN AUSTRALIA (ACARINA: ATURIDAE, MIDEOPSIDAE)

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Abstract

Harvey, M.S., 1990. Two new water mite genera from south-western Australia (Acarina: Aturidae, Mideopsidae). *Memoirs of the Museum of Victoria* 50(2): 341–346.

Wheenyoides cooki (Aturidae) and *Tillia davisae* (Mideopsidae) are described from south-western Australia.

Introduction

Although the water mite fauna of eastern Australia is fairly well known at the generic level (Cook, 1986), the faunas of northern and western Australia are less well known. It is not particularly surprising, therefore, that two new genera have been recently collected in south-western Australia. These taxa are described here.

Methods follow Harvey (1987), and the abbreviations for the glandularia follow Harvey (in press). Specimens are lodged in the Western Australian Museum, Perth (WAM).

Aturidae

Frontipodopsinae

Remarks. As conceived by Cook (1974, 1986), the Frontipodopsinae contains four genera, *Frontipodopsis* Walter, *Karlvietsia* K.O. Viets, *Wheenyella* Cook and *Tasmanaxona* Cook. It is poorly characterised, but is presently defined by the laterally compressed body and the lack of genital flaps. Its position within the Aturidae was questioned by Cook (1974) and I believe there is sufficient evidence to warrant the removal of the subfamily, along with certain other pioniform genera (notably *Wettina* Piersig), from the Aturidae to a separate family. The necessary revisionary work has not yet been completed to confirm both the character states that would rigorously define this family, or verify its constituents, and these four genera are for the present retained in the Frontipodopsinae.

Wheenyoides gen. nov.

Type species: Wheenyoides cooki sp. nov.

Diagnosis. Claws and claw insertion area of tarsus I greatly enlarged; body laterally compressed; glandularia of dorsum without enlarged platelets; coxae of female not fused at mid-line; ventral shield extending only to posterior margin of genital field in female.

Description. Body laterally compressed. Dorsum with 2 pairs of dorsalia (1 bearing the postocularia) and 8 pairs of glandularia lying free in the integument; glandularia of dorsum without enlarged platelets. Ventral shield of male extending to posterior margin of body; that of female extending to posterior margin of genital field. Coxae of male fused at mid-line; those of female not fused. Pedipalpal tibia with 2 large, ventral setae. Tarsus I with greatly enlarged claws and claw insertion area.

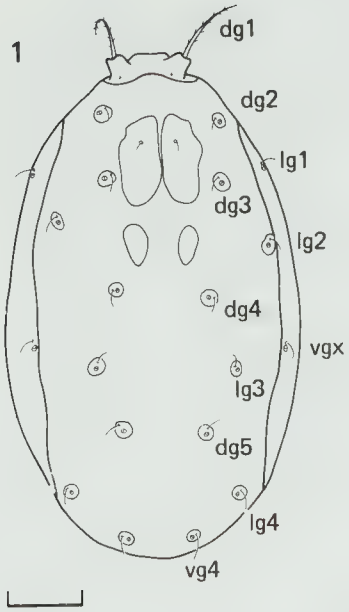
Etymology. The generic epithet is derived from *Wheenyella*, and is masculine.

Remarks. The combination of enlarged tarsal claws of leg I and a laterally compressed body distinguishes *Wheenyoides* from all other frontipodopsines except *Wheenyella* Cook. *Wheenyoides* differs from *Wheenyella* as follows: glandularia of dorsum without enlarged platelets (with enlarged platelets in *Wheenyella*); coxae of female not fused at mid-line (fused in *Wheenyella*); ventral shield extending only to posterior margin of genital field in female (extending to posterior margin of body in *Wheenyella*).

Wheenyoides cooki sp. nov.

Figures 1–9

Types. Holotype male, Serpentine River below falls, Ser-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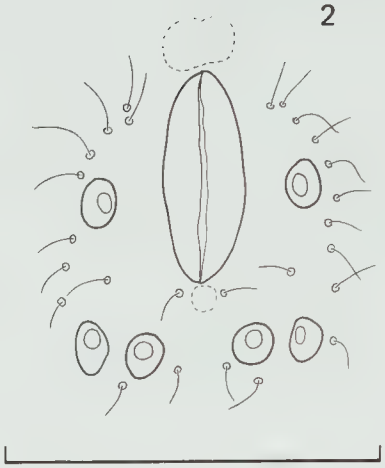
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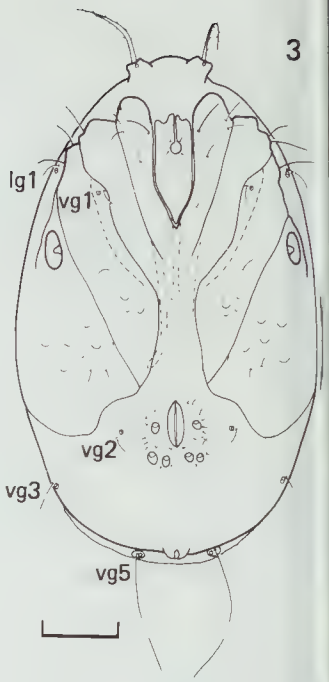
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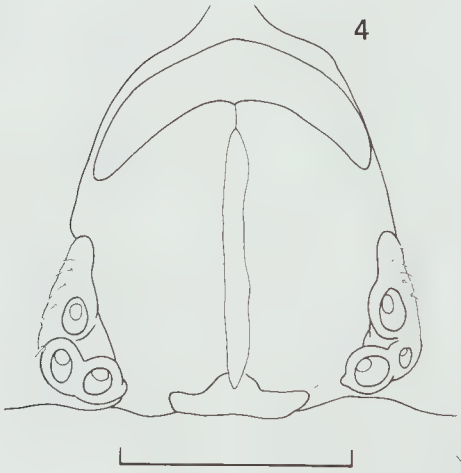
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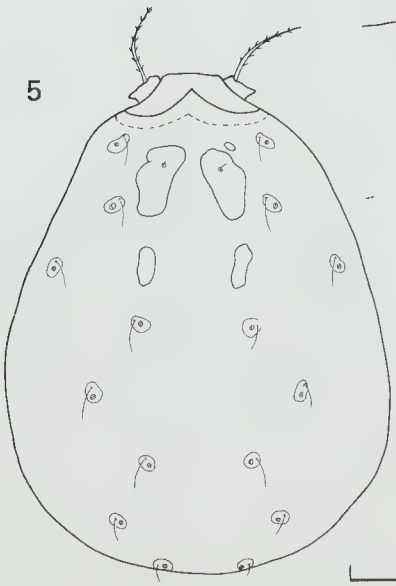
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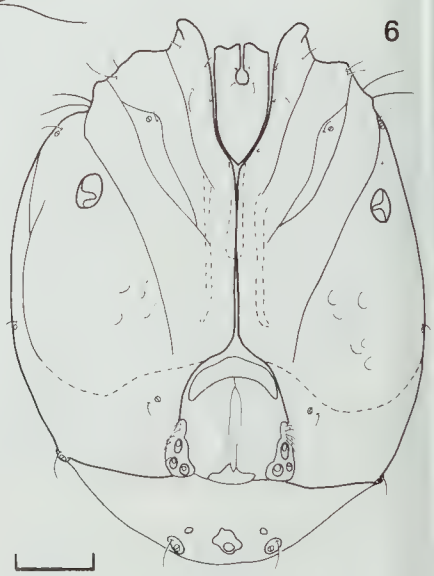
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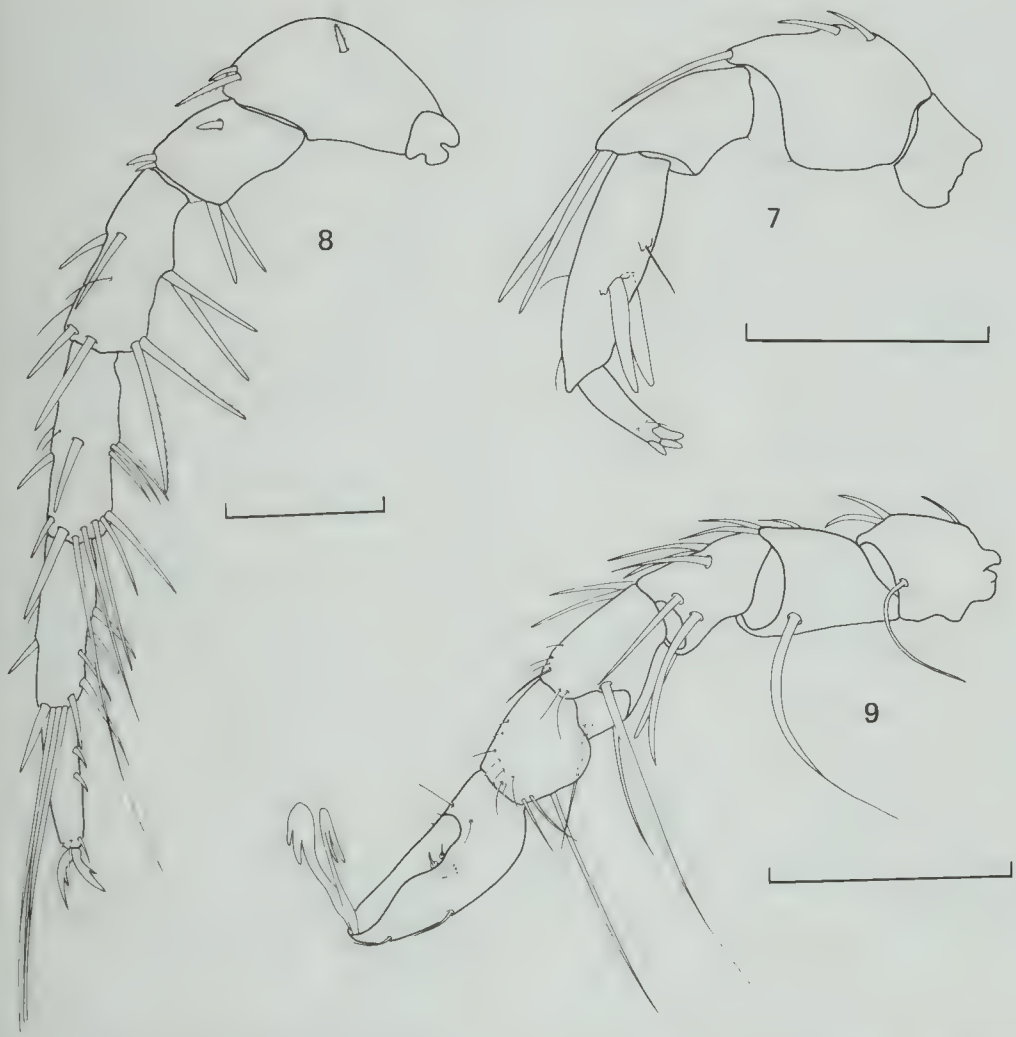


Figures 7–9. *Wheenyoides cooki* sp. nov. Fig. 7, paratype female. Figs 8, 9, holotype male. Fig. 7, right pedipalp; fig. 8, left leg IV; fig. 9, right leg I. Scale lines, 100 μm.

pentine Falls National Park, 32°23′S, 116°04′E, Western Australia, 24 Aug 1987, M.S. Harvey, J.D. Blyth and L.A. Barmuta, WAM 88/2926.

Paratype: 1 female, Lake Yeagarup, 18 km SW of Pemberton, 34°33′S, 115°43′E, Western Australia, 29 Aug 1987, M.S. Harvey and J.D. Blyth, WAM 88/2927.

Diagnosis. As for genus.

Description. Adults: 5 pairs of dorsoglandularia, 4 pairs of lateroglandularia and 5 pairs of ventroglandularia; seta of dg1 large, pinnate, and situated on large protuberances set in ventral shield; dg2, dg3, dg4, dg5, lg2, lg3, lg4 and vg4 in dorsum; lg1, vgx and vg3 on lateral margin of ventral shield. Dorsum (Figs 1, 5): with 2 pairs of dorsalia, the anterior pair completely surrounding the postocularia. Venter (Figs 3, 6): capitulum not fused to coxae; coxae of male fused at mid-line, of female not fused at mid-line; apodemes of coxa I nearly extending to posterior edge of coxal group; suture lines between coxae I and II and coxae II and III not reaching mid-line; suture lines between coxae III and IV extending postero-medially such that coxa IV is triangular; ventral shield extending to level of posterior edge of genital field in female, and to posterior edge of body in male; excretory

←

Figures 1–6. *Wheenyoides cooki* sp. nov. Figs 1–3, holotype male. Figs 4–6, paratype female. Figs 1, 5, dorsal aspect; figs 2, 4, genital field; figs. 3, 6, ventral aspect. Scale lines, 100 μm.

pore borne on small sclerite in female, incorporated into ventral shield in male. Genital region (Figs 2, 4): 3 pairs of small ovoid to circular acetabula borne on small acetabular plates in female, incorporated into ventral shield in male. Chelicera not examined. Pedipalp (Fig. 7): tibia with 2 very large ventral setae, and 1 thin ventral seta. Legs (Figs 8, 9): tarsus I with greatly enlarged claw insertion area, 0.68 (male), 0.72 (female) times as long as tarsus; claws of leg I enlarged, distally lobate; claws of other legs not particularly modified; legs II, III and IV with swimming setae arranged as follows: leg II: tibia 7; leg III: tibia 10; leg IV: tibia 3; legs with many long, often thick, setae.

Dimensions (μm), male (female): Body 653/397 (729/547). Capitulum length 134 (153). Genital field 83/70 (70/122). Pedipalp: trochanter 24 (32), femur 67 (87), genu 56 (72), tibia 77 (103), tarsus 40 (50). Leg I: trochanter 62 (83), basifemur 53 (78), telofemur 54 (70), genu 59 (70), tibia 49 (58), tarsus 94 (111), length of claw insertion area 64 (80). Leg IV: trochanter 153 (182), basifemur 64 (83), telofemur 120 (154), genu 126 (154), tibia 120 (146), tarsus 92 (115).

Etymology. This species is named for David Cook who first recorded frontipodopsines from Australia.

Remarks. Wheenyoides cooki has only been collected from two localities in south-western Australia, where it has been taken from a slow flowing area of the Serpentine River, and Lake Yeagarup, a moderately large dune lake.

Mideopsidae

Mideopsellinae

Remarks. The Mideopsidae are currently divided into five subfamilies, Mideopsinae, Mideopsellinae, Plaumanniinae, Gretacarinae and Guineaxonopsinae (Cook, 1974, 1986). The Mideopsellinae and Plaumanniinae differ from the remaining groups by the presence of an uncate pedipalp (Cook, 1974, 1988). The development of an uncate pedipalp appears to have occurred several times within the Arrenuroidea, and is of dubious value in delimiting higher taxa. The Mideopsellinae currently includes four genera: *Mideopsella* Lundblad, *Mideopsellides* K.O. Viets, *Tiramideopsis* Cook and *Phreatomideopsis* Schwoerbel, and possess acetabula in a single row (in the plaumanniines, the acetabula are in several rows). Although the new genus described below differs radically from the remaining genera of the subfamily in the position of the acetabula, I have little option but to assign it to the Mideopsellinae as presently defined.

Tillia gen. nov.

Type species. Tillia davisae sp. nov.

Diagnosis. Acetabula of female in a single row incorporated into ventral shield.

Description. Female: Dorsal and ventral shields present. Genital field with 7–8 pairs of minute acetabula, in a single row incorporated into ventral shield. Pedipalp uncate; tibia not rotated. Legs not modified, swimming setae absent.

Etymology. The generic epithet is an arbitrary combination of letters, and is feminine in gender.

Remarks. The form of the female genital field readily delimits this genus from other mideopsids. Unfortunately, only a single female of *Tillia* is known, and until males are examined its affinities are difficult to determine.

Tillia davisae sp. nov.

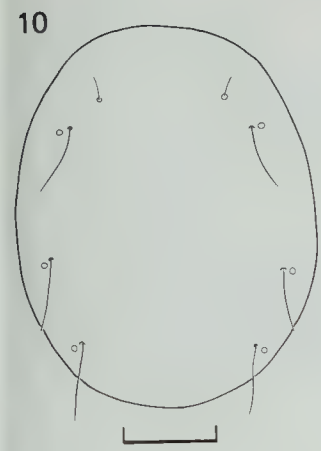
Figures 10–16

Type. Holotype female, Dirk Brook, Western Australia, 18 Sep 1986, J. Davis, L. Barmuta, WAM 88/2928.

Diagnosis. As for genus.

Description. Female: Dorsal and ventral shields present. Dorsal shield (Fig. 10) entire, bearing 3 pairs of dorsoglandularia; postocularia slightly anterior to the anterior-most glandularia of the dorsal shield. Ventral shield (Fig. 11) entire; vgl situated near posterior margin of coxa II; all coxal suture lines visible, those between I and II, II and III, and III and IV posteriorly directed, thus forming acute angles with the mid-line; medial margin of coxa IV narrow; posterior margin of coxa IV slightly rounded; foramina of leg IV without ventral lobes; capitular bay somewhat triangular; excretory pore incorporated into ventral shield. Genital field (Fig. 12) with 7–8 pairs of minute acetabula incorporated into ventral shield. Capitulum and chelicera as in Fig. 13. Pedipalp (Fig. 14) uncate; tibia not rotated; all setae acuminate. Legs (Figs 15, 16) not modified and without swimming setae; very few setae serrate.

Figures 10-16. *Tillia davisae* sp. nov., holotype female. Fig. 10, dorsal aspect; fig. 11, ventral aspect; fig. 12, genital field; fig. 13, capitulum; fig. 14, right pedipalp; fig. 15, left leg IV; fig. 16, left leg I. Scale lines, 50 μm (Figs 12–14), 100 μm (Figs 10, 11, 15, 16).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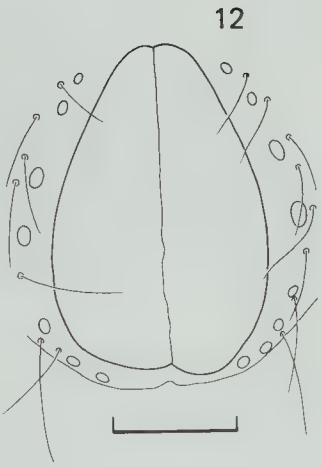
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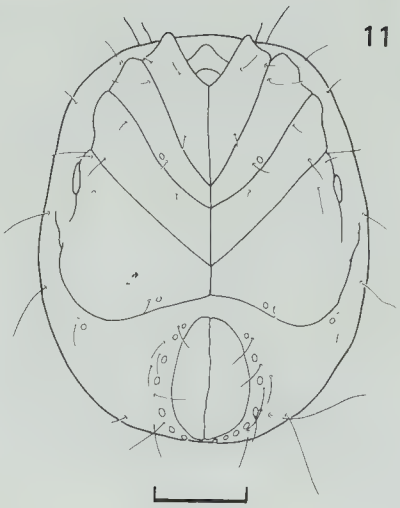
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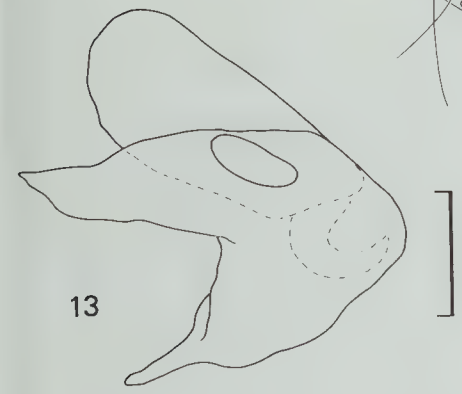
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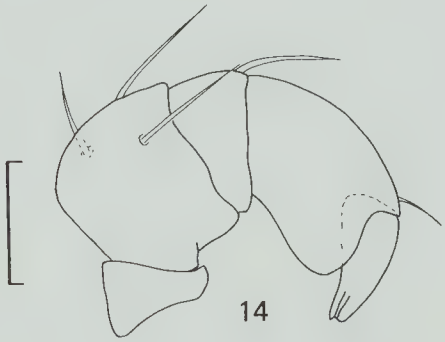
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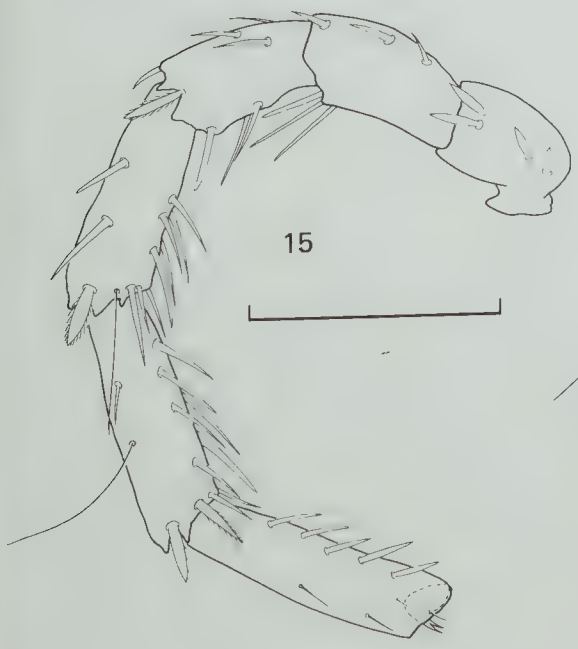
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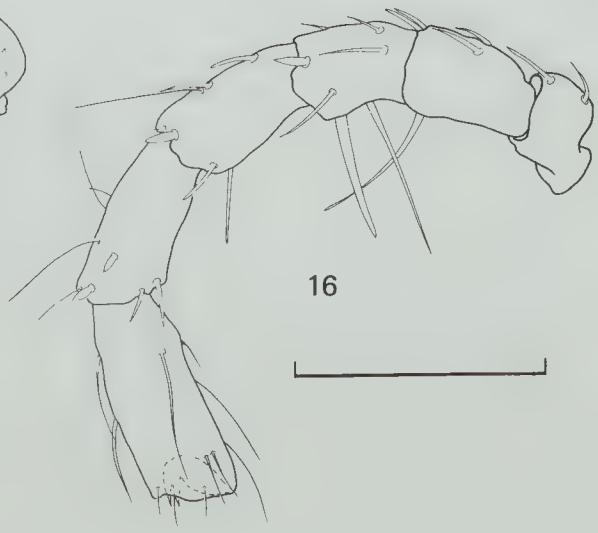
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Dimensions (μm) female: Dorsal shield 410/324, ventral shield 449/345. Pedipalp: trochanter 17, femur 41, genu 22, tibia 46, tarsus 27. Leg I: trochanter 52, basifemur 77, telofemur 52, genu 68, tibia 83, tarsus 102. Leg IV: trochanter 68, basifemur 67, telofemur 65, genu 102, tibia 117, tarsus 116.

Etymology. This species is named for Jenny Davis, one of the collectors of the holotype.

Acknowledgments

This work was funded by the Australian Biological Resources Study. The Western Australian Department of Conservation and Land Management provided valuable logistic support, as well as permission to collect in areas under their control.

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REVISION OF THE GENUS *NESOXYPILUS* BEIER (MANTODEA: AMORPHOSCELIDAE: PARAOXYPILINAE)

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Abstract

Milledge, G.A., 1990. Revision of the genus *Nesoxypilus* Beier (Mantodea: Amorphoscelidae: Paraoxypilinae). *Memoirs of the Museum of Victoria* 50(2): 347–355.

Two species of the ant mimicking genus *Nesoxypilus* Beier are recognized and described: *N. albomaculatus* Werner (with its new junior synonym *N. antennatus* Beier) and *N. pseudomyrmex* sp. nov. The genus is redefined and a key to the species is given. Relationships and aspects of biology are discussed.

Introduction

The genus *Nesoxypilus* contains small, ground dwelling, paraoxypiline mantids in which the female and nymphal stages, and to a lesser extent the male, closely resemble ants. Its known distribution is across the tropical north of Australia and in south-western Papua New Guinea.

Beier (1965) described *Nesoxypilus* to contain a single species, *N. antennatus*, from a male and a female specimen from Prince of Wales Island. Werner (1933) described a species of *Paraoxypilus*, *P. albomaculatus*, from two male specimens from Burnside, Northern Territory. I have examined the type material of both species and find that *P. albomaculatus* belongs to *Nesoxypilus* and, after examination of a number of other specimens, that *N. antennatus* is a synonym of *N. albomaculatus*. The genus *Nesoxypilus* is here redefined and *N. albomaculatus* is redescribed. An additional species, *N. pseudomyrmex* sp. nov., is described.

In describing the male genitalia the interpretation and terminology of La Greca (1953–1954) is followed. For study purposes the genitalia were removed from the relaxed specimen and soaked in 10% KOH for approximately 1 hour. After washing, the genitalia were transferred to 70% alchohol and the soft internal tissues teased out. They are preserved in glycerol and contained in microvials attached to the specimen pin of dry specimens. For wet preserved specimens they are preserved in 70% alchohol in glass microtubes contained in the specimen tube.

All drawings were done by the author using a Wild M4A binocular microscope with camera lucida attachment.

The following abbreviations are used for institutions where material is lodged: ANIC, Australian National Insect Collection, Canberra; BPBM, Bernice P. Bishop Museum, Honolulu, Hawaii; NMV, Museum of Victoria, Melbourne; NMB, Naturhistorisches Museum, Basel; NTM, Northern Territory Museum, Darwin; QM, Queensland Museum, Brisbane; UQ, University of Queensland, Brisbane; WAM Western Australian Museum, Perth.

Nesoxypilus Beier

Nesoxypilus Beier, 1965: 449. Type species *Nesoxypilus antennatus* Beier, by original designation.

Diagnosis. Small; male macropterous, female apterous. Head wider than pronotum, without paraocular spines or other projections, apical margin moderately arched, apex higher than eyes; frontal shield transverse, moderately arched transverse ridge running between bases of antennae; antennae setose, elongate in male, shortened in female, distinctly thickened, especially in female where segments are short and thickset, almost discoid.

Pronotum short and thickset with strongly defined, rounded and unarmed supracoxal expansion; margins narrowly lamellate; metazone strongly constricted at about two-thirds distance from supracoxal groove, with fine median keel raised into a lobe near caudal margin; meso- and metanotum with similar median keel and caudal lobe; lobes less strongly developed in male. Tegmina of male subopaque.

Forecoxa with anterior margin sparsely setose and in the female very finely denticulate; fore-

femur with 3 discoidal spines, the second long and powerful; foretibia with smooth outer ventral margin, inner ventral margin finely denticulate on distal half. Mid and hind legs relatively long, the metatarsus of the latter considerably longer than the remaining segments together; genicular spine absent.

Abdomen without lateral projections, slender in mature male, strongly broadened in female and nymphs; 3rd abdominal tergite with more or less well developed median lobe on caudal margin; supraanal plate an elongate, blunt tipped triangle in female, shorter and more rounded in male; cerci short, cylindrical. Male genitalia with distal process of ventral phallomere bearing two short, rather widely spaced, projections, right hand one curving dorsally. Dorsal lamina of left phallomere setose; apical process moderately long and sharply bent to the left; membranous lobe short, broad, tip finely shagreened; anterior process extending a short distance into body of membranous lobe; phalloid apophysis fused with anterior process. Apical area of main lobe of right phallomere setose; ventral plate fused to main body of phallomere, strongly sclerotized, finely shagreened ventrally; ventral sclerified process forming stout, blunt tipped, hook, surface finely shagreened.

Key to species of *Nesoxypilus*

1. Median lobe on caudal margin of 3rd abdominal tergite (Figs 4, 5, 6, 8) well developed ..... *N. albomaculatus*
— Median lobe on caudal margin of 3rd abdominal tergite (Figs 7, 9) poorly developed, almost absent ..... *N. pseudomyrmex*

Nesoxypilus albomaculatus (Werner) comb. nov.

Figures 1–6, 8, 10–13, 15–20

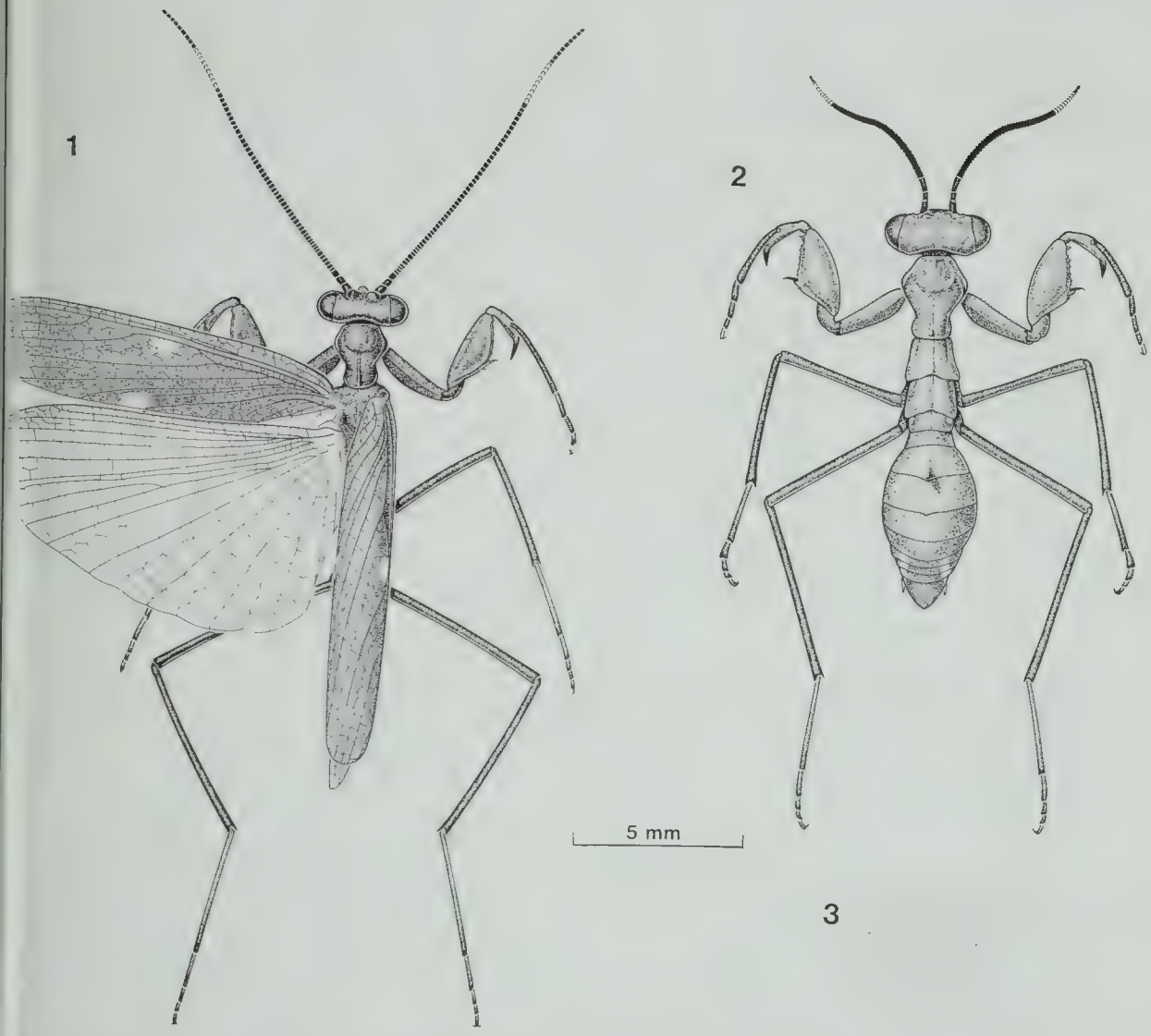
Paraoxypilus albomaculatus Werner, 1933: 444.
Nesoxypilus antennatus Beier, 1965: 450. Syn. nov.

Material examined. Lectotype male, here designated, of *Paraoxypilus albomaculatus*, Burnside, NT, Apr 1931, Handschin. Second handwritten label: Paraoxypilus albomaculatus ♂ type Wern. Paralectotype male, here designated, Burnside, NT, May 1932. Bears second handwritten label: Paraoxypilus albomaculatus ♂ paratype Wern., (both NMB).

Holotype male of *Nesoxypilus antennatus*, Prince of Wales Is., Cape York Islands, 25 Jul 1920, J.A. Kusche. Allotype female, Prince of Wales Is., Cape York Islands, 3 Aug 1920, J.A. Kusche, (both BPBM).

Other specimens examined (35 ♂, 34 ♀, 12 nymphs). Queensland. 1 ♀, near Dimbulah 17°05′S, 145°05′E, 26 Jun 1971, R.W. Taylor and J. Feehan; 1 ♀, 15°03′S, 145°07′E, 4 km SW of Casurina Hill, near Cooktown, 30 Apr–2 May 1981. D.C.F. Rentz; 1 ♀, 15°03′S, 145°09′E, 3 km NE of Mt Webb, 30 Apr–3 May 1981, J.E. Feehan; 1 ♀, Mareeba, Sep 1932, H. Hill; 1 ♀, 1 nymph, Forty Mile Scrub National Park, 13–14 Feb 1986, B.P. Moore; 1 nymph, 18°05′S, 144°52′E, Forty Mile Scrub National Park, 52 km SSW of Mount Garnet, 22 Jul 1986, D.C.F. Rentz; 3 ♂, 17°25′S, 145°04′E, 15 km W of Irvinebark, 27–28 Nov 1981, J. Balderson; 2 ♂, 1 ♀, 5 km W of Innot Hot Springs, 5 Jan 1984, D. Rugg; 1 ♂, Mt Norman, Norman R., Gregory Range, 8 May 1980, D. Frith; 1 ♂, 15 km S of Barcaldine, 1 May 1957, Key and Chinnick; 1 ♂, 5 km WSW of Camel Creek Homestead, W of Ingham, 5 Apr 1962, K.H.L. Key and E.L. Corby, (all ANIC); 1 ♂, 2 ♀, Lockerbie, Cape York, 6–10 Jun 1969, G.B. Monteith; 3 ♂, 25 km SW of Normanton, 25 May 1972, G.B. and S.R. Monteith; 1 ♂, Walker Creek, 42 km SE of Karumba, 28 May 1972, G.B. and S.R. Monteith; 1 ♂, 22 km SW Palmer River, Cooktown Highway, 16–22 May 1975, R.T. Storey; 1 ♀, 1 nymph, 2 km E of Wild River Crossing, near Innot Hot Springs, 10 Jan 1981, G. and A. Daniels, (all UQ); 1 ♀, Lakefield National Park, 75 km N of Laura, 15–28 Jun 1980, G.B. Monteith; 1 ♀, Lockerbie Scrub, Cape York, 14–18 Apr 1973, G.B. Monteith; 1 ♀, 10 km N of Hann. Crossing, Cape York Peninsula, 27 Jun 1975, G.B. Monteith; 2 ♂, 1 ♀, 5 km WSW of St Pauls, Moa (Banks) Is. Torres Strait, 16 Jul 1977, G.B. Monteith and D. Cook; 2 ♂, Sandstone Outcrops 30 km W of Fairview, via Laura, 22-24 Jun 1976, G.B. and S.R. Monteith; 1 ♂, Hughenden, H.H. Batchelor (all QM); 1 ♂, Prince of Wales Is., Torres Strait, 27 May 1969, A. Neboiss; 1 nymph, 17.15°S, 145.17°E, 1 km NNE of Collins Weir, W of Atherton, 10 Feb 1989, G. Milledge; 1 nymph, 17.19°S, 144.58°E, 5 km NE of Petford, 12 Feb 1989, G. Milledge (all NMV).

Northern Territory. 4 ♂, Tindal, 13 km ESE of Katherine, 14°31′S, 132°22′E, 30 Nov–20 Dec 1967, W.J.M. Vestjens; 1 ♂, 4 ♀, 5 km W of Jabiru, 7–10 Feb 1983, H.B. Gill and J.C. Wombey; 1 ♀, 3 nymphs, 1 ootheca, 12°17′S, 133°20′E, Cooper Creek, 11 km SW of Nimbuwah Rock, 2 Jun 1973, K.H.L. Key; 3 ♀, Jabiru, 7 km SSE of Mudginberri Homestead, 29 Aug 1981, H.B. Gill and J.C. Wombey; 1 ♀, Kakadu Headquarters, 6 km SSE of Mudginberri Homestead, 6 Sep 1981, H.B. Gill; 2 ♂, Jabiru, 7 km SSE of Mudginberri Homestead, 30 Aug 1981, H.B. Gill; 1 ♀, 13°07′S, 130°38′E, c. 4 km N of Wangi Homestaead, W of Batchelor, 3 Jul 1982, G. van de Klassorst; 3 ♂, 11°01′S, 136°45′E, Rimbaja Is., Wessel Is., 19 Feb 1977, Barrett and Bakker; 1 ♂, 12°43′S, 132°54′E, 14 km SE of Mudginberri Homestead, 12 Jun 1973, M.S.



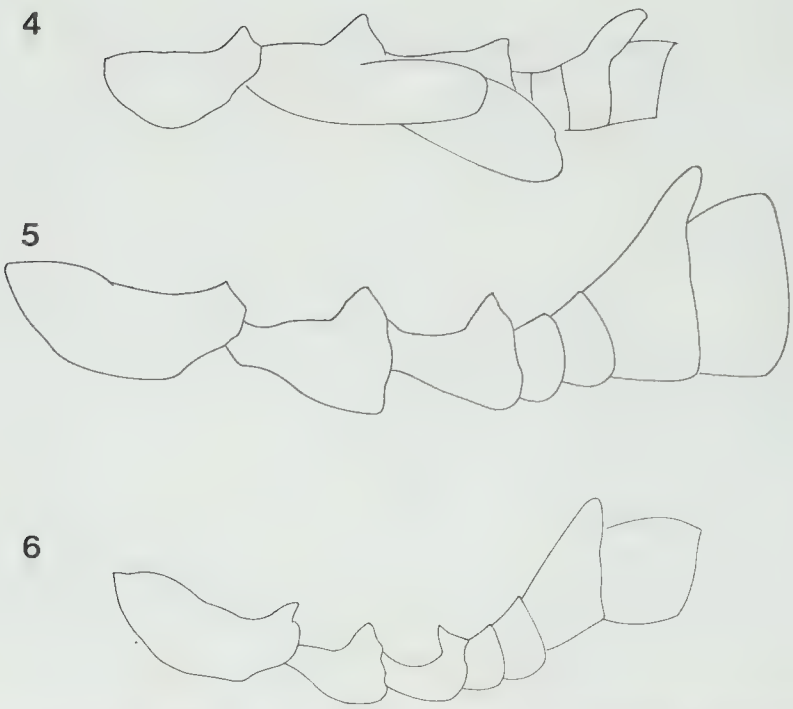
Figures 1–3. *Nesoxypilus albomaculatus* (Werner). Fig. 1, male dorsal. Fig. 2, female dorsal. Fig. 3, ootheca dorsolateral.

Upton and J.E. Feehan; 1 ♀, 12°50′S, 132°51′E, 16 km NE of Mt Cahill, 30 Oct 1972, K.H.L. Key; 1 ♀, 12°17′S, 133°20′E, Cooper Creek, 11 km SW of Nimbuwah Rock, 2 Jun 1973, K.H.L. Key; 1 nymph, 12°17′S, 133°20′E, Cooper Creek, 11 km SW of Nimbuwah Rock, 2 Jun 1973, R.L. Kitching; 1 ♂, 2 ♀, 1 ootheca, 12°23′S, 132°57′E, 5 km NNW of Cahills Crossing, East Alligator R., 28 May 1973, K.H.L. Key et al., 1 ♀, 1 km NE of Cahills Crossing, 12°25′S, 132°58′E, 11 Nov 1972, R.W. Taylor and J.E. Feehan; 1 ♂, Brocks Creek, 28 Mar 1936, T.G. Campbell; 1 ♂, Brocks Creek, 10 Jun 1933, T.G. Campbell (all ANIC); 1 ♂, 1 nymph, Darwin, May 1979, G. Milledge; 2 ♀, Kakadu National Park, Oct 1987, A.N. Andersen (all NMV); 1 ♀, Gove Peninsula, 24–29 Jun 1982, J. Major (NTM).

Western Australia. 2 ♂, Wyndham, 28 Jul 1960, G.F. Mees (WAM).

Papua New Guinea. 1 ♀, 2.8 km ENE of Morehead, Western District, 30 Apr 1971, Balderson and Baker; 2 ♀, 4 nymphs, 8°42′S, 141°40′E, 3 km ENE of Morehead, Western District, 27 Sep 1972, Balderson and Stibick (all ANIC).

Description. Body colour of dry specimens yellowish, reddish or blackish brown, antennae with short whitish section subapically; thoracic nota with distinct median triangular lobe near



Figures 4–6. *Nesoxypilus albomaculatus* (Werner). Fig. 4, male nymph nota and abdominal terga 1–4 latera (3 km ENE of Morehead PNG). Fig. 5, female nota and abdominal terga 1–4 lateral (Forty Mile Scrub National Park). Fig. 6, female nota and abdominal terga 1–4 lateral (16 km NE Mt Cahill, NT).

caudal margin, somewhat variable in shape (Figs 4–6, 8); mesothorax with white blotch on trochantin, lower corner of episternum and sometimes basisternum; metathorax similar but white blotch extends across basisternum forming a band; fifth tarsal segment of foreleg whitish; costal and discoidal areas of male tegmen sub-opaque brown, discoidal area with white spot at mid anterior and posterior margins, anal area hyaline; wings with slight pearly iridescence, darkly flushed apically, remainder hyaline; first abdominal tergite with white blotch in anterior corner (not always apparent in male); third abdominal tergite with a distinct, dorsoposteriorly directed, median lobe on posterior margin, variable in size (Figs 4–6, 8), always smaller in male; 5th abdominal sternite of female with broad white band on anterior margin; 7th, 8th and 9th abdominal tergites of female with white patch near outer margin, 10th whitish on lateral margin, forming short white band; cerci whitish. Male genitalia (Figs 12, 13, 15–19) with spiny, knob-like projection on upper right margin of phalloid apophysis, situated ventrally relative to membranous lobe.

Measurements (in mm). Length of body, ♂ 10.0–11.8, ♀ 9.4–11.8. Length of pronotum, ♂ 1.7–2.1, ♀ 2.0–2.4. Width of pronotum, ♂ 1.3–1.5, ♀ 1.6–1.8. Length of tegmina, ♂ 9.0–16.0. Length of wing, ♂ 9.0–15.0. Length of hind femur, ♂ 4.0–5.4, ♀ 4.6–5.6. Length of hind tibia, ♂ 4.0–5.4, ♀ 5.0–5.6.

Immature stages. Nymphal stages of both sexes similar to adult female in appearance except that late instar male has large wing buds (Fig. 4). Dorsal lobes present from first instar (Fig. 11). Ootheca (Fig. 3) small, pale buff coloured, short double row of almost upright cells, thin projection at posterior end.

Distribution. Northern parts of the Northern Territory, Western Australia and Queensland, and Papua New Guinea (Fig. 20).

Remarks. The form of the dorsal lobes in the female is slightly variable but the abdominal lobe is always distinct (Figs 4–6). Although the abdominal lobe is shorter and more delicate in the male it is always present (Fig. 8). However it

may be folded down or broken off in dry specimens.

The distal process of the male genitalia shows some slight variation but a pattern is not apparent (Figs 15–19). The form of the phalloid apophysis is quite uniform in those specimens examined.

This species can be distinguished from *N. pseudomyrmex* sp. nov. by the possession of a distinct median lobe on the caudal margin of abdominal tergite 3, generally brownish colour, and a spiny knob-like projection on the phalloid apophysis in the male.

Nesoxypilus pseudomyrmex sp. nov.

Figures 7, 9, 14, 20

Material examined (4 ♂, 1 ♀).

Holotype: ♂, 14°49′S, 125°50′E, Mining Camp, Mitchell Plateau, Kimberley District, WA, 9–19 May 1983, D.C.F. Rentz and J. Balderson (ANIC).

Paratypes: ♂, same locality as holotype; ♂, 15°19′S, 126°32′E, Old Doongan, Kimberley District, WA, 2 Jul 1975, Common and Upton; ♀, Cape Bougainville, Kimberley District, WA, 14°05′S, 126°08′E, 7 Jun 1988, A.N. Andersen; ♂, 14°25′S, 126°36′E, CALM site 13.4, 12 km S of Kalumburu Mission, WA, 7–11 Jun 1988, T.A. Weir; 2 nymphs, 14°25′S, 126°40′E, CALM site 4.3, 14 km SE of Kalumburu Mission, WA, 3–6 Jun 1988, T.A. Weir (all ANIC).

Diagnosis. Body colour of dry specimens black, antennae with short whitish section subapically; thoracic nota with fairly well developed median lobe near caudal margin (Figs 7, 9); mesothorax sometimes with white blotch on trochantin; metathorax with whitish band on trochantins, lower corner of episternum and basisternum; fifth tarsal segment of foreleg white, other tarsal segments of all legs becoming pale proximally; tegmen of male with costal area black, discoidal area black except for white patch on mid anterior and posterior margins, anal area hyaline; wing with slight pearly iridescence, apex flushed blackish, remainder hyaline; 1st abdominal tergite with white spot near anterior corner (not apparent in male); 3rd abdominal tergite with very small, hardly noticeable, mid dorsal lobe at

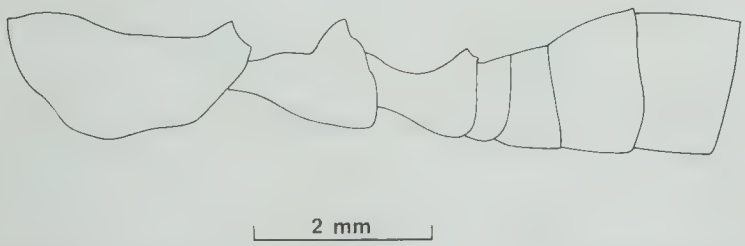


Figure 7. *Nesoxypilus pseudomyrmex* sp. nov., female nota and abdominal terga 1–4 lateral (Cape Bougainville, WA).

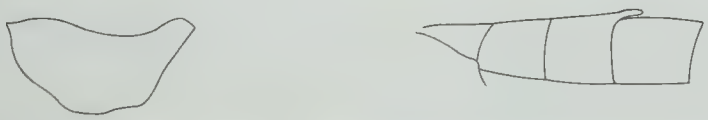
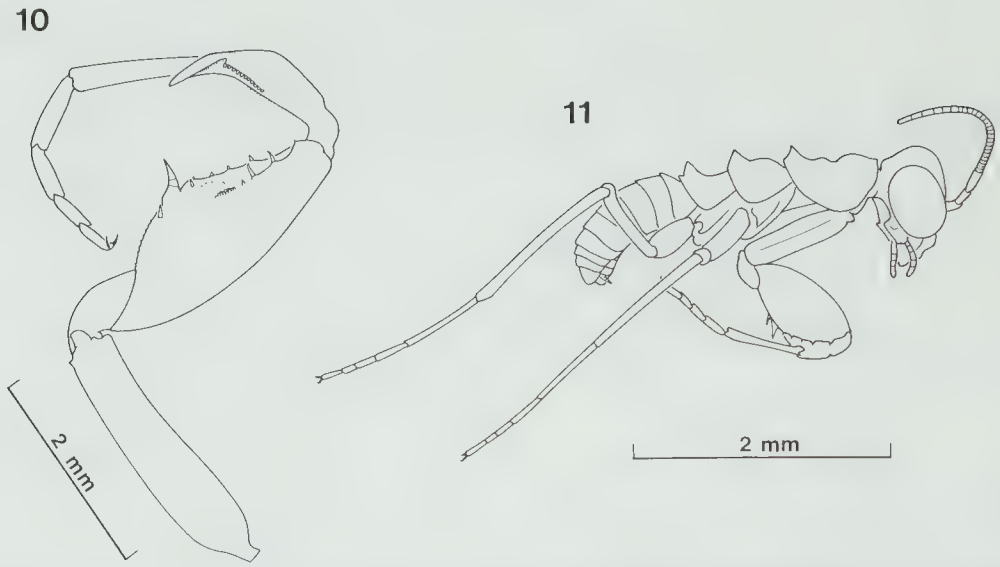


Figure 8. *Nesoxypilus albomaculatus* (Werner), male pronotum and abdominal terga 1–4 lateral (13 mi. SW of Palmer R., Cooktown Highway, Qld).

Figure 9. *Nesoxypilus pseudomyrmex* sp. nov., male pronotum and abdominal terga 1–4 lateral (Old Doongan, Kimberley District, WA).



Figures 10, 11. *Nesoxypilus albomaculatus* (Werner). Fig. 10, inside face of foreleg female. Fig. 11, 1st instar nymph lateral.

Figures 12, 13, *Nesoxypilus albomaculatus* (Werner). Fig. 12, male genitalia dorsal (left) and ventral (right) (5 km NNW of Cahills Crossing, NT). Fig. 13, male genitalia dorsal (left) and ventral (right) (Prince of Wales Is., Qld).

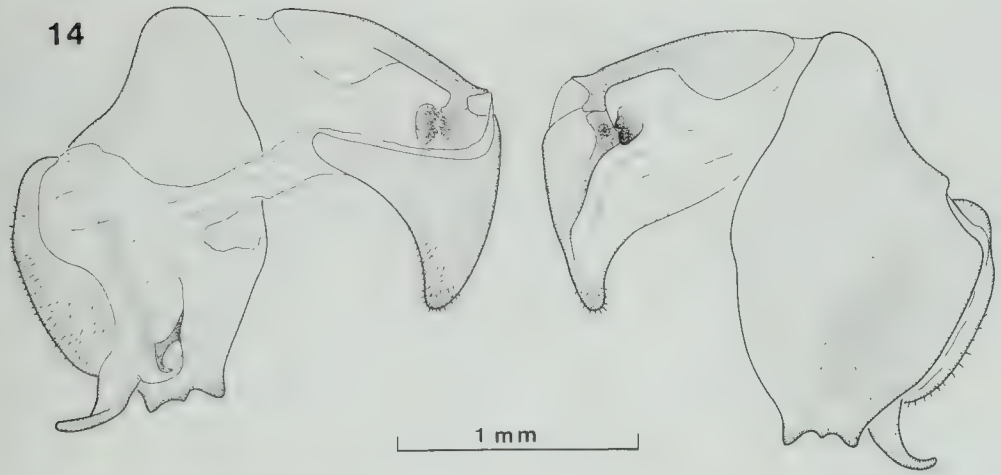


Figure 14. *Nesoxypilus pseudomyrmex* sp. nov.; male genitalia dorsal (left) and ventral (right) (Old Doongan Kimberley District, WA).

Figures 15–19. *Nesoxypilus albomaculatus* (Werner), distal process of male genitalia dorsal. Fig. 15, 8 mi. ESE of Tindal, NT. Fig. 16, Rimbija Is., NT. Fig. 17, 9 mi. S of Barcaldine, Qld. Fig. 18, 5 km W of Innot Hot Springs, Qld. Fig. 19, 15 km W of Irvinebank, Qld.

caudal margin (Figs 7, 9); 5th abdominal sternite of female apparently lacking white band on anterior margin; 7th, 8th and 9th abdominal tergites of female with whitish patch near outer margin, 10th whitish on lateral margin, forming short whitish band; cerci whitish. Male genitalia with phalloid apophysis lacking projections (Fig. 14).

Measurements (in mm). Length of body ♂ 10.6–10.8, ♀ 11.8. Length of pronotum, ♂ 2.0–2.1, ♀ 2.7. Width of pronotum, ♂ 1.4–1.5, ♀ 2.0. Length of tegmen, ♂ 10.6–11.0. Length of wing, ♂ 9.2–9.6. Length of hind femur, ♂ 5.2–5.5, ♀ 6.0. Length of hind tibia, ♂ 5.2–6.2, ♀ 6.5.

Immature stages. Late instar nymphs similar to adult female in appearance except that male has large wing buds. Ootheca unknown.

Etymology. Specific epithet from the Greek *pseudos* meaning false and *myrmex* meaning ant.

Distribution. Recorded only from the Kimberley district in Western Australia (Fig. 20).

Remarks. This species is very similar to *N. albomaculatus* but can be distinguished by the extreme reduction of the third abdominal dorsal lobe, black colouration and lack of any projections on the phalloid apophysis of the male. The measurements indicate that the mid and hind legs are relatively longer. However, more specimens are needed to judge whether this is a constant feature.

Discussion

Members of this genus are sometimes found running on the ground close to the foraging trails of ants of the genus *Rhytidoponera*. Their resemblence to these ants, both physical and behavioural, is quite remarkable. It is probable that this resemblance is an advantage to *Nesoxypilus*, enabling them to hunt actively without being attractive to potential predators. It seems unlikely that they actually feed on the ants as their raptorial forelegs appear too small to handle them, but they may benefit by preying on smaller insects disturbed by the foraging ants.

The white markings on the body of *Nesoxypilus* are curious as the ants, presumably the models, do not have corresponding markings. Matthews (1976) suggested these markings mimic the highlights on the body surface of the

Figure 20. Distribution of *Nesoxypilus* species.

ant. This may be true for the dorsal abdominal markings although they possibly also serve to camouflage the cerci. It is more likely that the thoracic, ventral abdominal and tegminal white markings serve to give the body a more distinctly segmented appearance, similar to that of ants. The white band on the antennae may serve to attract attention to the ant like movements of these organs.

Beier (1965) stated that this genus belonged to the paraoxypiline genus group with unarmed forecoxae and that its closest relative was the principally Australian genus *Phthersigena* Stäl without giving any reasons for this judgement. While this is likely, a more thorough study of the Paraoxypilinae is required before the relationships of *Nesoxypilus* can be arrived at with any certainty.

Giglio-Tos (1913) described another apparent ant mimic paraoxypiline genus, *Myrmecomantis*, from Australia, which has similar, though less well developed, features to *Nesoxypilus* giving it an ant-like appearance. However it can be distinguished from *Nesoxypilus* by the pronotum which has the margins distinctly tubercled or spined, by the anterior margin of the forecoxa being armed and the forefemur distinctly expanded and by both of these being coloured yellowish on the internal face.

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COCKROACHES FROM THE KRAKATAU ISLANDS (DICTYOPTERA: BLATTARIA)

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Abstract

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Literature dealing with cockroaches collected on the Krakatau Islands, since the original volcanic eruption, is reviewed and the cockroaches taken on these islands during the 1984 and 1985 expeditions to these islands are reported. Eighteen species have been recorded, but at least five of the earlier identifications are questionable or wrong. Among the new records are *Periplaneta americana* (Linn.), *Lobopterella dimidiatipes* (Bolívar), *Blattella radicifera* (Hanitsch), *Margattea nimbata* (Shelford) probably earlier reported as *Margattea ceylanica* (Saussure), *Margattea paraceylanica* Roth, and an undetermined nymph of *Balta*. A key is given to the adult cockroaches found on the four Krakatau Islands. *Margattea laxiretis* (Bolívar) is a junior synonym of *Balta notulata* (Stål).

Introduction

The cataclysmic eruption of Krakatau in 1883 left little of the original island. Since then there has been considerable interest in the redevelopment of the biota on the four islands of the Krakatau group (Rakata, Sertung, Panjang, Anak Krakatau). This paper is the result of my attempt to identify specimens of cockroaches collected by personnel from institutions in Australia, Indonesia, and the United Kingdom during 1984 and 1985 expeditions to the Krakataus.

The floral and faunal surveys of the Krakatau group following the 1883 eruption, and the recent expeditions are discussed in Thornton and Rosengren (in press). Cockroaches were first collected on Krakatau (Anak Krakatau) and Sertung (Verlaten) islands in 1908 (Dammerman, 1922:97) and later in 1919–1922, 1924, and 1929–1933 (Dammerman, 1948; also included collections from Lang Island).

I redescribe or add diagnostic characters to some of the species, and provide a key to the adults. This study adds to our knowledge of the reintroduction of cockroaches into a tropical ecosystem from a sterile base-line.

Material

The methods used for collecting the Krakatau material is given by Thornton and Rosengren (in press). The Krakatau material was borrowed from and returned to La Trobe University where it was distributed between Museum Zoologicum Bogoriense, Museum of Victoria, and the Australian National Insect Collection. In addition, specimens were borrowed through the following entomologists or assistants, from the following museums:

ANSP—Academy of Natural Sciences of Philadelphia, Philadelphia, PA, USA; Mr Donald Azuma.

BMNH—British Museum (Natural History), London, England; Mrs Judith Marshall.

ISNB—Institut Royal des Sciences Naturelle de Belgique, Brussels, Belgium; Dr P. Grootaert.

KUKJ—Kagoshima University, Kagoshima-shi, Japan; Dr J. Yukawa.

MCZH—Museum of Comparative Zoology, Harvard University, Cambridge, MA, 02138, USA.

NMWA—Natural History Museum, Vienna, Austria; Dr A. Kaltenbach and Dr Ulrike Aspöck.

RNHL—Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands; Dr Jan van Tol.

TUVA—La Trobe University, Bundoora, Victoria, Australia; Dr I.W. B. Thornton and Mr Patrick J. Vaughan.

UGMG—University of Guam, Mangilao, Guam, USA; Dr Ilse Schreiner.

UZMC—Universitets Zoologiske Museum, Copenhagen, Denmark; the late Dr S.L. Tuxen.

ZILS—Zoological Institute, Lund, Sweden; Dr R. Danielsson.

Early and Recent Identifications

Although at least eight papers record cockroaches from the Krakatau Islands, several of the more recent publications repeat earlier determinations (Table 1). Until the 1984–1985 expeditions,

Table 1. Cockroaches reported from the Krakatau Islands.

Species	Anak Krakatau	Sertung (Verlaten)	Rakata	Panjang (Lang)	Author
Blattoidea					
Blattidae					
1. *Periplaneta americana* (Linn.)	+				10
2. *Periplaneta australasiae* (Fab.)	+	+			1, 2, 3, 6, 10
3. *Blatta orientalis* Linn.	+				1, 2, 3, 6
4. *Hebardina concinna* (Haan)	+	+			6, 10
5. *Neostylopyga picea* (Brunner)	+	+	+	+	1, 2, 3, 4, 5, 6, 10
Blaberoidea					
Blattellidae					
6. *Margattea contingens* (Walker)	+	+		+	1, 2, 3, 6, 8
7. *Margattea anceps* (Krauss)	+			+	6
8. *Margattea ceylanica* (Saussure)	+				6, 7
9. *Margattea nimbata* Shelford	+				11
10. *Margattea paraceylanica* Roth		+	+	+	11
11. *Balta notulata* (Stål)	+	+	+	+	1, 3, 6, 10
12. *Balta vilis* (Brunner)	+	+	+	+	9, 10
13. *Balta* sp.		+	+	+	10
14. *Blattella radicifera* (Hanitsch)		+			10
15. *Lobopterella dimidiatipes* (Bolívar)		+	+	+	10
Blaberidae					
16. *Pycnoscelus surinamensis* (Linn.)	+	+	+		1, 2, 3, 6, 10
17. *Haanina major* (Saussure)		+	+	+	3, 6, 9, 10
Total species	12	12	8	9	

*(1) Karny in Dammerman, 1922. (2) Hanitsch, 1923a. (3) Hanitsch in Dammerman, 1929. (4) Hanitsch, 1923b. (5) Hanitsch, 1928. (6) Dammerman, 1948. (7) Bruijning, 1948. (8) Princis, 1969. (9) Yukawa et al., 1984. (10) this paper. (11) Roth, 1989.

about fifteen species were recorded but apparently some were misidentifications. Thirteen species of cockroaches were collected in 1984–1985. Not represented were the following previously reported taxa: *Blatta orientalis* Linn., *Margattea ceylanica* (Saussure), *Margattea contingens* (Walker), *Margattea anceps* (Krauss), and *Margattea humeralis* (Walker). Hanitsch (1923a: 198) listed 1 male and 4 females of *M. contingens* from Krakatau. I have seen three of these specimens and they are *Balta vilis* (Brunner). In his 1923a paper, Hanitsch agreed with Shelford's synonymy of *M. humeralis* (male from Singapore) with *M. contingens* (female from Sarawak) but later decided that these two species are valid. Princis (1969: 866) listed *M. humeralis* from Krakatau, even though none of the references given in his Catalogus record this species from that island. Princis probably listed *M. humeralis* from Krakatau because one of Hanitsch's published records of *"M. contingens"* was a male, and presumably the synonym *M. humeralis*. I have examined the types of *M. humeralis* and *M. contingens* and concluded that Shelford was correct in synonymizing them (Roth, 1989).

The records of *Margattea ceylanica* from the Krakataus probably referred to *Margattea nimbata* which has been considered to be its junior synonym, but both are valid species. The former may be restricted to Sri Lanka whereas *M. nimbata* is very widely distributed occurring in Australia (Northern Territory), Krakatau, Kei Island, Christmas Island, Thailand, Sarawak, Borneo, and Java. However, it is also possible that the Krakatau record of *M. ceylanica* was based on a misidentification of *Margattea paraceylanica* Roth, which has been found on Sertung, Rakata, and Panjang (Roth, 1989).

Although *Margattea anceps* was not taken on the 1984–1985 expeditions, its markings are sufficiently different from the other species of the genus (on the Krakataus) that it is readily identified. Its head is yellowish brown with a broad transverse dark brown band on the vertex, and the tegmina have a dark brown macula on the basal portion (Roth, 1989).

Princis (1965: 376) listed *Anaplecta javanica* Saussure from Krakatau, Sumatra, and Java. Of the 11 references listed under this species by Princis, only Karny (in Dammerman, 1922: 107) gave records from Krakatau and Verlaten Islands. However, Karny also included records from Sebesy and listed *A. javanica* only from this island. Princis probably erred in listing this species from Krakatau.

In a preliminary report, Yukawa et al. (1984) listed *Platyzosteria denini* Hanitsch (Blattidae: Polyzosteriinae) from Sertung, and *Rhicnoda* sp. (Blaberidae) from Sertung and Rakata. Both were collected in 1982 and identified by S. Asahina. I have examined these specimens and determined the former as a female of *Neostylopyga picea* and the latter as a nymph of *Haanina major*.

The following are new records for the Krakataus: *Periplaneta americana* (Linn.), *Blattella radicifera* (Hanitsch), *Lobopterella dimidiatipes* (Bolívar), *Margattea paraceylanica* Roth, *Margattea nimbata* (Shelford) (probably earlier reported as *ceylanica*) and one undetermined species, probably a *Balta* (nymphs only).

Thornton and Rosengren (in press) discussed the possible causes of changes in species complement from one survey to the next (cryptoturnover, pseudoturnover, immigration, and extinction). The biota of Anak was largely destroyed by eruptions in 1952 and the vegetation again was severely damaged in 1972 so that this island ". . .is effectively no more than about three decades old." In spite of this relatively recent destruction, six species of cockroaches have already been reintroduced, only two or three species less than the number recorded from Rakata and Panjang. The largest number of cockroach species occur on Sertung (Table 1; at least three of the twelve species listed under Anak are questionable).

Key to the cockroaches (adults only) from the Krakatau Islands

The following key includes fourteen of the species listed in Table 1. *Margattea contingens* and *M. ceylanica* are omitted because they were probably based on misidentifications. The males of these two species were recently redescribed (Roth, 1989) and both lack a tergal gland on the eighth segment, whereas the males of *M. paraceylanica* and *M. nimbata* have a tergal specialization on T8. The lateral corners of the male subgenital plate of *contingens* are produced and style-like so that there appears to be four styles rather than two as in the Krakatau species in the key.

1. Male subgenital plate with a pair of similar, elongate, cylindrical styles situated laterodistad on the subgenital plate (Figs 1A, B, 2B, 3E). Female subgenital plate with mesodistal portion valvular (Figs 1D, 3C). (Blattidae) .. 2

— Styles of subgenital plate not as above. Female subgenital plate not valvular 7

2. Tegmina fully developed or reduced, hind wings present but may be reduced or vestigial 3
– Tegmina short lateral pads, hind wings absent (e.g., Fig. 3B) 6
3. Tegmina and wings fully developed (26–36 mm long). Pronotum with a pair of large blotches usually on a lighter yellowish background (e.g., Fig. 1E) 4
– Tegmina and wings usually reduced, rarely both developed, but if they are, less than 20 mm long 5
4. Humeral area of tegmen (that portion anterior to the subcosta) yellow (♂, ♀). Hind margin of ♂ supra-anal plate subtruncate (Fig. 1A) ..... *Periplaneta australasiae*
– Humeral area of tegmina not yellow, similar to the rest of the wing cover (♂, ♀). Hind margin of ♂ supra-anal plate with a deep V-shaped excavation (Fig. 1F) ..... *Periplaneta americana*
5. Male first abdominal tergum unspecialized. Arolia subobsolete (Fig. 2D). Tegmina and wings reduced, covering only about two-thirds of the abdominal terga (♂). ..... *Blatta orientalis*
– Male first abdominal tergum with a large, dense, setal specialization medially (Fig. 3A). Arolia moderately developed. Tegmina and wings usually reduced, but sometimes fully developed (in brachypterous males and most brachypterous females, hind wings usually are smaller and narrower (vestigial) than the tegmina (Fig. 3A), but some females have wings as long as the tegmina) ..... *Hebardina concinna*
6. Arolia subobsolete (Fig. 2E). Supra-anal plate with a mediolongitudinal ridge, distal margin angulate-emarginate (Fig. 2C). Tegmina usually extend only to about middle of metanotum. (♀) ..... *Blatta orientalis*
– Arolia relatively large (Fig. 3G). Supra-anal plate not as above (Figs 3D, E). Tegmina usually shorter reaching to about hind margin of mesonotum (Fig. 3B) (♂, ♀) ..... *Neostylopyga picea*
7. Cerci long and slender, extending well beyond supra-anal plate. Legs long and slender (Fig. 10C) ..... (Blattellidae) .. 8
– Cerci short, not projecting much beyond hind margin of supra-anal plate (Figs 11B E). Legs shorter and more stocky ..... (Blaberidae) .. 14
8. Tarsal claws distinctly asymmetrical (Fig. 6C) 9
– Tarsal claws symmetrical (e.g., Figs 2D, E) 10
9. Face and pronotal disk with characteristic pattern as in Figs 6A, B. Costal veins of hind wing thickened distad (Fig. 7D). Male: supra-anal plate trigonal, apex weakly indented (Figs 7A, E); subgenital plate widely, deeply, concavely excavated, with a distinct median lobe (Figs 7B, F). Female: intercalary sclerties poorly defined, mostly hidden under ovipositor valves (Fig. 6D) ..... *Balta notulata*
– Face and vertex of head with weak markings. Pronotal disk immaculate (Fig. 8E). Costal veins of hind wing not thickened (Fig. 8H). Male: supra-anal plate very short, rectangular (Fig. 8D); subgenital plate with a deep V-shaped excavation (Fig. 8A). Female: intercalary sclerites of genitalia distinct, narrowly rectangular, oblique (Fig. 8G) ..... *Balta vilis*
10. Anteroventral margin of front femur with large spines that decrease in length distad, terminating in 3 heavy spines, becoming longer in increasing ratio (Type A_3); tarsal claws not serrated on ventral margins. In fully developed wings, costal veins of hind wing not clubbed 11
– Anteroventral margin of front femur with 1 or more large proximal spines followed by a row of piliform spinules, terminating in 2 large spines (Type B_2); tarsal claws minutely serrated on ventral margins (may be subobsolete and difficult to see). Costal veins of hind wings clubbed 12
11. Tegmina and wings fully developed, extending beyond end of abdomen. Pronotal disk with dark brown pattern as in Fig. 10A (♂, ♀). Male seventh abdominal tergum with a setal specialization (Fig. 10B) .. *Blattella radicifera*

– Tegmina reduced, not reaching beyond the third abdominal tergum; hind wings lateral, vestigial. Tegmina with a hyaline area anteromedially through which a pale mesonotal macula is visible. Second abdominal tergum with a pair of narrow, rectangular, hyaline spots. (Fig. 10C) (♂, ♀) .... *Lobopterella dimidiatipes*

12. Tegmina with a dark brown macula on basal portion (see Fig. 41 in Roth, 1989), that may extend the length of the wing cover (♂, ♀) .... *Margattea anceps*

– Tegmina without markings 13

13. Abdominal sterna pale with broad dark brown lateral borders, this colour narrower on posterior segments. Hind margin of supra-anal plate distinctly concavely indented (♂, ♀) (Figs 16, 19 in Roth, 1989). Male median genital phallomere with a pair of large spinelike structures apically (can be seen in pinned specimens if the supra-anal and subgenital plates are separated; Fig. 18 in Roth, 1989) ..... *Margattea nimbata*

– Abdominal sterna without broad dark brown lateral borders. Hind margin of supra-anal plate more shallowly concave (Figs 8, 14 in Roth, 1989) (♂, ♀). Apex of male's median genital phallomere without a pair of spinelike processes (Fig. 10 in Roth, 1989) ..... *Margattea paraceylanica*

14. Pronotum shiny blackish brown with yellowish margins anteriorly and anterolaterally (amount of yellow sometimes greatly reduced), hind margin convex (Fig. 11A). Anteroventral margin of front femur fringed with regularly placed hairs, the more proximal longest, shorter distal hairs piliform, terminating in 1 large spine (♀; this species is parthenogenetic and generally produces only females) ..... *Pycnoscelus surinamensis*

– Pronotum hyaline with dark stippling, hind margin practically straight (Fig. 11C). Anteroventral margin of front femur with some large proximal spines followed by a row of piliform spinules terminating in 2 large spines ... . *Haanina major*

Records and redescriptions of some species

Periplaneta australasiae (Fabricius)

Figure 1A–E

Periplaneta australasiae (Fab.).—Princis, 1966: 447–455 (references to biology, synonymy and records).—Roth and Willis, 1960: pl. 20 (habitus ♂, ♀).

Material examined. Anak Krakatau. (TUVA): 1 male, 1 nymph, 2 Sep 1984.

Remarks. The terminal abdominal segments of the male and the female, and the pronotal markings are shown in Figs 1A–E.

This circumtropical species has previously been reported from Krakatau and Verlaten Islands (Hanitsch, 1923a: 208; Dammerman, 1929: 112; 1948: 484) where it is found among fallen leaves and other vegetable debris.

Periplaneta americana (Linnaeus)

Figure 1F

Periplaneta americana (Linn.).—Princis, 1966:405–438 (references to biology, synonymy, and records).—Roth and Willis, 1960, pl. 19 (habitus ♂, ♀). *Material examined.* Anak Krakatau. (TUVA 6°06′S, 105°26′E, mixed forest, at light, 1 ♀, 20 Aug 1985.

Remarks. This species differs superficially from *P. australasiae* by the absence of the yellowish humeral stripe on the tegmina. The male's supra-anal plates are distinctly different between these two species (cf. Figs 1A and 1F).

This is a cosmopolitan species and one of the most important domiciliary cockroach pests. It is the first record of *P. americana* from the Krakataus.

Blatta orientalis Linnaeus

Figure 2

Blatta orientalis Linn.—Princis, 1966: 475–507 (references to biology, synonymy, and records).—Roth and Willis, 1960, pl. 4 (habitus, ♂, ♀).

Remarks. This blattid is sexually dimorphic. The male has brachypterous tegmina and wings that do not reach the end of the abdomen, whereas the female has short, lateral tegmina, and hind wings are absent. Dammerman (1948: 484) incorrectly stated that the female is apterous. Male and female

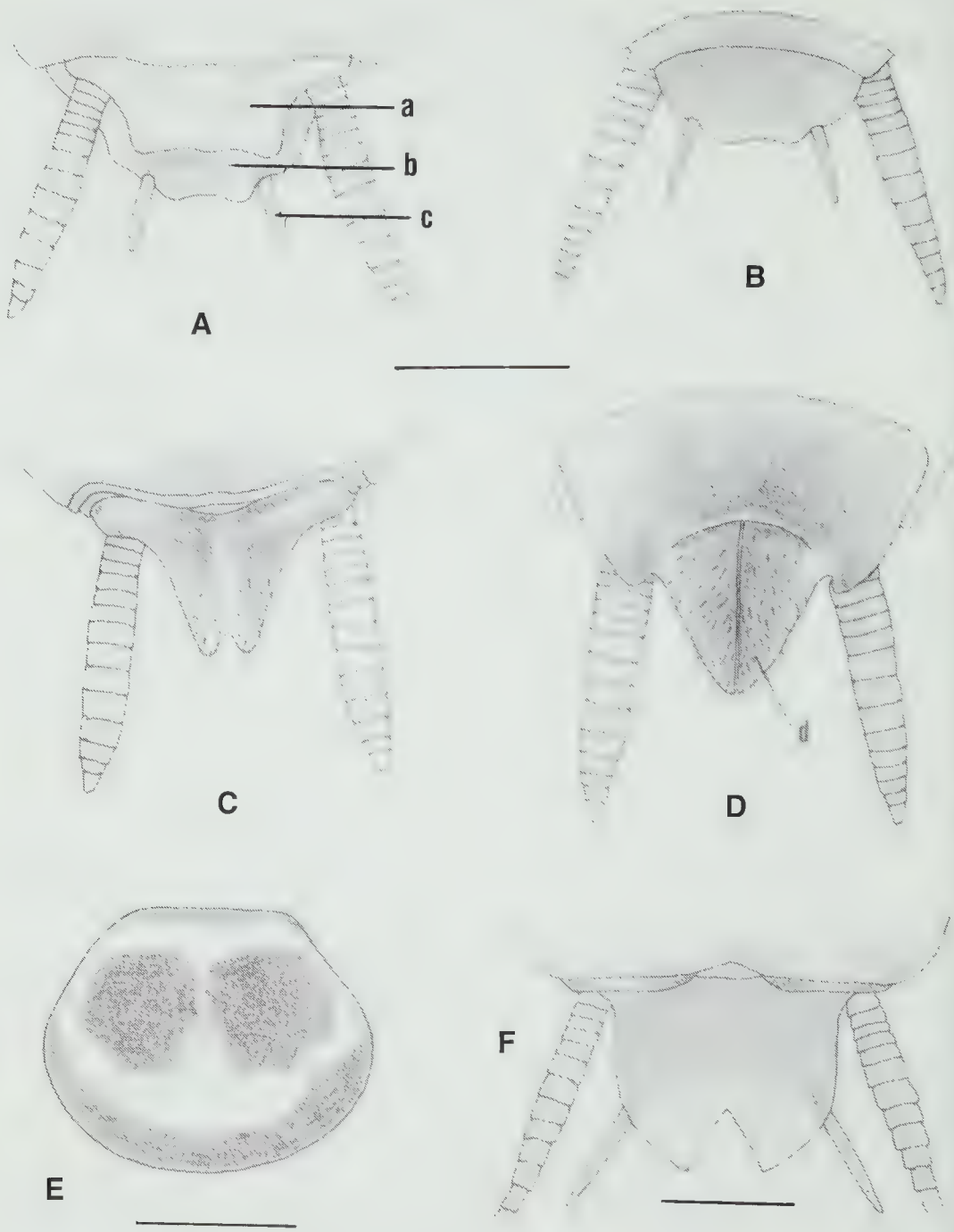


Figure 1. *Periplaneta* spp. A–E. *Periplaneta australasiae*: A, ♂ supra-anal and subgenital plates (dorsal); B, ♂ subgenital plate (ventral); C, ♀ supra-anal plate (dorsal); D, ♀ subgenital plate (ventral); E, ♂ pronotum. F, *Periplaneta americana*, ♂ supra-anal plate (dorsal). Abbreviations: a, supra-anal plate; b, subgenital plate; c, style; d, valve of last sternum. Scales (mm): A–D, 3.0; E, F, 2.0.

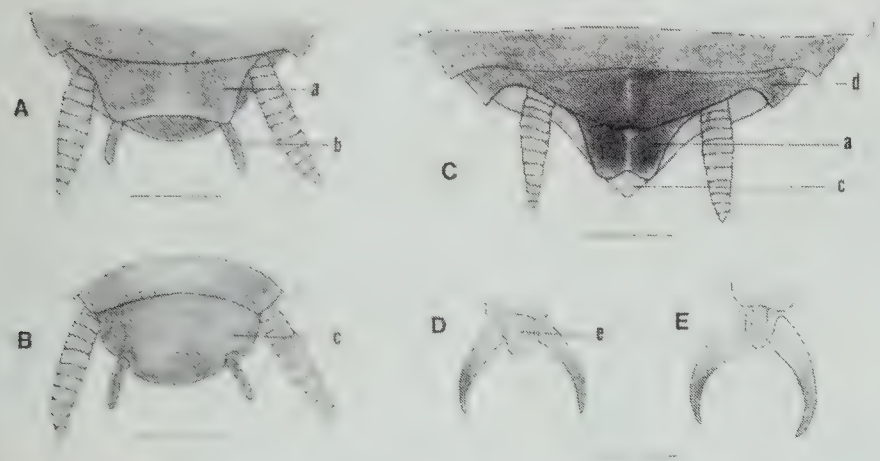


Figure 2. *Blatta orientalis*. A, ♂ supra-anal and subgenital plates (dorsal); B, ♂ subgenital plate (ventral); C, ♀ terminal abdominal segments (dorsal); D, ♂ tarsal claws and arolium; E, ♀ tarsal claws and arolium.
Abbreviations: a, supra-anal plate; b, style; c, subgenital plate; d, seventh abdominal tergum (T8 and T9 are greatly reduced and hidden under T7); e, arolium. Scales (mm): A–C, 2.0; D, E, 0.5.

terminal abdominal segments are shown in Figs 2A-C, and the reduced arolia in Figs 2D, E.

Blatta orientalis was not represented in the 1984 and 1985 Krakatau collections. It was previously reported from Krakatau by Hanitsch (1923a: 208) and Dammerman (1948: 484; this probably referred to Hanitsch's earlier record). Karny (in Dammerman, 1922: 107) listed it with a query, from Krakatau.

It seems unusual that this cosmopolitan domiciliary pest, if established on the Krakatau islands, has not been collected again since the original record. It is possible that it was misidentified and the specimen may have been *Hebardina concinna*.

Hebardina concinna (Haan)

Figure 3A

Blatta/Periplaneta concinna Haan, 1842: 50 (♂, ♀).—Hanitsch, 1915: 104, pl. 1, fig. 60 (habitus).

Hebardina concinna (Haan).—Bey-Bienko, 1938: 23, 1950: 157.—Princis, 1966:466–467 (generic changes, synonyms, records).—Asahina, 1983, pl. 1, Fig. 5A (habitus).

Material examined. Krakatau Islands. (TUVA): Anak, 1 ♀, in litter, 12 Sep 1984, 6°06′S, 105°26′E, 1 ♀, under logs, 21 Aug 1985; Panjang, 6°05′S, 105°28′E, 1 ♂, 16 Aug 1985; Rakata, Owl Bay, 6°09′S, 105°28′E, 1 ♂ nymph, 100 m, under rocks, 26 Aug 1985; Sertung, 1 ♀, 15 Sep 1984.

Sumatra. (ANSP): Guenong Soegi, Lampong, 1 ♂, Oct-Nov 1901, A.C. Harrison Jr and Dr H.M. Miller (reported by Hebard, 1929: 84).

Java. (ANSP): Tjibodas, 1400 m, 2 ♀, Aug 1921; Java, 1 ♀, C. Pictet (det. by Saussure as *Stylopyga concinna*) (reported by Hebard, 1929: 84).

India. (ANSP): Trichinopoly, Madras Presidency, 1 ♀, C. Leigh (reported by Hebard, 1929: 84); Inde méridionale, 1 ♂, under rotten wood, 4 Mar, Voy. Carl et Escher; Calcutta, zoological garden, 1 ♀, under stone, 11 Nov 1910; Kota, Naini, Tal Dist. U.P., 1 ♂, 5 May 1908, R.H.; Sasan, Kathiawar, 1 ♀, 6-7 Dec 1912.

Philippine Islands, (ANSP): Los Baños, 1 ♀, 13 Nov 1930, N. Cuevas, 1 ♀, 26 Jun 1926, J. Pegiña, 1 ♂, 26 Aug 1927, B.M. Aquanta.

Measurements (mm) (♀ in parentheses). Length, 13.0–15.0 (10.6–20.0); pronotum length × width, 3.7–4.1 × 4.8–5.5 (3.9–5.2 × 4.8–6.5); tegmen length, 8.5–15.2 (7.5–11.0).

Remarks. The tegmina in both sexes of *H. concinna* usually are reduced, but the extent of reduction varies considerably (Bruijning, 1948: 115) (Fig. 4B). In brachypterous males and most brachypterous females, the hind wings are usually much smaller (reaching to about the hind margin of the second abdominal tergum) and narrower than the tegmina, but veins are still present. Some females have wings that are about the same size as the reduced tegmina. The male illustrated by Asahina (1983, pl. 1, fig. 5A) has fully developed tegmina that extend beyond the end of the abdomen. Males have a large, densely setose medial specialization on the first abdominal tergum (Fig. 3A, arrow). The species varies considerably in size; the females tend to be larger than males but their measurements overlap (Fig. 4A).

Dammerman (1948: 484) reported *H. concinna* from Krakatau. The present records from the Krakatau Islands are the first for Panjang, and Rakata. The species is widespread and has been

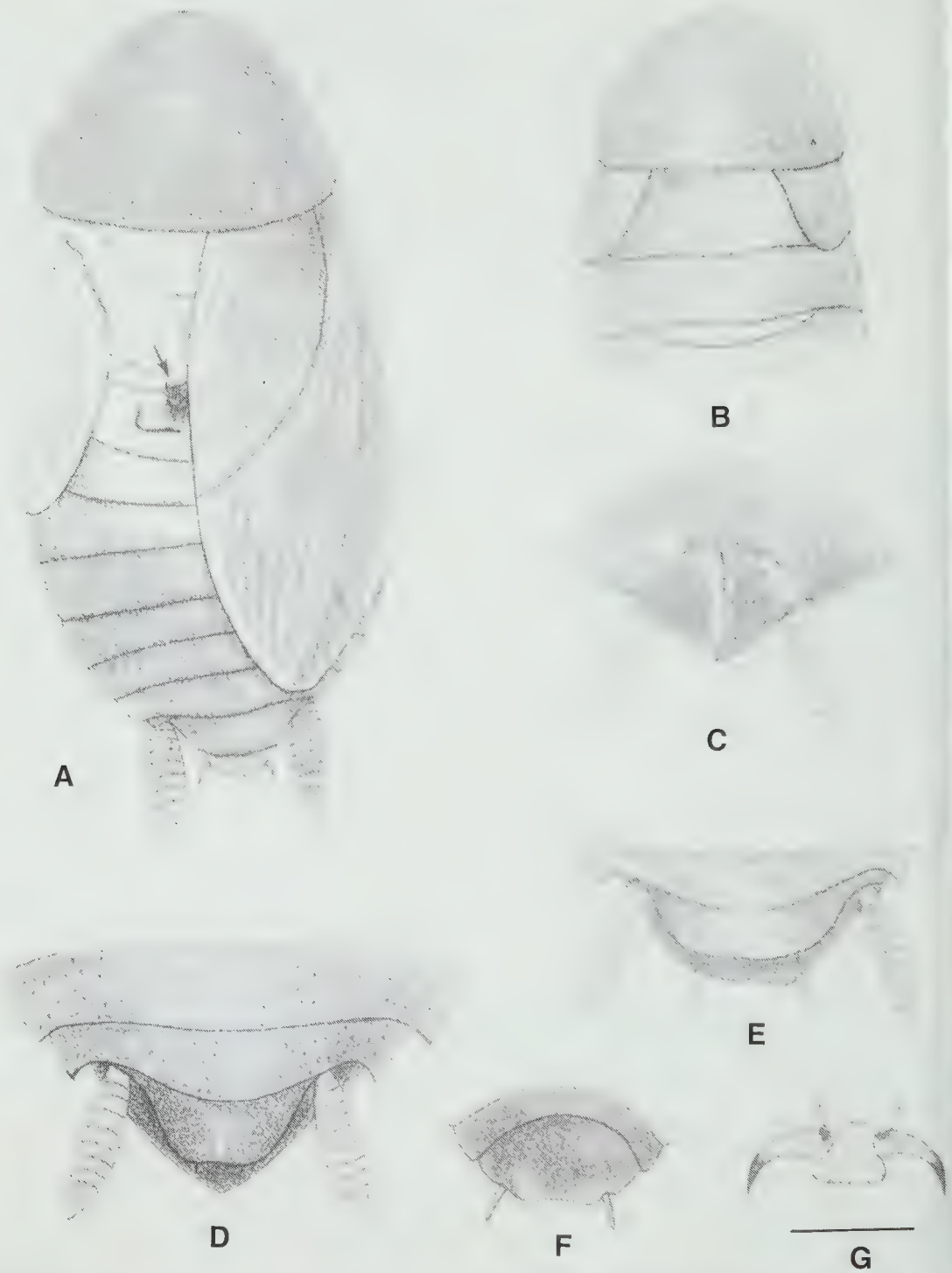


Figure 3. A, *Hebardina concinna*, ♂ habitus, from Panjang left tegmen removed to show vestigial hind wing; arrow indicates setal gland (partly hidden by right tegmen) on first abdominal tergum. B–G, *Neostylopyga picea* from Sertung: B, ♀ thorax, tegmina, and abdominal terga 1 and 2; C, ♀ subgenital plate (ventral); D, ♀ terminal abdominal segments (dorsal); E, ♂ terminal abdominal segments (dorsal); F, ♂ subgenital plate and styles (ventral); G, ♂ tarsal claws and arolium. Scales (mm): A–F, 2.0; G, 0.5.

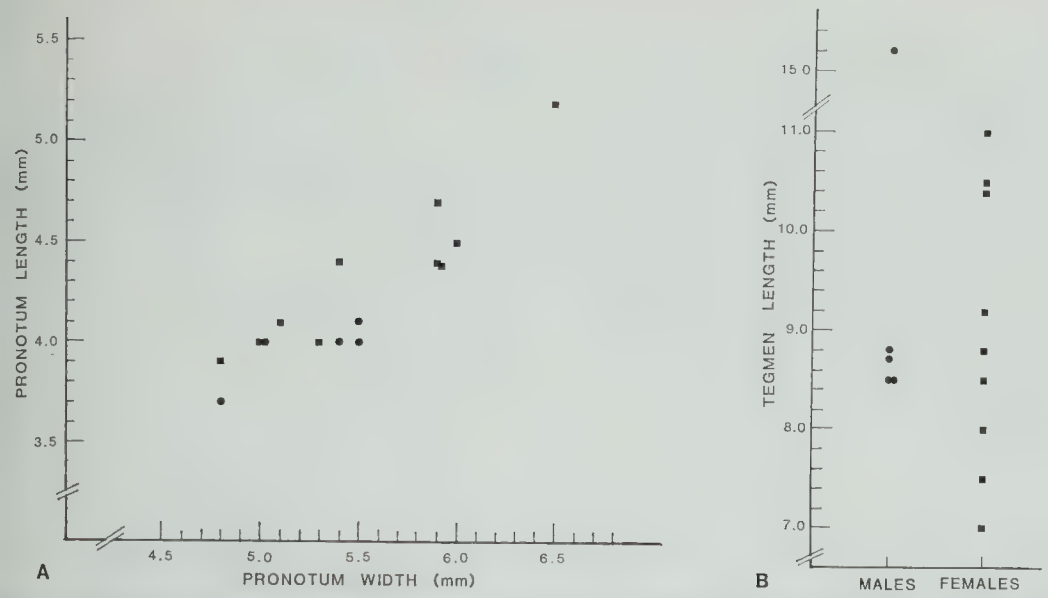


Figure 4. *Hebardina concinna*. A, variation in size of pronotum: B, variation in tegmen length. Circles = males; squares = females.

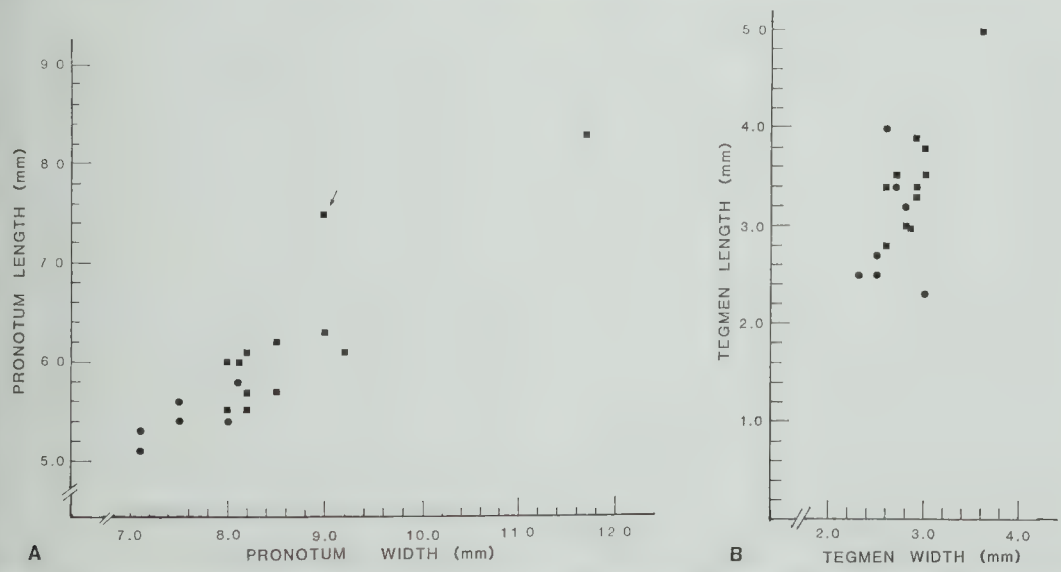


Figure 5. *Neostylopyga picea*. A, variation in size of pronotum; B, variation in tegmen size. Circles = males; squares = females; arrow indicates Brunner's measurement of the type ♀ from Sambelong Island, Nicobar group; the largest female measurements (pronotum and tegmen) are from a ♀ from Pulau Ubin.

recorded from Burma, Malakka, Sumatra, Java, and Borneo, with questionable records from India, Hong Kong, Vietnam, and the Philippines (Princis, 1966:466). The material, other than from the Krakataus, which I am reporting here shows that *H. concinna* is found in India and the Philippines. Asahina (1983:2) stated that the species occurs, but is scarce, in Thailand.

Neostylopyga picea (Brunner)

Figure 3B–G

Neostylopyga picea (Brunner).—Princis, 1966: 537–538 (references to biology, records, and generic combinations).

Material examined. Krakatau Islands. (TUVA): Anak Krakatau, 6°06′S, 105°26′E, 1 ♀ nymph, 18 Nov 1986;

Rakata, Zwarte Hoek, 6°09'S, 105°25'E, under rocks, 1 ♂, 2 ♀ (1 with ootheca), 1 ♂ nymph, 1 Nov 1984, 1 ♂ nymph, under log, 15 Nov 1984, on rotten log, 2 ♀, 1 ♂ nymph, 11 Nov 1984, Base Camp, under rock, 1 ♂, 12 Nov 1984; Panjang, 6°05'S, 105°28'E, 1 ♀ nymph, 20 Nov 1984, in litter, 1 ♀ (with partially formed ootheca), 2 ♂ and 1 ♀ nymphs, 14 Nov 1984, under logs, 2 ♂, 2 ♂ nymphs, 16 Aug 1985; Sertung, 6°05'S, 105°23'E, 1 ♀ nymph, 15 Nov 1984, under bark of dead *Ficus* on beach, 1 ♂ nymph, 11 Nov 1984, forest III, under logs, 1 ♂, 18 Aug 1985, 1 ♂, 2 ♀, 19 Aug 1985, forest II, under logs near spring, 2 nymphs, 19 Aug 1985, spit 6°04'S, 105°24-25'E, *Casuarina* under bark and logs, 1 ♂ nymph, 18 Aug 1985. (KUKJ): Sertung, 1 ♀, at light, 4 Nov 1982, J. Yukawa (reported as *Platyzosteria denini* Hanitsch, by Yukawa et al., 1984).

Pulau Ubin (Strait of Johore). (ANSP): 1 ♀, under fallen log, 25 Nov 1921, F.N. Chasen (reported by Hebard, 1929: 83).

Measurements (mm) (♀ in parentheses). Length, 16.0–18.0 (17.0–30.0); pronotum length x width, 5.1–5.8 x 7.1–8.1 (5.5–8.5 x 7.1–11.7); tegmen length x width, 2.3–4.0 x 2.3–3.0 (2.8–5.0 x 2.6–3.6).

Remarks. Both sexes of *N. picea* have short, lateral, tegminal pads, and lack hind wings (Fig. 3B). The subgenital and supra-anal plates of both sexes, and tarsal claws are shown in Figs 3C–G. This species varies considerably in size (Fig. 5), and the females tend to be larger than the males. The unusually large female came from Pulau Ubin. Hanitsch (1923a: 209) gave the measurements (mm) of female specimens from Krakatau and Verlaten Islands as: body, 30; pronotum, 11 × 12; tegmina, 3.5. The pronotal length appears to be rather long, but the size of the specimen is somewhat similar to the specimen from Pulau Ubin.

Karny (in Dammerman, 1922: 107), Hanitsch (1923a: 209; 1923b: 436; 1928: 36) and Dammerman (1922: 83; 1948: 484) reported *N. picea* from Krakatau and Sertung where it is found in humus and decaying wood. Karny (1924: 7, 8; 1925: 191) discussed reproduction of Krakatau specimens supplied him by Dammerman, and illustrated the ootheca and nymph. Dammerman (1922: 83) stated that the nearest localities to Krakatau where *N. picea* was known, were Borneo and Singapore. According to Princis (1966: 537), the species is found in Java and Sumatra, as well as Nicobar Islands, Malacca, and questionably from Thailand.

Balta notulata (Stål) comb. nov.

Figures 6, 7

Lupparia notulata (Stål).—Princis, 1969: 958 (references to biology, synonymy, generic combinations, and distribution).

Onychostylus notulatus (Stål).—Asahina, 1965, figs 11–19 (Japanese: English summary).

Margattea laxiretis Bolívar, 1924: 327 (♂).—Princis, 1969: 868. New Synonymy.

Material examined. Krakatau Islands. (TUVA): Rakata, Zwarte Hoek, in decaying wood, 1 ♀ (genitalia slide no. 5), 11 Nov 1984; Panjang, north, 6°05'S, 105°28'E, beating, 1 ♂ (terminalia slide no. 6), 1 ♂ nymph, 16 Aug 1985; Sertung, 6°05'S, 105°23'E, forest III, sweep, 1 ♀, 19 Aug 1985.

Chagos Island. (BMNH): Salomon Atoll, male holotype of *Margattea laxiretis* Bolívar, May–Dec 1905, J.S. Gardiner, Percy Sladen Trust Expedition.

Marianas Islands. (UGMG): Tinian, 1 ♀, 8 Jan 1985, C.J.P. and C.D.B.

New Caledonia. (NMWA): Bachufer südl., Oubatche, 1 ♂ (terminalia slide 48), 15 Nov 1965, Austrian/New Caledonia Exp. 1965 [reported as *Lupparia notulata* (Stål) by Princis, 1974: 515]. Oubatche is the type locality of *Margattea scripta* Chopard (type in the Basel Museum), a junior synonym of *B. notulata*.

Java. (NMWA): Sukabumi, West Java, 1 ♂, Fruhstorfer, coll. Br. v. W.

Sulawesi. (NMWA): Samanga, S. Celebes, 1 ♀, Nov 1895. H. Fruhstorfer, coll. Br. v. W.

Sarawak. (NMWA): 1 ♂ (labelled *L. hieroglyphica* Brunner, by Ruschka).

Borneo. (NMWA): 1 ♂, Pfeiffer, 893, coll. Br. v. W. [According to Kaltenbach (personal communication) this specimen may be a syntype of *Phyllodromia hieroglyphica* (a junior synonym of *B. notulata)*, provided "893" does not refer to the year of collection. Perhaps the label refers to the Australian explorer, Lady Ida Pfeiffer who arrived in Sarawak in 1851. The Natural History Museum Vienna received one part of her collection. However, Pfeiffer is a rather common name in Germany and Austria. Kaltenbach further stated that there is a "Borneo" specimen of *P. hieroglyphica* from the Novara Reise 1854–59 expedition. The label shows a faint but clearly visible locality "Taiti". This specimen (which I have not seen) certainly is a syntype of *P. hieroglyphica*, but it has no identification label.]

Papua New Guinea. ISNB: Madang, Nubia Village, 1 ♂, Jul 1981, J. Van Goethem. The following were collected by P. Grootaert: Awar bush, 1 ♂, 9 Jul 1982, 1zf, 2 Jun 1982; Laing, 1 ♂, 7 May 1982, 1 ♀, 18 Oct 1982.

Taiwan. (MCZH): "Kuraru", 1 ♀, 11 Aug 1934, L. Gressitt (labelled *Onychostylus notulatus*, by Princis dated 1960).

Description. Tegmina and wings fully developed. Hind wing with costal veins clubbed, cubitus vein with 4 complete and 0 incomplete branches, apical triangle small (Fig. 7D). Anteroventral margin of front femur with 2 or 3 large proximal spines followed by a row of piliform spinules, terminating in 2 or 3 large apical spines; pulvilli present on 4 proximal tarsomeres, arolia present, tarsal claws distinctly asymmetrical (Fig. 6C). Male: Abdominal terga unspecialized. Supra-anal plate trigonal, apex shallowly indented; right and left paraprocts

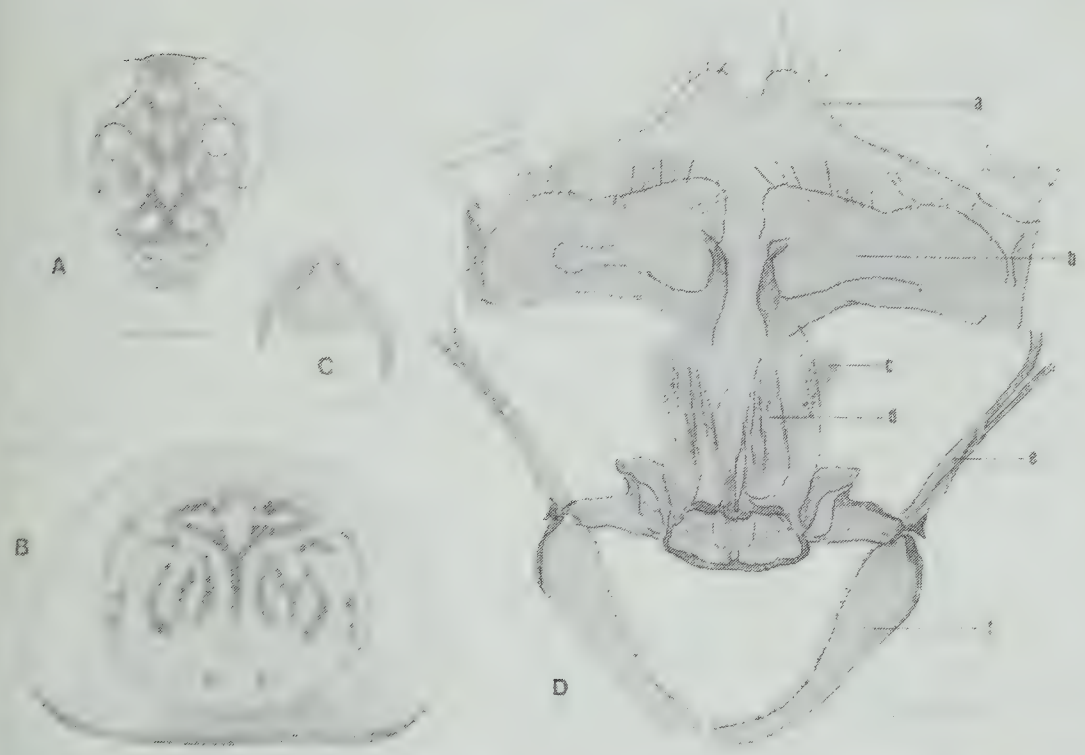


Figure 6. *Balta notulata*, ♀ from Rakata. A, head (frontal); B, pronotum; C, tarsal claws and arolium; D, genitalia (ventral).

Abbreviations: a, supra-anal plate; b, paraproct; c, intercalary sclerite; d, ovipositor valve; e, paratergite; f, first valvifer. Scales (mm): A, B, 1.0; C, 0.25; D, 0.5.

essentially similar plates (Figs 7A, E). Hind margin of subgenital plate deeply, concavely excavated with a small projecting medial lobe, styles small, bulbous (Figs 7B, F). Genitalia as in Figs 7C, G; hooklike genital phallomere on the right side (not left as claimed by Asahina, 1965, fig. 16). Female: Supra-anal plate transverse, apex deeply excavated (Fig. 6D). Genitalia as in Fig. 6D; intercalary sclerites small, mostly hidden under the ovipositor valves; paratergites bifurcated near middle; first valvifer with a fringe of setae along one margin.

Coloration. Brownish yellow. Head and pronotum with brown markings as in Figs 6A, B. Legs yellowish with small brown spots at the base of the spines and a brown spot at the base and apex of the internal surface of the anterior femurs. The pronotal and facial markings of the nymph are similar to those of the adult.

Remarks. The characteristic structures of the male from Panjang (Figs 7A–C) are similar to those of a male from New Caledonia (Figs 7E–G). The colour markings are distinctive and the male's subgenital plate with its interstylar lobe make the species easily identifiable. I have examined the male holotype of *Margattea laxiretis* Bolívar, from Chagos Island, and it is clearly *Balta notulata*.

This species has been placed in the following genera: *Allacta, Blatta, Blattella, Eoblatta, Graptoblatta, Margattea, Onychostylus, Phyllodromia*, and finally *Lupparia* (Princis, 1969: 958). Based on male genitalia characters, as well as wing venation, front femur type, tarsal claws, and subgenital plate, I believe that *B. notulata* is a species of *Balta*. *Lupparia* is very close to it but its hind wing has a more disinct apical triangle. Unfortunately *Lupparia* was based on a female from the Philippines, and I have not seen a male of the type species *Lupparia adimonialis* (Walker).

Balta notulata is very widespread (Princis, 1969: 958). Karny (in Dammerman, 1922: 107) recorded it from Krakatau, and Dammerman (1948: 483) reported it from Krakatau, Sertung and Panjang. The present female taken on Rakata is the first record from that island.

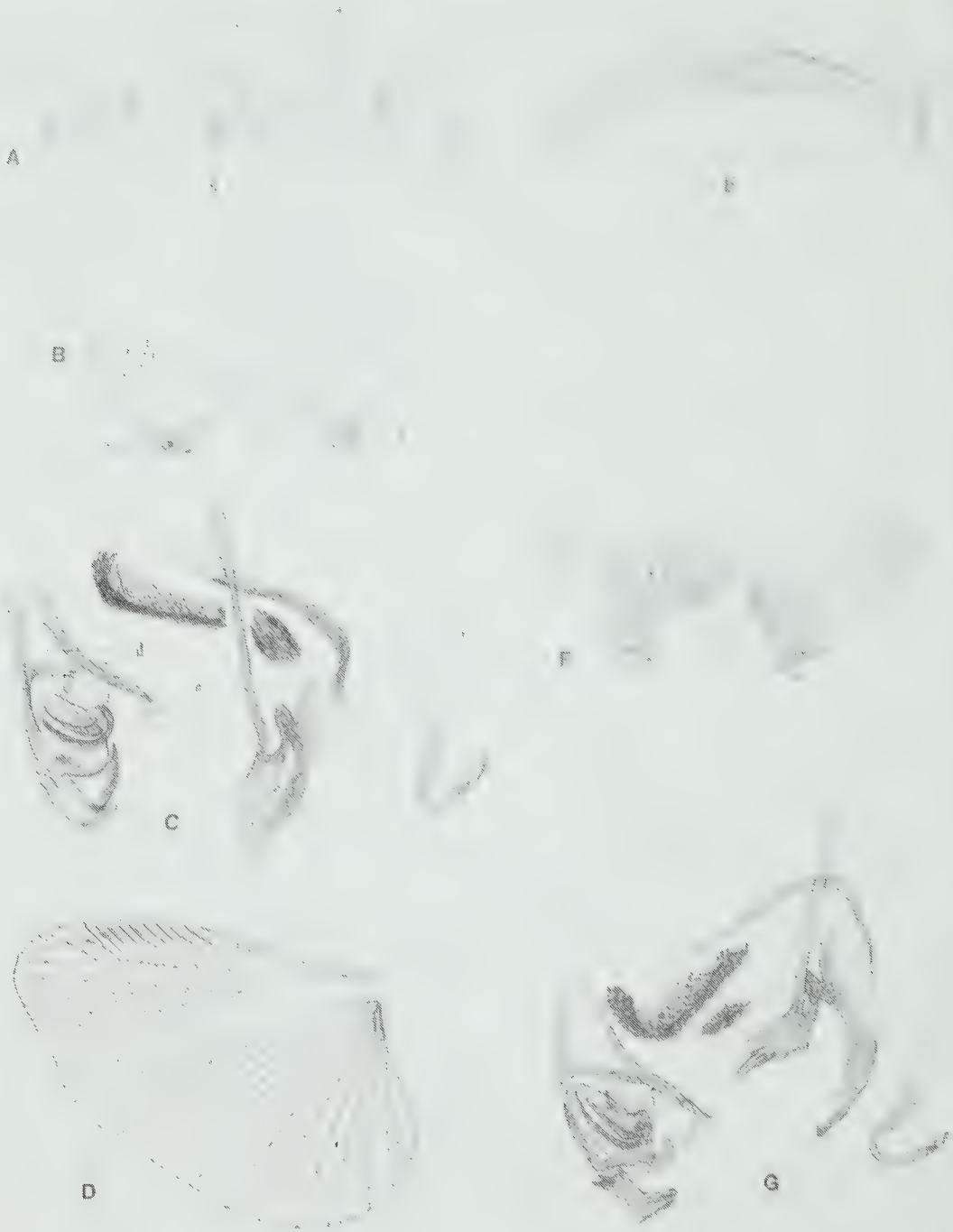


Figure 7. *Balta notulata* males. A–D, from Rakata: A, supra-anal plate and paraprocts (ventral); B, distal region of subgenital plate (dorsal); C, genitalia (dorsal); D, hind wing. E–G, from New Caledonia: E, supra-anal plate (ventral); F, subgenital plate (dorsal); G, genitalia (dorsal). Abbreviations: a, supra-anal plate; b, paraproct; c, style; d, left phallomere; e, median phallomere; f, hooklike right phallomere. Scales (mm): A–C, 0.5; D, 2.0; E–G, 0.5.

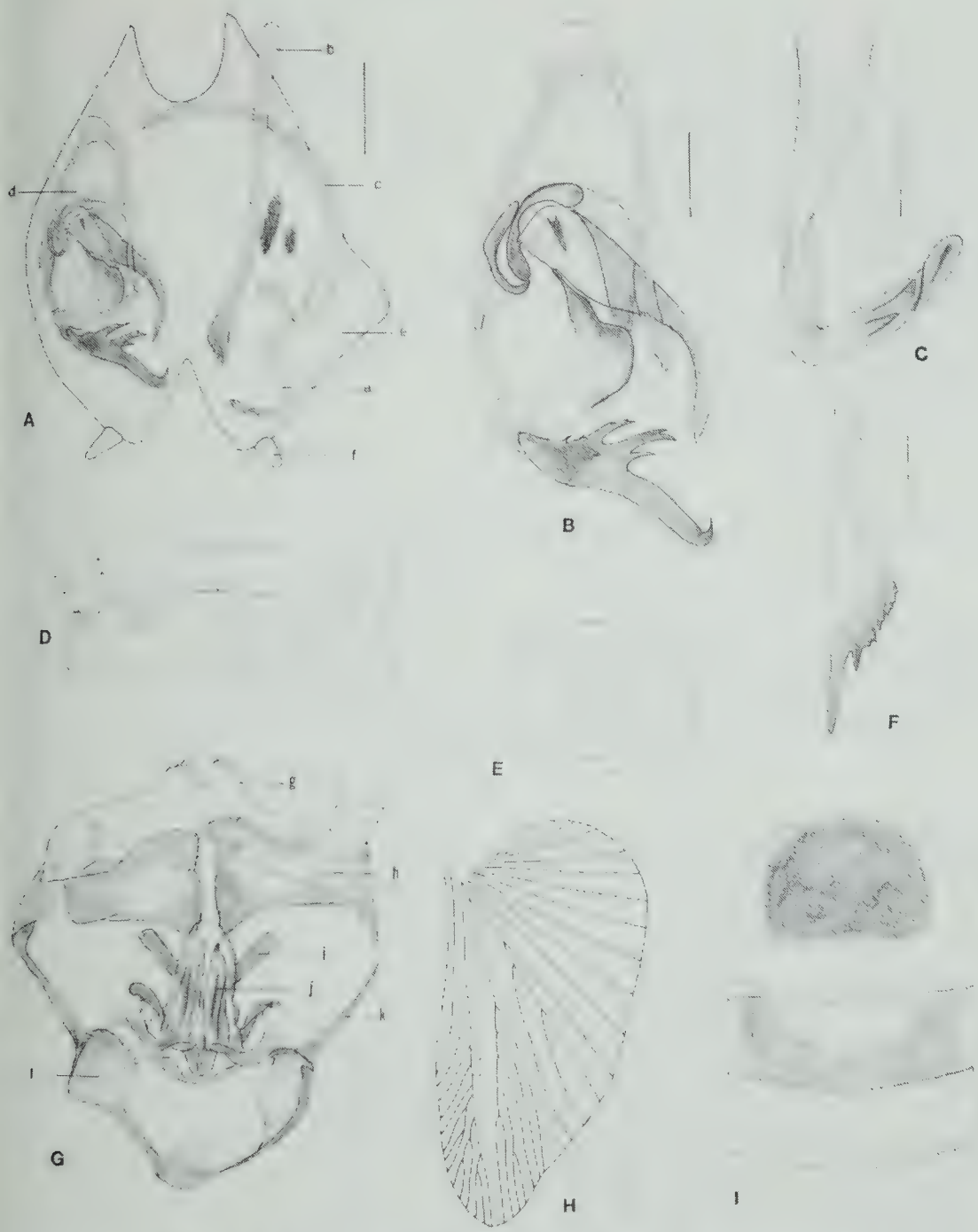


Figure 8. A–H, *Balta vilis*: A, B, ♂ from Sertung, subgenital plate and genitalia (dorsal), and left genital phallomere (dorsal). C–F, ♂ from Rakata: C, right hooklike phallomere; D, supra-anal plate (ventral); E, pronotum; F, apical region of median genital phallomere: G, ♀ from Anak, genitalia (ventral); H, ♂ hind wing. I, *Balta* sp., nymph from Panjang, pro-, meso-, and metanotum.

Abbreviations: a, hooklike right phallomere; b, median phallomere; c, accessory median phallomere; d, left phallomere; e, subgenital plate; f, style; g, supra-anal plate; h, paraproct; i, intercalary sclerite; j, ovipositor valve; k, paratergite; l, first valvifer. Scales (mm): A, 0.5; B, 0.25; C, 0.15; D, 0.5; E, 2.0; F, 0.15; G, 0.5; H, 2.0; I, 0.5.

Figure 9. *Balta vilis*. A, ♂ from Macassar (type locality), subgenital plate and genitalia (dorsal); B, ♀ holotype, supra-anal plate, and first valvifer of genitalia (ventral). Scale (mm): 0.5.

Balta vilis (Brunner) comb. nov.

Figures 8, 9

Onychostylus vilis (Brunner).—Asahina, 1965: 12, figs 20–26 (♂, ♀) (Japanese: English summary).

Lupparia vilis (Brunner).—Princis, 1969: 960 (references to synonymy, generic combinations, and distribution).

Material examined. Macassar. (NMWA): Female holotype of *Phyllodromia vilis* Brunner (genitalia slide 53), coll. Br. v. W. labelled *Onychostylus vilis* (Br. W.), by Princis, 1961; 1 ♂ (terminalia slide 54), coll. Br. v. W. [with the following labels: *Phyllodromia vilis* Brunner, labelled by Brunner; *Onychostylus vilis* (Brunner), labelled by Princis dated 1961; *Lupparia vilis* (Brunner)].

Krakatau Islands. (TUVA): Rakata, Zwarte Hoek, base camp, 1 ♂ (terminalia slide 1), 1 ♀, 12 Aug 1984; Anak (6°06′S, 105°26′E), mixed forest, 1 ♂, 20 Aug 1985, ex litter, 1 ♀ (genitalia slide 2), 10 Sep 1984, at light, 1 ♂, 15 Aug 1985, N. Foreland, 1 ♀, 28–29 Sep 1986, Malaise, camp, 1 nymph, 13–19 Aug 1985, 1 nymph, 22 Aug 1985, 20 nymphs, saccharum bait, 15 Aug 1985, 1 nymph, beat *Casuarina*, 1 nymph, 15 Aug 1985, 27 nymphs, beat broad leaved plants, 21 Aug 1985, 1 nymph, beat grass, 21 Aug 1985; Panjang, 6°05′S 105°28′E, 1 nymph, 16 Aug 1985; Sertung, spit, casuarinas, 11 nymphs, 8 Aug 1985, 10 m, 1 ♂ nymph, 12 Nov 1984. (KUKJ): Sertung, 1 ♂ (terminalia slide 1), at light, 9 Nov 1982, J. Yukawa (det. as *Onychostylus vilis*, by Asahina). (RNHL): Krakatau, 1 ♀, Sep 1920 (labelled *Phyllodromia contingens* Wlk.), 1 ♀, (abdomen missing), Dec 1919, Mus. Btzg., no. 6, 1 ♀, Sep 1920 (both labelled *Margattea contingens* Walk. by Hanitsch).

Description. Tegmina and wings fully developed. Costal veins of hind wings not clubbed, cubitus vein with 2–5 complete (1 or more bifurcate) and 0 incomplete branches, apical triangle small (Fig. 8H). Anteroventral margin of front femur with 1 large proximal spine followed by a row of piliform spinules and terminating in 3 distal spines (Type B_3; 1 specimen which lacked the abdomen has Type B_3 with 2 and 4 large proximal spines, the number being different on the two femurs); tarsal claws strongly asymmetrical, pulvilli and arolia present. Some specimens lack large proximal spines and have a row of piliform spinules only terminating in 3 large spines (Type C_3). Male: Abdominal terga unspecialized. Supra-anal plate transverse, rectangular, hind margin entire or essentially so; right and left paraprocts, broad similar plates without spinelike processes (Fig. 8D). Subgenital plate with a deep V-shaped excavation, styles small, similar, cylindrical, each located laterad to the V (Fig. 8A). Genitalia as in Figs 8A, B, C, F, 9A; genital hook on the right side (not left as claimed by Asahina, 1965: fig. 24); shape and number of spinelike processes on the left phallomere are variable. Female: Supra-anal plate transverse, a broad median area produced, hind margin medially excavated forming a pair of small, apically rounded lobes (Figs 8G, 9B). Genitalia as in Fig. 8G; intercalary sclerites V-shaped, lightly sclerotized, partly hidden under the ovipositor valves; first valvifer swollen basally (Fig. 8G) or enlarged unevenly along its full length (Fig. 9B, lower). Three females have one front femur Type B_3 (with 1 large proximal spine), and the other femur Type C_3. The female holotype has Type B_3 with 4 large proximal spines (only 1 femur present).

Coloration. Yellowish brown. Vertex of head with a light brown band, and a light transverse band between the top of the antennal sockets, face with 2 small dots near the antennal sockets and a band between them. Pronotum with broad lateral areas hyaline, disk essentially without markings (Fig. 8E).

Nymphs. Some of the nymphs have faint head markings similar to those of the adult. Front femurs Type B_3, C_2 or C_3.

Measurements (mm) (♀ in parentheses; measurements in brackets refer to ♂:♀ holotype, both from Macassar). Length, 11.0–11.5 (9.0–10.5) [9.8:9.3]; pronotum length × width, 2.5–2.6 × 3.8–4.0 (2.6–2.7 × 3.7–4.2) [2.6 × 4.0: 3.0 × 4.5]; 10.5–11.0 (9.5–10.8) [10.7:9.9].

Remarks. This species apparently varies in femur type. The shapes of the first valvifer of the holotype, and the left genital phallomere of the male from Macassar differ somewhat from these structures in the specimens from the Krakatau Islands. I believe these differences are simply variations of a single species, *B. vilis*.

Balta vilis is easily differentiated from *notulata* (the only other species of adult *Balta* so far recorded from the Krakataus) by differences in colour markings on the head and pronotum, and shapes of the male supra-anal and subgenital plates, and male and female genitalia.

Like *B. notulata*, this taxon is widely distributed and has been reported from Iwo Jima, China, Thailand, Malacca, Java, Randja, Komodo, Sumba, Sumbawa, Timor, and Wetar (Princis, 1969:960). Hanitsch incorrectly reported the species as *Margattea contingens*, from Krakatau. It now occurs on all four Krakatau Islands.

Balta sp.

Figure 8I

Material examined. Krakatau Islands. (TUVA): Panjang (6°05′S, 105°28′E), central, beat, 3 nymphs, under bark, 1 nymph, 17 Aug 1985, sweep, 1 nymph, 16 Aug 1985, 5 nymphs, 16 Aug 1985, 200 ft, beating, 1 nymph, 14 Sep 1984, north, beating, 1 nymph, 20 Sep 1984; Rakata, S. face, 200 m, 2 nymphs, 24 Aug 1985, 50–100 m, 3 nymphs, 26 Aug 1985, 20–50 m, 1 nymph, 25 Aug 1985, Zwarte Hoek, sweep, 1 nymph, 31 Aug 1984, litter, 1 nymph, 12 Sep 1984, beating 1 nymph, 15 Sep 1984, W. ridge, 850 ft, beating, 1 nymph, 16 Sep 1984, Malaise, 1 nymph, 19 Sep 1984; Sertung (6°05′S, 105°23′E), 1 nymph, Sep 1984, forest, beating, 100 ft, 1 nymph, 250 ft 1 nymph, 11 Sep 1984, forest III, east ridge, 4 nymphs, under logs, bark, 1 nymph, 19 Aug 1985, forest I, beating, 3 nymphs, 18 Aug 1985, forest II, beating, near spring, 2 nymphs, 18 Aug 1985, spit, transit zone (6°04′S, 105°24–25′E), beating, 1 nymph, 18 Aug 1985, forest south, east ridge, 6°05′S, 105°23′E, 1 nymph, 27 Sep 1986.

Remarks. The above nymphs are all small (early instars) and strikingly marked. The head is dark brown except for a whitish band on the vertex, and the pro-, meso-, and metanota are marked with brown as shown in Fig. 8I. The abdominal terga are speckled with brown. I consider these immature specimens to be a *Balta* because their front femur is Type C, and the tarsal claws are asymmetrical; so far *Balta* is the only genus on the Krakataus with asymmetrical tarsal claws. It seems unusual that no adults were collected, although nymphs apparently were abundant. Adults should be examined to confirm my provisional determination. The colour markings of the nymphs are distinctly different from those of *notulata* (nymphal markings similar to their adults) and *vilis* (pronotal disk without distinctive markings).

Margattea ceylanica (Saussure)

Margattea ceylanica (Saussure).—Princis, 1969: 862.—Roth, 1989: 211, figs 1–7 (♂, ♀).

Remarks. This species appears to be restricted to Sri Lanka and all of the localities other than this island, listed by Princis (1969) probably refer to *Margattea nimbata* Shelford which was considered to be a junior synonym of *M. ceylanica*.

Margattea paraceylanica Roth

Margattea paraceylanica Roth, 1989: 213, figs 8–14 (♂, ♀).

Remarks. This species was collected in Rakata, Panjang, and Sertung, on the 1984–1985 Krakatau expeditions. The males have a setal gland on T8 which is absent in *M. ceylanica*.

Margattea nimbata (Shelford)

Margattea nimbata (Shelford).—Princis, 1969: 863 (incorrectly listed as a synonym of *M. ceylanica*).—Roth, 1989: 215, figs 15–26 (♂, ♀).

Remarks. Until recently, *M. nimbata* was a junior synonym of *M. ceylanica* but the male and female genitalia differ strongly and both are valid taxa. Whereas *ceylanica* so far is limited to Sri Lanka, *M. nimbata* occurs on Krakatau, Northern Territory (Australia), Kei Island, Christmas Island, Thailand, Sarawak, Borneo (Kalimantan), and Java (Roth, 1989).

Margattea anceps (Krauss)

Margattea anceps (Krauss).—Princis, 1969: 864.—Roth, 1989: 220, figs 36–46 (♂, ♀).

Remarks. The dark brown macula on the tegmina distinguishes this species from the other species of

Margattea in the Krakataus. This species was not collected on the 1984–1985 expeditions to the Krakataus, but was listed for Krakatau by Dammerman (1948: 483). The type locality of *M. anceps* is Java (Tjibodas) but Princis (1969:864) listed other localities, namely Malacca, Sumatra, Mentawi Islands, and Borneo. However, these localities are, for the most part, based on *Margattea nigrovittata* (Hanitsch) which Hanitsch claimed was a junior synonym of *M. anceps*. I have seen the type of *M. nigrovittata* and it is clearly a valid species distinctly different from *M. anceps* (Roth, 1989).

Blattella radicifera (Hanitsch)

Figures 10A, B

Symploce radicifera (Hanitsch).—Princis, 1969: 881.
Blattella radicifera (Hanitsch).—Roth, 1985: 106, figs 56E, F, 59A-G, 60A-F.

Material examined. Sertung. (TUVA): 2 ♀ (one with genitalia slide 8), 15 Sep 1984, forest III, 6°05'S, 105°23'E, sweep, 1 ♂, 1 nymph, under logs, bark, 19 Aug 1985.

Remarks. This species was redescribed by Roth (1985). The male of *B. radicifera* is readily distinguished from other blattellids in the Krakataus by the setose gland on the seventh abdominal tergum, the shape of the supra-anal plate, and the cylindrical styles which are close together and located to the left of the midline on the hind margin of the subgenital plate (Fig. 10B). The markings on the adult pronotum (Fig. 10A) may vary. The nymph has dark longitudinal pronotal bands characteristic of immature specimens of *Blattella* spp. (e.g., *Blattella germanica*).

This is a rather common and widely distributed species having been recorded from Borneo, Java, Laos, Malaysia, Sabah, Sarawak, South Vietnam, Sumatra, and Thailand. The present specimens from Sertung are the first from the Krakataus.

Lobopterella dimidiatipes (Bolívar)

Figure 10C

Loboptera dimidiatipes (Bolívar).—Zimmerman, 1948: 89, fig. 43.—Chopard, 1924: 319, fig. 27, pl. 3, fig. 2 (as *Temnopteryx bimaculata* Chopard).—Hanitsch, 1932: 72, fig. 13 (as *Scabina transversa* Hanitsch).—Hebard, 1933: 121.—Fullaway and Krauss, 1945: 35, pl. 2, fig. 14 [as *Loboptera sakalava* (Saussure and Zehntner)].
Lobopterella dimidiatipes (Bolívar).—Princis, 1957: 145.—McKittrick, 1964, figs 68A, B.—Gurney and Roth, 1966: 196, figs 5, 6, 21.—Roth, 1968, figs 112–114.—Princis, 1969: 856.—Asahina, 1973: 124, figs 4–8, 16–18.—Roth, 1988, fig. 6A.

Material examined. Krakatau Islands. (TUVA): Sertung, rainforest litter, 1 ♂, 11 Sep 1984; Rakata, W. ridge, 280 m, water trap, 1 (abdomen missing), 22 Sep 1984; Rakata, Zwarte Hoek, under rocks, 1 ♀, 6 Sep 1984.

Thailand. (ZILS): Sakaerat (ASRTC site), Khorat Province, 2 ♀ reared from nymphs, 1 nymph, 12 Oct 1967, N. Kobayashi.

Description. This distinctive species (Fig. 10C) should be easily identified from the following:

Tegmina reduced in length reaching to hind margin of metanotum, width normal, apical margin oblique; hind wings vestigial, lateral. Anteroventral margin of front femur Type A_3, tarsal claws simple, symmetrical, pulvilli and arolia present. Male: Seventh abdominal tergum with a pair of minute nonsetose pits (Gurney and Roth, 1966: fig. 21; Roth, 1988: fig. 6A). Supra-anal plate broadly rounded (Asahina, 1973: fig. 5). Subgenital plate small, strongly convex, asymmetrical, deeply excavated, with styles and setose processes (Gurney and Roth, 1966: fig. 6; Chopard, 1924: fig. 27). Genitalia as in Gurney and Roth (1966: fig. 5).

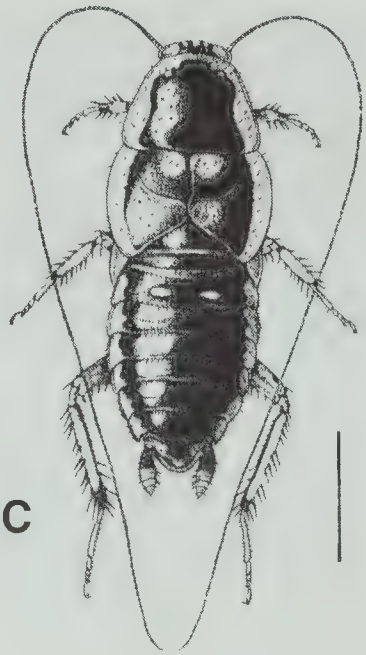
Coloration. Face blackish brown, cheeks and vertex pale, occiput dark; maxillary palps pale, fifth segment dark on basal half. Pronotum blackish brown except for narrow yellowish lateral and anterior borders. Tegmina dark brown, anterior border yellowish, a continuation of the pale pronotal border. Anteromedially on each tegmen is a hyaline area through which a pale macula on the mesonotum is visible. Metanotum with a smaller pair of pale maculae hidden by the tegmina. Abdominal terga dark brown, lateral borders pale, second tergum with a pair of narrow rectangular hyaline spots. Abdominal sterna dark brown, lateral borders pale. Cerci dorsally with slightly more than basal half dark brown, remainder pale, ventrally with basal portions of segments dark, remainder pale. Legs pale with dark brown spots as follows: coxae (anterior surface) with small basal maculae on front coxae, larger spots on basal half and smaller spots laterally on mid and hind coxae. Femur (anterior surface): basal spots on all femurs, and a distal spot as well on hind femur. Tibiae with basal and distal spots.

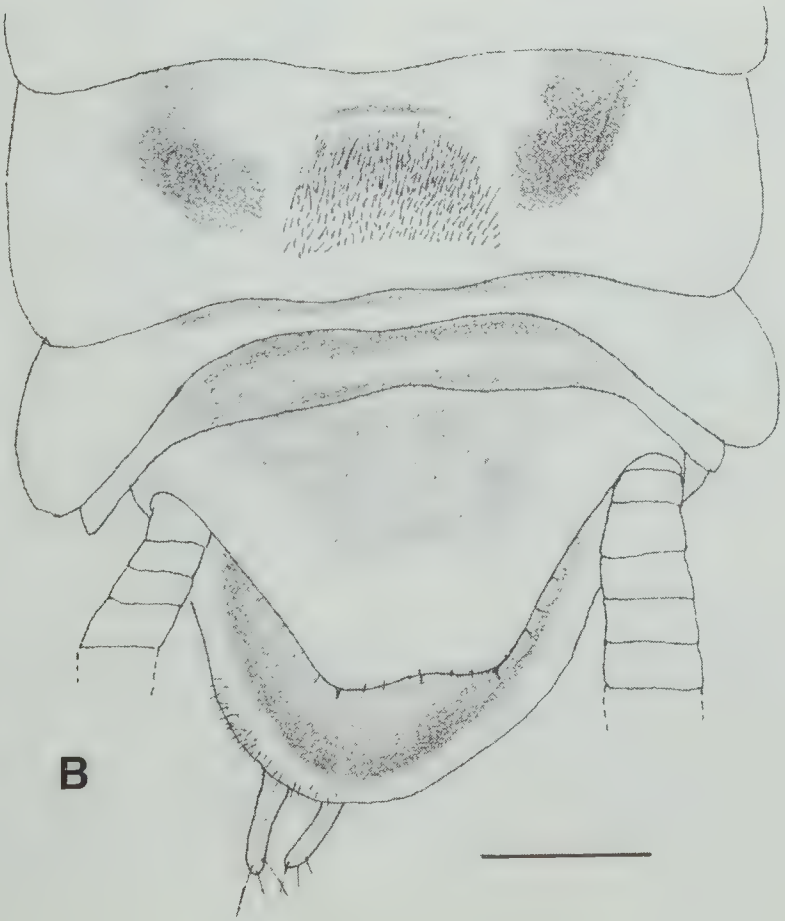
Measurements (mm). Length, 10.5; pronotum length × width, 3.0 × 4.5; tegmen length, 3.0.

→

Figure 10. A, B, *Blattella radicifera*, ♂ from Sertung: A, pronotum; B, abdominal terga 7 to 10, subgenital plate and styles (dorsal). C, *Lobopterella dimidiatipes*, ♀ (reproduced from Chopard, 1924, pl. 4, fig. 2).
Scales (mm): A, 1.0; B, 0.5; C, 3.5.


A


C


B

Female. The female essentially is similar to the male in tegmina and wing reduction, size, and colour pattern. The hind margin of the subgenital plate is rounded. Supra-anal plate trigonal, apex rounded (Asahina, 1973: fig. 8). Genitalia as in McKittrick (1964: figs 68A, B), and ootheca in Roth (1968: figs 112–114).

Remarks. In Hawaii, *Lobopterella dimidiatipes* is found on imported plants and appears to prefer wet districts where it is found under trash, stones, etc. (Fullaway and Krauss, 1945). The present record is the first for the Krakataus but the species is very widely distributed having been recorded from Hawaii, Marquesas, Tahiti, Samoa, Fiji, New Caledonia, Philippines, Sumatra, Madagascar, Seychelles, Zanzibar, Tanzania (Princis, 1969: 856), East Sumba, Flores, new Britain (Princis, 1957: 145), and from the Ryukyu Islands and southern Taiwan (Asahina, 1973: 128).

Pycnoscelus surinamensis (Linnaeus)

Figures 11A, B

Pycnoscelus surinamensis (Linn.).—Princis, 1964: 264 (references to biology, synonyms, and distribution).

Material examined. Krakatau Islands. (TUVA): Rakata, S. Fall, 400 m, 1 ♀, 24 Sep 1985, Sertung, 6°05′S, 105°23′E, forest II, under logs near spring, 1 ♀ nymph, 19 Aug 1985, under logs, 1 ♀ nymph, 18 Aug 1985, forest III, east ridge, under bark, etc., 1 ♀ nymph, 19 Aug 1985. Anak Krakatau, 6°06′S, 105°26′E, 2 ♀, 18 Sep 1986.

Diagnosis. Pronotum shining blackish brown with brownish yellow along anterolateral and anterior margins (Fig. 11A). Tegmina dark chestnut brown, marginal field yellowish brown. Colour markings vary considerably between geographical localities (see Fig. 1 in Roth, 1974). Hind margin of supra-anal plate convexly rounded and weakly indented medially (Fig. 11B). Anteroventral margin of front femur with row of slender piliform spinules only (proximal ones longer), and terminates in 1 large distal spine (Type C_1).

Nymphs deep chestnut brown to blackish chestnut brown. Head, pro-, meso-, and metanotum, and first 3 abdominal terga shiny, remaining abdominal terga dull shagreenous (see figs 4A–C in Roth and Willis, 1961).

Remarks. Pycnoscelus surinamensis was originally described from Surinam specimens, but is widely distributed in tropical and subtropical regions; in colder climates it can survive in greenhouses. It is obligatorily parthenogenetic in the New World, where males normally do not occur. It probably originated in the Sunda Islands and Malay Archipelago where it may occur in the same regions as its bisexual relative, *Pycnoscelus indicus* (Fabricius), which cannot reproduce parthenogenetically (Roth, 1967). The habitus of *P. indicus* and *P. surinamensis* are similar (see figs 5C and F in Roth and Willis, 1961: fig. 5C is *P. surinamensis* and 5F is *P. indicus*, which, at that time we considered to be a bisexual strain of *P. surinamensis).* The habitus of the nymphs of *P. indicus* and *P. surinamensis* are similar.

Pycnoscelus surinamensis is a multiclonal form composed of many genotypes that are successful invaders (Parker et al., 1977). It was previously reported from Krakatau and Sertung (= Verlaten) Islands by Karny (in Dammerman, 1922: 107), Hanitsch (1923a: 211), and Dammerman (1948: 484). The present records are the first for Rakata.

Haanina major (Saussure)

Figures 11C–F, 12

Haanina major (Saussure).—Hebard, 1929: 13.—Princis, 1967: 642 (distribution, synonymy, and generic combinations).

Material examined. Krakatau Islands. (TUVA): Rakata, base camp, 1 ♀, 12 Sep 1984, 250 m, 1 ♂, 4 Sep 1984, in litter, 850 ft, 5 nymphs, 19 Sep 1984, 1 ♀, 10 Sep 1984; Rakata, Zwarte Hoek (6°09′S, 105°25′E), at light, 1 ♂ nymph, 1–3 Sep 1984, on bush, 1 ♀ nymph, 16 Sep 1984, 1 ♂, 30–31 Aug 1984, 1 ♀, 1 Sep 1984, under rocks, 2 ♂ nymphs, 6 Sep 1984, 1 ♂ nymph, 16 Sep 1984, 1 ♂, 8 Sep 1984, in litter, 1 nymph, 12 Sep 1984; south side, beating vegetation, 1 ♂, 18 Sep 1984; Owl Bay (6°09′S, 102°28′E), beat thorny palm, 1 ♀, 26 Aug 1985, sweeping, 1 ♀ nymph, 22 Aug 1985; W. ridge, 250 m, 1 ♂ nymph, 1 Sep 1984; Sertung, in *Casuarina* litter, 2 nymphs, 11 Sep 1984; forest direct search, 6°05′S, 105°23′E, 2 ♀, 18 Aug 1985; forest I, under logs, 1 ♂ nymph, 18 Aug 1985; forest III, east ridge, beating, 1 ♂ nymph, 19 Aug 1985, sweep, 1 ♂, 1 ♀ nymph, 19 Aug 1985; spit, transit zone (6°04′S, 105°24-25′E), 1 ♂ (terminalia slide 9), 18 Aug 1985; forest, under logs, 6°05′S, 105°23′E, 2 ♀ nymphs, 18 Aug 1985; Panjang, litter in secondary rain forest, 2 nymphs, 14 Sep 1984. (KUKJ): Sertung, 1 nymph, Nov 1982, J. Yukawa (det. as *Rhicnoda* sp. by Asahina).

Nicobar Island. (UZMC): 1 ♂ (terminalia slide 3), Galathea Expedition, 1845–48 [originally reported as *H. macassariensis* (Hahn) by Princis (1951: 37), but later determined as *H. major* (Princis, 1969: 643)].

Diagnosis. Tegmina and wings fully developed reaching beyond end of abdomen, or somewhat reduced reaching to about T7 (in ♂ from Nicobar Island, Fig. 12A). Tegmina punctate except for part of right tegmen covered by left one. Anteroventral margin of front femur Type B_2 (rarely B_1), pulvilli large on 4 proximal tarsomeres, arolia large, tarsal claws simple, symmetrical. Hind margins of male

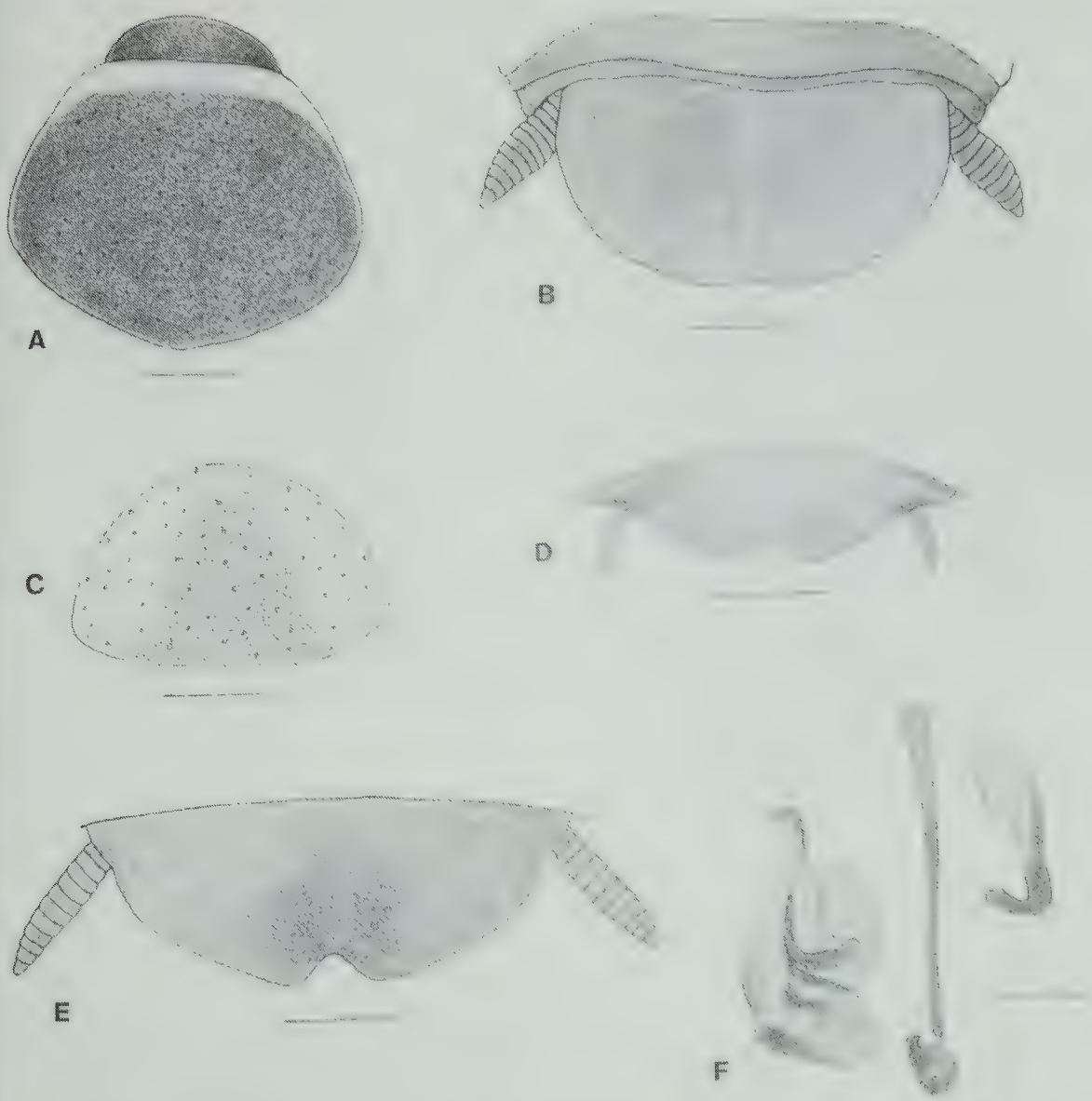
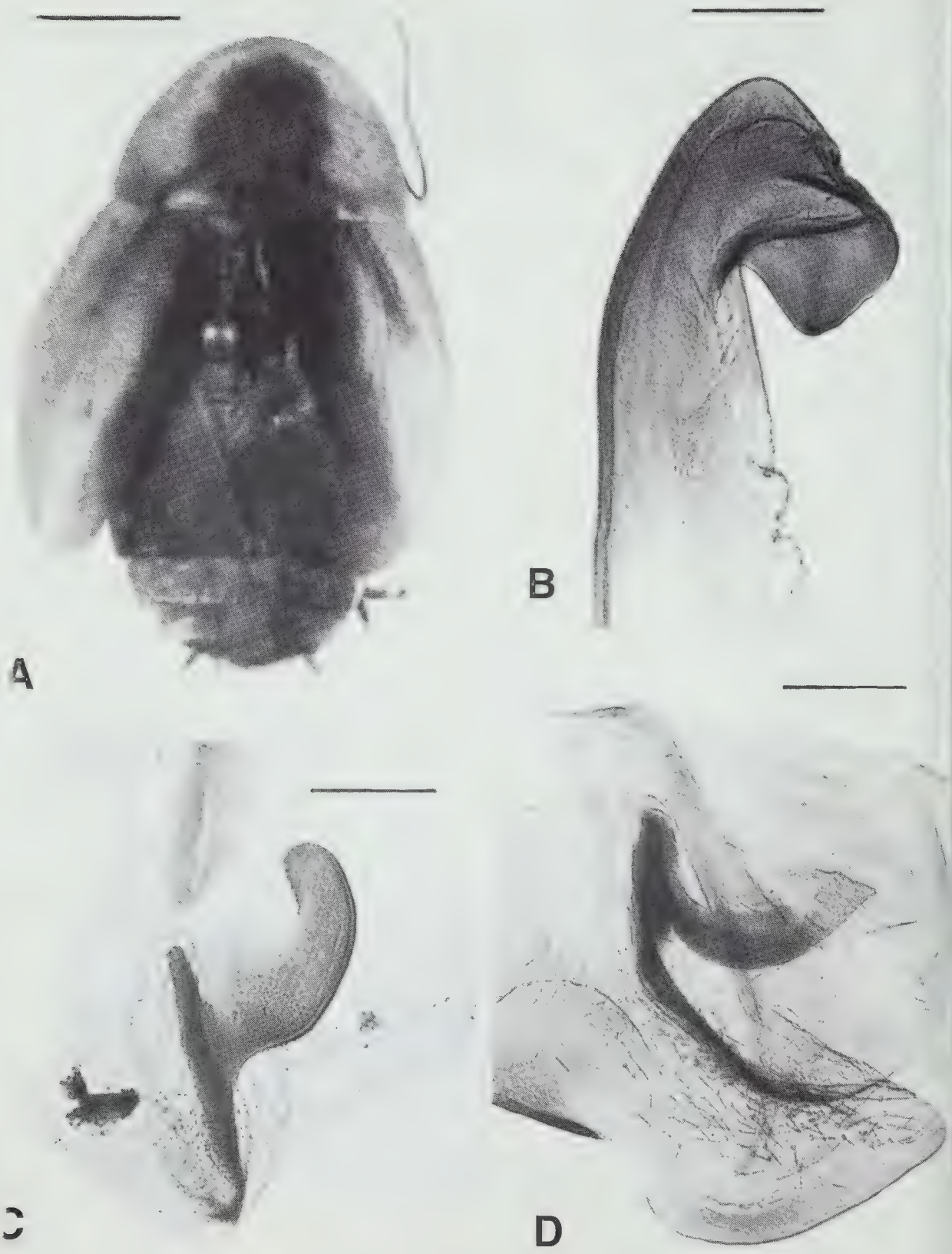


Figure 11. A, B, *Pycnoscelus surinamensis*, ♀, pronotum, and supra-anal plate. C–F, *Haanina major*, ♂ from Rakata: C, pronotum; D, subgenital plate and styles (ventral); E, supra-anal plate and cerci (dorsal); F, genitalia (dorsal). Scales (mm): A, 2.0; B, 1.0; C, 5.0; D, E, 1.0; F, 0.75.

supra-anal (Fig. 11E) and subgenital (Fig. 11D) plates medially indented. Male genitalia as in Figs 11F, 12B–D. Hind margin of female supra-anal plate indented medially, hind margin of subgenital plate convexly rounded and entire.

Coloration. Tan to light brown with reddish tinge. Head with small and large black dots between eyes becoming denser on occiput, small oblique reddish maculae near each antennal socket, and an interrupted median longitudinal streak becoming denser on clypeus, blackish maculae on genae. Pronotum translucent with fine stippling becoming denser on disk, small but larger round circles widely spaced over surface (Fig. 11C).

Measurements (mm) (♀ in parentheses). Length, 20.8–26.0 (25.0–28.0); pronotum length × width, 6.9–7.8 × 10.7–12.3 (8.1–8.6 × 12.2–13.5); tegmen length, 18.4–22.1 (22.0–23.0).


A
B
C
D

Nymph with small tubercles mostly along hind margins of thoracic and abdominal terga, giving it a roughened appearance. This differs from the smooth surface of *P. surinamensis* nymphs.

Remarks. This species has previously been reported from Sertung (Hanitsch, in Dammerman, 1929: 112; Dammerman, 1948: 483). Princis (1967: 642) listed it from Krakatau, Greater and Lesser Nicobar Islands, and Java. The present collections extend the distribution in the Krakataus to Rakata and Panjang.

Acknowledgments

I thank the curators and assistants, noted in the Material sections who sent me specimens. I am grateful to the Australian Biological Resources Study (ABRS) for partial support.

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←

Figure 12. *Haanina major,* ♂ from Nicobar Island: A, habitus; B–D, genital phallomeres: B, right hook; C, apex of median; D, left.

Scales (mm): A, 5.0; B,C, 0.2; D, 0.3.

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ACCALATHURA (CRUSTACEA: ISOPODA: PARANTHURIDAE) FROM NORTHERN AUSTRALIA AND ADJACENT SEAS

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Abstract

Poore, G.C.B. and Lew Ton, H.M., 1990. *Accalathura* (Crustacea: Isopoda: Paranthuridae) from northern Australia and adjacent seas. *Memoirs of the Museum of Victoria* 50(2): 379–402.

Eleven new species of *Accalathura* Barnard from reef and shelf environments in northern Australia and the Coral Sea are figured and described. Most are typical of the genus in the possession of narrow uropodal exopods: (*A. avena, A. eulalia, A. poa, A. spathia, A. themeda, A. triodea, A. vulpia* and *A. zoisia*); but three differ from all others in having a very broad exopod: (*A. dimeria, A. oryza* and *A. sehima*). *Accalathura barnardi* (Nierstrasz) from Indonesia is redescribed and a key to the species from the region is presented. Species from the Indian Ocean, which have often been misidentified, are discussed.

Introduction

The tropical anthuridean isopod fauna of Australia is dominated by species of the anthurid genus *Amakusanthura* Nunomura (Poore and Lew Ton, 1988) and the paranthurid genus *Accalathura* Barnard. In this contribution new species of *Accalathura* from this region are described. The genus has been recorded several times from the Indian Ocean and south-east Asia. These records are reviewed.

The genus is distinguished from all other paranthurids by the possession of a multiarticulate flagellum on both pairs of antennae. Most species are inhabitants of soft sandy or muddy sublittoral substrates but some are recorded from coral debris. The genus includes the longest anthuridean known, *A. gigantissima* Kussakin from the Southern Ocean (Poore, 1981; Wägele, 1985). Tropical species, in contrast, are of a size more typical of anthurideans generally.

Indo-west-Pacific species of Accalathura

These new species bring to 22 the number of species of *Accalathura* described. Two, possibly four, are known from the West Atlantic, one from the North Pacific, two from southern Australia, and one from Antarctic seas (Poore, 1980, 1981).

Seven species of *Accalathura* have been described or recorded from the Indian Ocean and south-east Asia but a review of published descriptions and figures suggests that some are misidentifications. A complete re-examination of all the material is beyond the scope of this paper.

The most widely reported Indian Ocean species is *A. borradailei* (Stebbing, 1904) originally described from the Maldives. It has a rounded telson and a relatively broad uropodal exopod. Records from India (Chilton, 1924; Pillai, 1966) fit this description but those from east Africa (Monod, 1972a, b) are of another species with an acute telson and narrow exopod. *Accalathura laevitelson* (Kensley, 1975), described from a manca, is similar in all critical characters and may be an appropriate name for this east African species. These records may be of the same species which Kensley (1980, 1988) reported from the same area and from Aldabra Atoll and which he referred to *A. sladeni* (Stebbing, 1910).

Accalathura sladeni was described from Cargados Carajos, north of Mauritius, and although it is similar to the material figured by Monod and Kensley (1980) there are subtle differences. In particular, the appendix masculina of *A. sladeni* is simple while that of Kensley's male has a bifid apex. It seems, therefore, that at least two similar species from the Indian Ocean have been referred to *A. sladeni* and that both are different from *A. borradailei*. The name *A. sladeni* was also used by Hale (1937) for an *Accalathura* from South Australia but this material has subsequently been described as *A. bassi* Poore, 1981. A species similar to the African one, with a bifid appendix masculina, was recorded from sou-

thern Western Australia by Thomson (1951) as *A. gigas* which it is not (Poore, 1981).

The types of three Indonesian species from the "Siboga" collections (*Katanthura barnardi* Nierstrasz, 1941, *Metanthura indica* Nierstrasz, 1941 and *M. normani* Nierstrasz, 1941) were examined by GCBP in Amsterdam in 1981. All have been placed in *Accalathura* (Poore, 1980). The types are not available for detailed illustration and only *A. barnardi* is re-illustrated in this contribution from new material. *Accalathura indica* is similar to *A. sladeni* in the possession of a digitiform palmar lobe on pereopod 1 (not triangular as figured by Nierstrasz). Kensley (1977, 1982) recorded this species from east Africa but his illustrations suggest the same species as that he called *A. sladeni* in 1980. *Accalathura normani* (Nierstrasz, 1941), described from a male, is not sufficiently well described to be easily recognised.

In summary, *A. borradailei* is definitely recorded from the Maldives and India, *A. sladeni* from Cargados Carajos, and *A. barnardi, A. indica* and *A. normani* from Indonesia. There is certainly at least one other species from East Africa and Aldabra Atoll (variously reported as *A. borradailei, A. sladeni,* and *A. indica*) which may be the same as *A. laevitelson* described from that area. The identity of a Western Australian species is also still enigmatic.

Species from Australia and adjacent seas

Many species of *Accalathura* are superficially quite similar which accounts for the misidentification of several species from the Indian Ocean. But in this contribution a new group of species is reported (*A. dimeria, A. oryza, A. sehima*) in which a very broad uropodal exopod is held erect over the telson; in all other species the exopod is linear. *Accalathura dimeria* differs from the other two in having a rounded telsonic apex and tapering propodus on pereopod 2. *A. oryza* is much smaller than *A. sehima* and differs in pereopod 2 and uropodal endopod.

The remaining species are very similar and are not easily gouped on morphological criteria. One group of species is those in which the palmar lobe of the propodus of pereopod 1 is well defined: *A. avena, A. indica, A. poa, A. triodea* and *A. vulpia.* In the remaining species the palmar lobe is poorly defined.

Two species (*A. avena* and *A. vulpia*) differ from the others in having the uropodal exopod moderately broad (2.4 to 3 times as long as broad) and not reaching the end of the peduncle. In most species the uropodal exopod is about 4 times as long as wide and exceeds the peduncle.

The telson is usually about 2.5 times as long as wide but in three species (*A. themeda, A. poa* and *A. zoisia*) it is much narrower, about 3 times as long as wide. The apex is typically acute but *A. vulpia* differs from the others in having a rounded apex, similar in some ways to the three species of the broad-exopod group in which the telson apex is very obtusely angled.

Several species are dorsally and dorsolaterally pigmented from the head to telson: *A. avena, A. dimeria, A. eulalia, A. poa* and *A. themeda.* Preserved material of the other species is not pigmented but the possibility of pigment having been lost cannot be discounted.

Similarities between species are not discussed further in this paper.

Methods

In this contribution the new species, *Accalathura themeda,* is figured and described in detail first. Except for the three species with broad uropodal exopods, there are only minor differences between this species and the rest in the shape and setation of the antennae, mouthparts, posterior pereopods, and pleopods. For these conservative characters *A. themeda* may be taken as typical of the genus (Figs 1–3). Other species have been dissected and examined in detail but only the most species-diagnostic features are figured: tailfan, telson, uropods and first, second and fourth pereopods. All limbs are from the left side and only distal articles are drawn. Illustrations are somewhat simplified. For pereopod 1, setae and the bases of the palmar spines are shown; the spines on and near the palmar lobe are drawn at a higher magnification; and the lateral setal row is not figured. On other parts only the bases of many setae are figured and long setae, e.g., on the telson and uropod have been truncated. The written diagnoses are similarly abbreviated to concentrate on important characters. When known, male characters are described.

In figures the following abbreviations are used: A1, A2, antennae 1, 2; MD, mandible; MDp, mandibular palp; MX, maxilla; MP, maxilliped; P1–P7, pereopods 1–7; PL1–PL5, pleopods 1–5; T, telson; UN, UX, uropodal endopod and exopod; AM, appendix masculina. Figures marked a or unmarked are of the holotype; those marked b are from a male paratype.

Following a pattern established earlier, the new species are named for genera of Australian plants; this time all are genera of grasses.

Material is lodged in the Museum of Victoria, Melbourne (NMV), Australian Museum, Sydney (AM), Queensland Museum, Brisbane (QM), Northern Territory Museum and Art Gallery, Darwin (NTM), Zoological Museum, Amsterdam (ZMA), and Zoological Museum, Copenhagen (ZMC).

Accalathura Barnard

Type species. Calathura crenulata Richardson, 1905.

Remarks. Poore (1980, 1981) provided a synonymy, diagnosis and description of this easily recognised genus. The diagnosis must now be expanded to accommodate variability in the uropod. The endopod may well exceed the telson not barely exceed as previously stated) and the exopod may be broad (not always narrow). The multiarticulate antennal flagella are unique within the Anthuridea and are a probable synapomorphy.

In males of *Accalathura,* as in many other anthuridean genera, the pleon, uropods and telson are more elongate than in females and juveniles. The antenna 1 flagellum consists of two types of articles; proximal, discoid articles which bear dense whorls of aesthetascs, and distal cylindrical articles which do not. Pereopod 1 is more elongate and densely setose, but pereopods 2 and 3 may also be modified with strong teeth.

Key to species of *Accalathura* from northern Australia and adjacent seas

1. Uropodal exopod not more than twice as long as broad, with a well-developed dorsal lobe, not reaching to end of peduncle; pereopod 1 with palmar lobe defined by a right angle 2
— Uropodal exopod more than 2.4 times as long as broad, without a dorsal lobe, reaching to end of peduncle or not; pereopod 1 with palmar lobe defined by a right angle or obtuse angle 4
2. Uropodal endopod exceeding end of telson; apex of telson obtusely angled 3
— Uropodal endopod reaching as far as telson; apex of telson rounded . ..... *A. dimeria*
3. Pereopod 2 propodus oval (twice as long as wide); uropodal endopod with gently convex inner margin ..... *A. oryza*
— Pereopod 2 propodus linear (3 times as long as wide); uropodal endopod with strongly convex inner margin ..... *A. sehima*
4. Pereopod 1 propodal palmar lobe right-angled 5
— Pereopod 1 propodal palmar lobe obtusely-angled 9
5. Uropodal exopod not reaching to end of peduncle; peduncle inner distal angle half as long as endopod ..... *A. avena*
— Uropodal exopod reaching beyond or as far as end of peduncle; peduncle inner distal angle less than half as long as endopod 6
6. Uropodal exopod 2.4 times as long as wide; endopod as long as wide; apex of telson rounded ..... *A. vulpia*
— Uropodal exopod about 4 times as long as wide; endopod longer than wide; apex of telson acute 7
7. Pereopod 1 palmar lobe broadly triangular, near midpoint of overall length of propodus; uropodal endopod parallel-sided, with broadly angled apex ..... *A. triodea*
— Pereopod 1 palmar lobe digitiform, about one-third along length of propodus; uropodal endopod tapering, elongate, triangular 8
8. Uropodal exopod 4.5 times as long as wide; peduncle with acute inner angle, one-third as long as endopod ..... *A. poa*
— Uropodal exopod 3.7 times as long as wide; peduncle with blunt inner angle, one-tenth as long as endopod ..... *A. indica*
9. Telson tapering from near base; uropodal endopod with 2 setae on inner margin ..... *A. themeda*
— Telson widest near midpoint; uropodal endopod with 3 or more setae on inner margin 10

10. Telson apex acute 11
— Telson apex rounded 12
11. Uropodal endopod apex acute; pereopod 2 propodus 2.4 times as long as wide ..... *A. eulalia*
— Uropodal endopod apex rounded; pereopod 2 propodus 2.0 times as long as wide ..... *A. barnardi*
12. Uropodal endopod more than twice as long as wide; male appendix masculina with 2 distal fingers; male pereopod 2 propodus with slightly convex palm ..... *A. spathia*
— Uropodal endopod less than twice as long as wide; male appendix masculina with 3 distal fingers; male pereopod 2 propodus with strong proximal palmar lobe ..... *A. zoisia*

Accalathura themeda sp. nov.

Figures 1–3

Material examined. 1 male, 1 female, 44 juveniles; 5–14 mm.

Holotype. Coral Sea (French Territory), Chesterfield Reefs, Long Is. (19°52′S, 158°19′E), seaward edge, 12 m, N.L. Bruce, 5 May 1979, QM W8130 with 2 slides, juvenile, 11.4 mm.

Paratypes. Type locality, QM W8121(1 specimen), W8126(2), W8128(2), NMV J10125(8). Chesterfield Reefs, Long Is., seaward edge, 15 m, N.L. Bruce, 6 May 1979, QM W15989(1). Bennett Is.: inner reef edge, 12 m, N.L. Bruce, 6 May 1979, QM W8104(3); lagoon, rearward edge, 1 m, N.L. Bruce, 7 May 1979, W8124(4); N end of lagoon, 1 m, N.L. Bruce, 8 May 1979, W8101(2 juveniles, 1 female). Cay N of Long Is., seaward slopes, 15 m, N.L. Bruce, 8 May 1979, QM W8102(1).

Australian Coral Sea Territory. Magdalaine Cay (16°37′S, 150°17′E): beach rock, N.L. Bruce, 26 Apr 1979, QM W8098(2); dead coral, 10 m, N.L. Bruce, 27 Apr 1979, W8122(1). Mellish Reef (17°25′S, 155°50′E): reef edge-drop off, 13 m, N.L. Bruce, 2 May 1979, QM W8097(2); back reef bommie, 10 m, N.L. Bruce, 1 May 1979, W8123(1); lagoon, 10 m, N.L. Bruce, 1 May 1979, W8125(3); back reef edge, 20 m, N.L. Bruce, 1 May 1979, W8127(1). Marion Reef (19°10′S, 152°17′E), lagoon pinnacle, 2 m, N.L. Bruce, 13 May 1979, QM W8120(2). Marion Reef, Brodie Cay, reef front, 15-20 m, N.L. Bruce, 12 May 1979, QM W8096 with 1 slide (1 male, 12.4 mm), NMV J10124(2).

Other material. Qld. Yonge Reef (14°37′S, 15°38′E), 2 m, P. Hutchings and P. Weate, 19 Jan 1975 (stn 75 Liz S-3), AM P26036(1). Lizard Island (14°40′S, 145°28′E), B. Kensley, Jan 1982, NMV J12853(2).

Diagnosis. Dorsally pigmented. Telson tapering from near base to an acute apex, 3.0 times as long as wide. Uropodal peduncle reaching 85% of length of telson, distally defined by acute angles; endopod distally rounded, exceeding telson by half its length; exopod tapering from base, 4.3 times as long as basal width, reaching just beyond peduncle. Pereopod 1 propodus with proximal palmar lobe separated from palm by rounded angle of 130°. Pereopod 2 propodus 2.7 times as long as wide, with convex palm bearing 8 spines on distal two-thirds. Pereopod 4 carpus and propodus with 5 and 6 spines respectively; propodus 4.5 times as long as wide.

Description. Head, pereon and pleon with persistent dorsal and dorsolateral pigment pattern. Ratio of dorsal lengths of head, pereonites 1–7, pleon, telson – 0.6 : 1.0 : 1.1 : 1.1 : 1.1 : 1.0 : 1.0 : 1.1 : 0.4 : 0.7 : 0.8.

Head with short rostrum; eyes pigmented. Articulations of pereopods marked by groups of long setae. Pleonites free, 1–5 of equal length, pleonite 6 longer and fused to telson but with a well marked transverse ridge dorsally between the two.

Antenna 1, 2.3 times as long as head; peduncle with second article shortest, flagellum longer than peduncle, of basal article plus 17 isometric articles of which 4 to 14 each bears 1 aesthetasc. Antenna 2, 3.5 times as long as head; flagellum shorter than peduncle, of 27 setose articles.

Mouthparts produced well forward beyond eyelobes. Mandibular palp with 3 articles, first short with 1 seta, second with 3 setae, third falcate with longitudinal row of 16 even setae plus 1 longer seta. Maxilla 1 a finely serrate spine. Maxilliped with small epipod, coxa and basis fused to head, endite a broad blade with subterminal seta; palp with articles 1 and 2 fused (together with 5 ventral setae), articles 3–5 fused (together with 1 dorsal and 14 apical setae).

Pereopod 1 with basis and ischium of equal lengths, merus completely enclosing carpus; propodus with proximal palmar lobe separated from palm by rounded angle of c. 130°, palm with a mesial row of c. 30 setae, a lateral row of c. 60 serrate spines of various lengths, lateral face with row of 15 setae. Pereopod 2 with setose margins on basis and ischium; propodus 2.7 times on long as greatest width, palm convex,

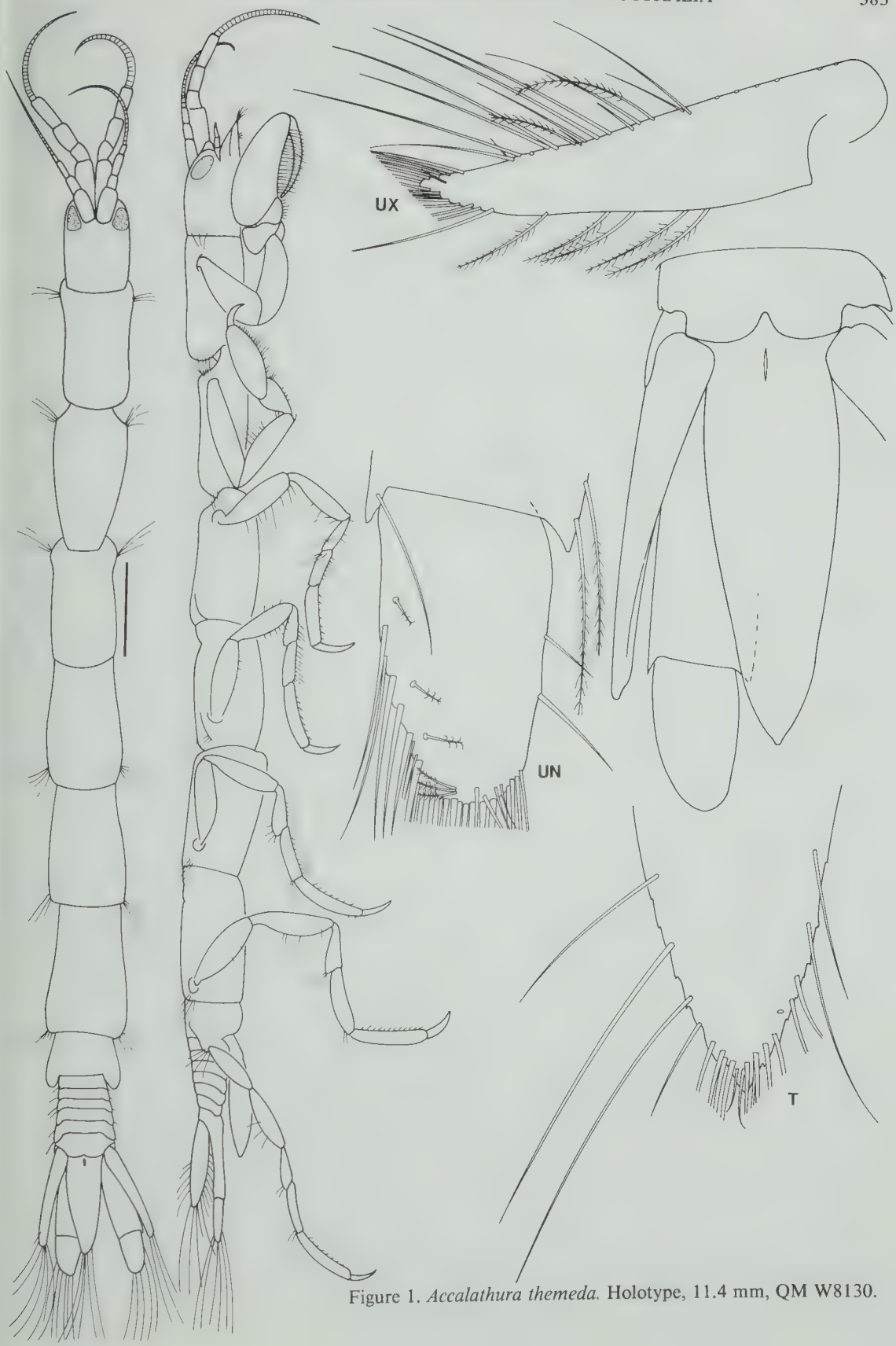

Figure 1. *Accalathura themeda.* Holotype, 11.4 mm, QM W8130.

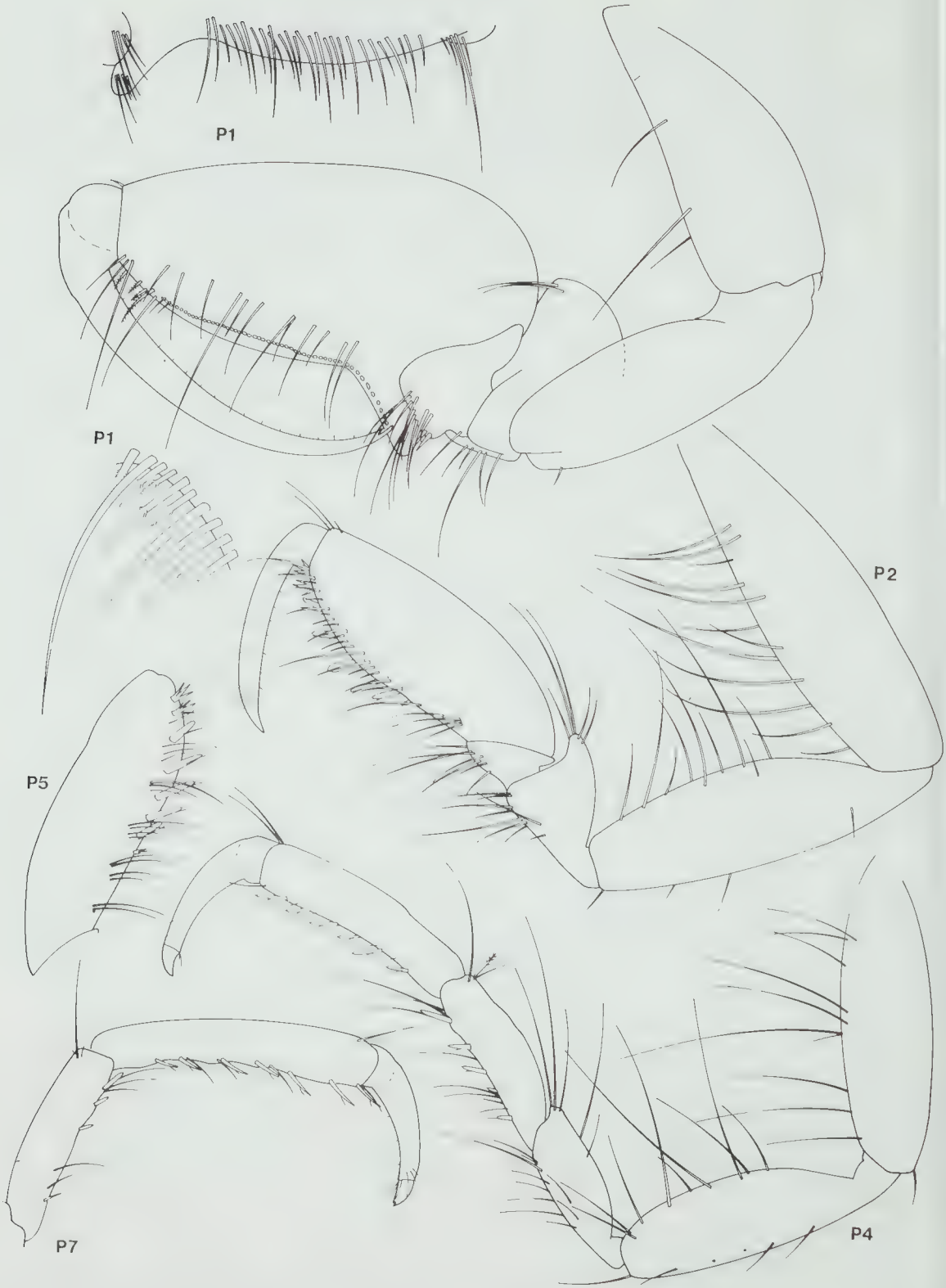

Figure 2. *Accalathura themeda.* Holotype, 11.4 mm, QM W8130.

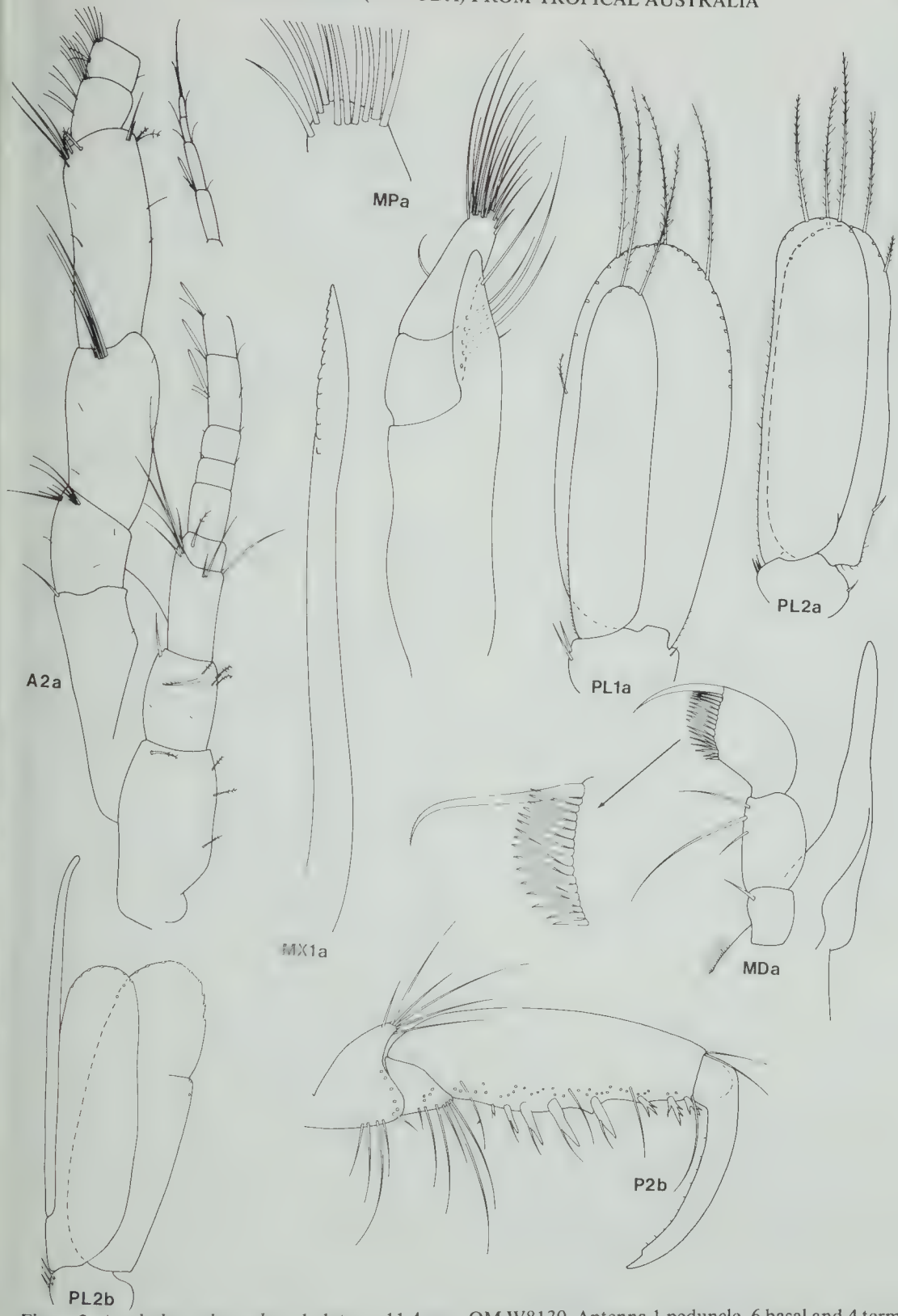

Figure 3. *Accalathura themeda.* a, holotype, 11.4 mm, QM W8130. Antenna 1 peduncle, 6 basal and 4 terminal flagellar articles; antenna 2 peduncle and 2 flagellar articles; maxilliped with detail of mesial apex. b, paratype male, 12.4 mm, QM W8096.

with lateral and mesial setae and 8 submarginal spines (distal ones complex) on mesial face. Pereopod 3 similar to 2, propodus more elongate. Pereopods 4–7 becoming longer posteriorly; basis, ischium and merus setose; carpus 3–4 times as long as wide (narrower posteriorly), with 4–5 marginal spines; propodus 4–5 times as long as wide, with 6–7 marginal spines; dactylus about half length of propodus.

Pleopod 1 exopod, 2.2 times as long as broad, with 23 marginal plumose setae; endopod shorter, with 4 terminal plumose setae. Pleopods 2–5 shorter than pleopod 1, similar, with rami similar, endopod with 5 setae, exopod with 9–12 setae.

Uropodal peduncle reaching 85% of length of telson, distally defined by acute angles surrounding endopod; endopod distally rounded, exceeding telson by half its length, with 2 mesial setae and dense setation distally and laterodistally, and with 3 separate brush-setae plus group of 3 brush-setae dorsally; exopod reaching just beyond peduncle, tapering from base, 4.3 times as long as basal width, marginally setose, mostly simple setae dorsally, plumose ventrally. Telson tapering from near base to an acute apex, 3.0 times as long as wide, apex with c. 18 long submarginal setae plus pair of small setae at apex.

Male. Pereon, pleon and pereopods more elongate than juvenile. Antenna 1 flagellum with 23 articles each with ring of numerous aesthetascs, plus 6 narrow terminal articles without aesthetascs. Pereopod 1 propodus densely setose mesially. Pereopod 2 propodus narrower distally than in juvenile, with marginal row of 8 spines.

Distribution. Coral Sea and northern Great Barrier Reef; coral rubble at 1–20 m depth.

Accalathura avena sp. nov.

Figure 4

Material examined. 10 juveniles, 12.0–28.7 mm.

Holotype. Qld, N of Magnetic Is. (19°08′S, 146°50′E), 7 m, P. Arnold, 25 Aug 1976, NMV J10101 with 1 slide, juvenile, 28.7 mm.

Paratypes. Qld (all collected by P. Arnold in Townsville region). Bowling Green Bay, muddy sand, 17 m, 7 Aug 1975, NMV J10103(1 specimen); mud, 13 m, 9 Dec 1975, NMV J10107(1); sand, 18 m, 16 Apr 1975, NMV J10105(1); mud, 14 m, 17 Jun 1975, NMV J10106(1). Halifax Bay, 15 m, 24 May 1976, NMV J10102(1); muddy sand, 13 m, 24 Feb 1971, AM P39440(1), NMV J10108(1), QM W15990(1). Cleveland Bay, mud, 3 m, 4 Jun 1974 NMV J10104(1).

Diagnosis. Dorsally pigmented. Telson widest two-thirds along, tapering to a broadly acute apex, 2.5 times as long as wide. Uropodal peduncle reaching 95% of length of telson, mediodistally defined by a broad triangular lobe half as long as endopod; endopod distally tapering, 1.5 times as long as wide, exceeding telson by one-third of its length; exopod widest at midpoint 3.0 times as long as wide, not reaching base of endopod. Pereopod 1 propodus with strong proximal palmar lobe, separated from palm by right angle. Pereopod 2 propodus 2.7 times as long as wide, distally narrower, with convex palm bearing 8 spines. Pereopod 4 carpus and propodus with 5 and 4 spines respectively, 3.8 times as long as wide.

Distribution. Queensland (type locality only), shallow shelf near Townsville, 7–18 m.

Accalathura barnardi (Nierstrasz)

Figure 5

Katanthura barnardi Nierstrasz, 1941: 243–247, figs 1–13.

Accalathura barnardi.—Poore, 1980: 59.

Material examined. 1 male, 1 female, 1 juvenile; 11.7–15.1 mm.

Holotype. Indonesia, Solo Strait, 113 m, M. Weber, 8 Feb 1900 ("Siboga" Expedition stn 305), ZMA Is.100.620, female, 14 mm.

Other material. Indonesia, S of Bali (8°46′S, 115°15′E), coral sand, 19 m, 12 Sep 1951 ("Galathea" stn 483), ZMC (juvenile 15.1 mm, male 11.7 mm).

Diagnosis. Dorsal pigment possible. Telson widest at midpoint, lateral margins evenly curved to moderately acute apex, 2.5 times as long as wide. Uropodal peduncle reaching 90% of length of telson, distally defined by a broad triangular mesial projection; endopod distally rounded, exceeding telson by half its length; exopod tapering over most of its length, 4.0 times as long as wide, reaching just beyond peduncle. Pereopod 1 propodus with proximal palmar lobe separated from palm by a obtuse angle. Pereopod 2 propodus 2.1 times as long as wide, ovate, with 9 marginal spines. Pereopod 4 carpus and propodus with 6 and 8 spines respectively; propodus 3.5 times as long as wide.

Male. Pereopod 2 propodus palm irregular. Appendix masculina with elongate subapical blade.

Distribution. Indonesia, 19–113 m.

Accalathura dimeria sp. nov.

Figure 6

Material examined. 2 sub-males, 1 female, 2 juveniles; 10.3–13.7 mm.

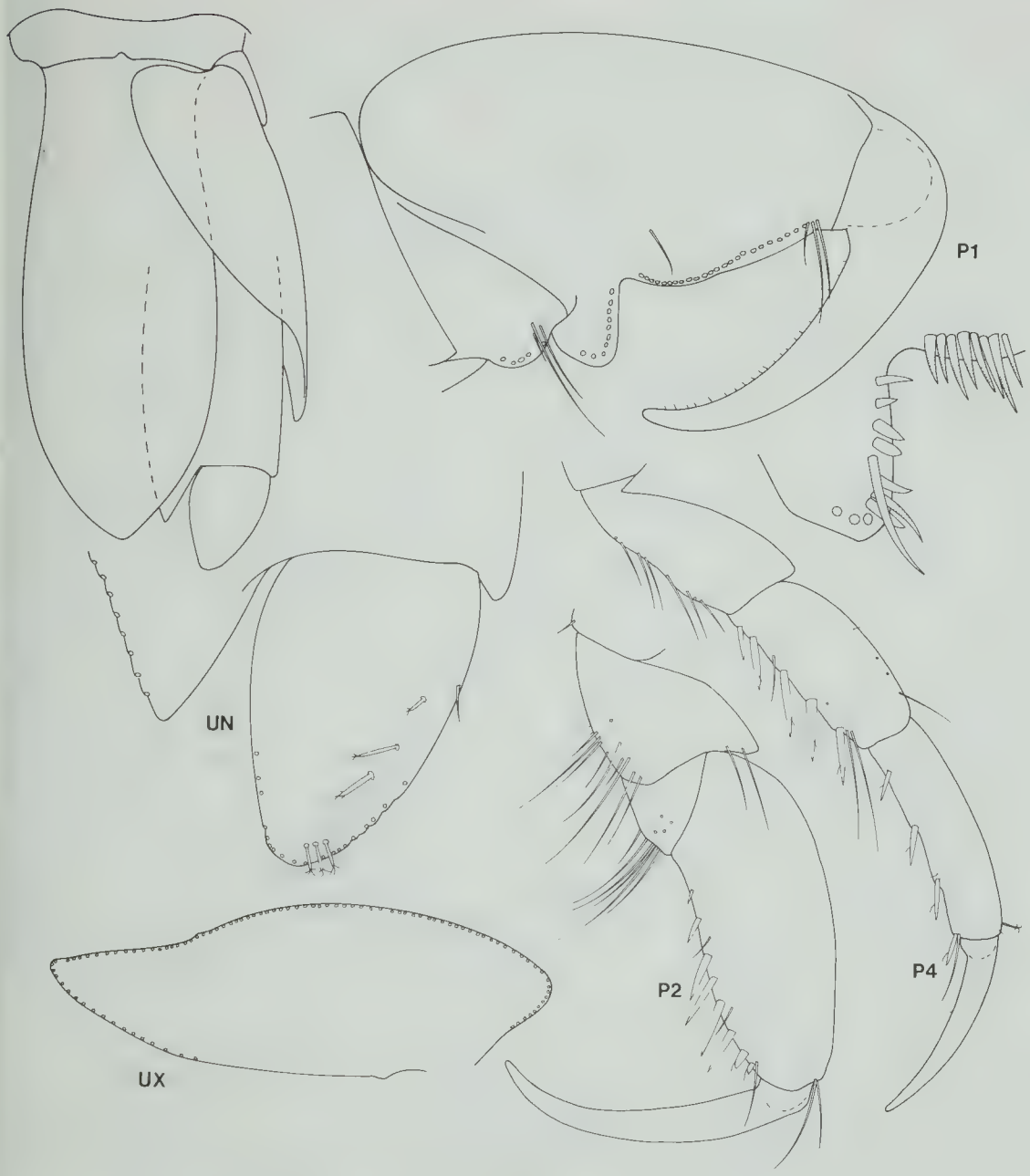

Figure 4. *Accalathura avena.* Holotype, 28.7 mm, NMV J10101.

Holotype. Qld, Halifax Bay (19°05′S, 146°43′E), 10 m, P. Arnold, 24 Aug 1976 (TBS stn), NMV J10109(juvenile, 11.6 mm).

Paratypes. Qld. Halifax Bay, 3–13 m, coarse silt to very fine sand, P. Arnold, various dates (TBS stns), NMV J10110 with 2 slides (1 specimen), J10111(1), J10112(1 sub-male), J10113(1 sub-male), QM W15991(1).

Diagnosis. Dorsally pigmented. Telson almost parallel-sided for much of length, tapering to a broadly rounded apex, 2.4 times as long as wide. Uropodal peduncle reaching about two-thirds of length of telson, distally defined by acute angle mesially and broad lobe laterally; endopod narrow, apically subacute, reaching to end of telson; exopod strongly dorsally lobed, about 1.5 times as long as greatest width, ventral lobe reaching three-quarters along peduncle. Pereo-

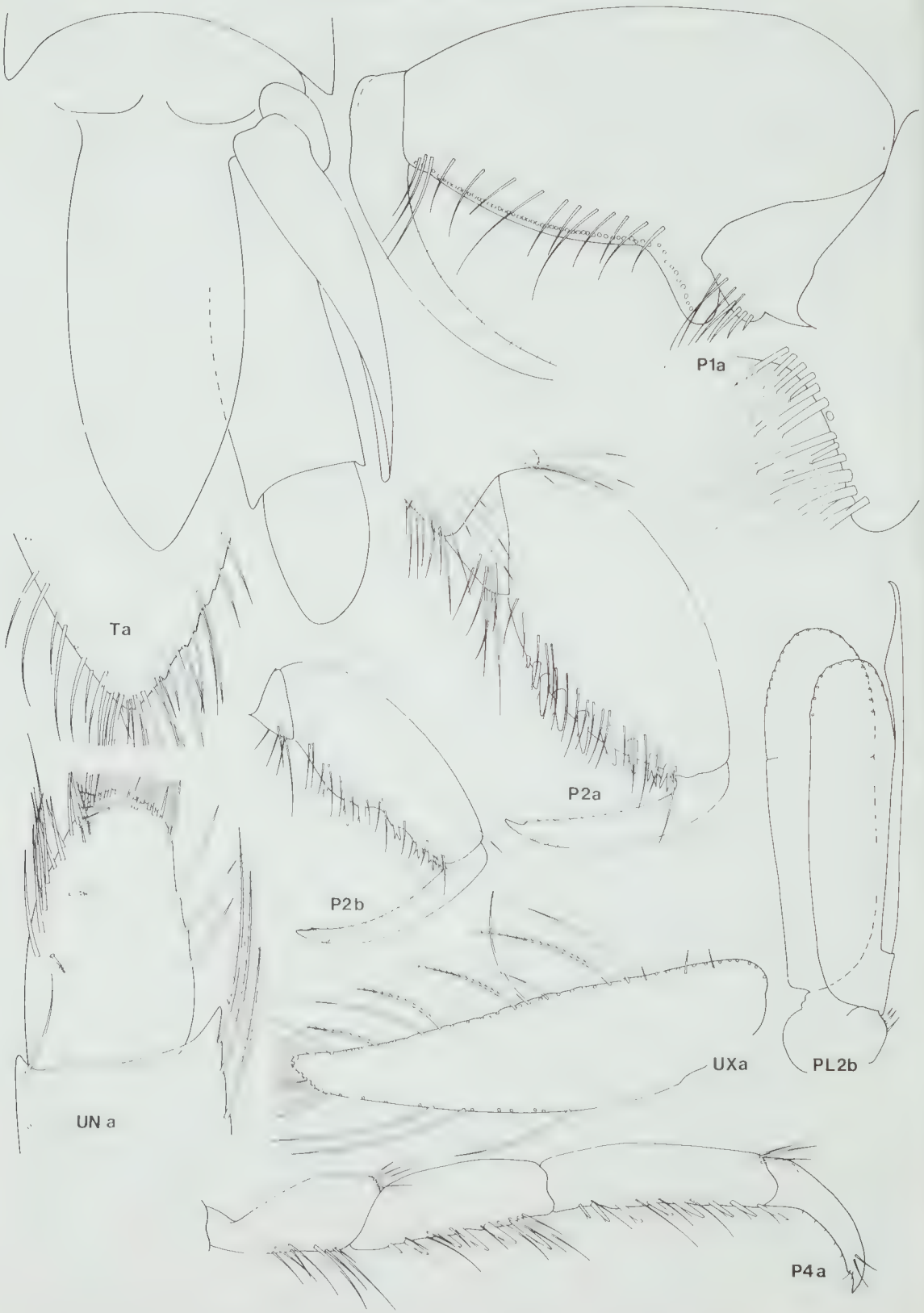

Figure 5. *Accalathura barnardi.* a, juvenile, 15.1 mm, ZMC. b, male, 11.7 mm, ZMC.

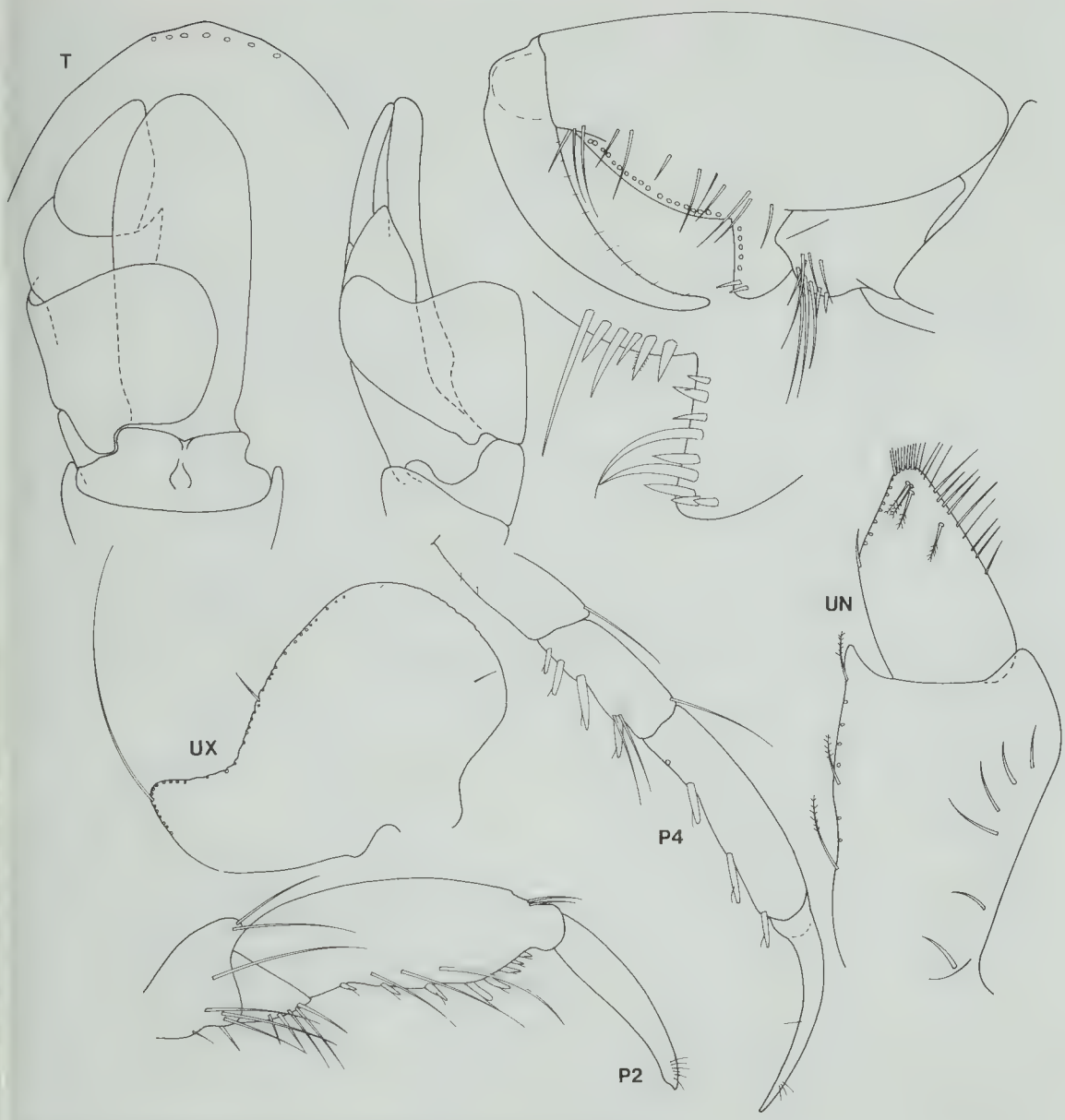

Figure 6. *Accalathura dimeria.* Holotype, 11.6 mm, NMV J10109.

pod 1 propodus with proximal palmar lobe separated from palm by acute angle. Pereopod 2 propodus 3.0 times as long as wide, abruptly tapering distally, with 8 spines on convex margin. Pereopod 4 carpus and propudus each with 4 spines; propodus 4.0 times as long as wide.

Distribution. Queenland, Halifax Bay only, 3–13 m.

Accalathura eulalia sp. nov.

Figure 7

Material examined. 5 juveniles, 1 manca, 6.8–11.0 mm.

Holotype. NT, S side of New Year Is. (10°54′S, 132°02′E), hydroids and small yellow tunicates, 14 m, G.C.B. Poore on "Alegrias", 14 Oct 1982 (stn NT-22), NMV J10114 with 1 slide, juvenile, 11.0 mm.

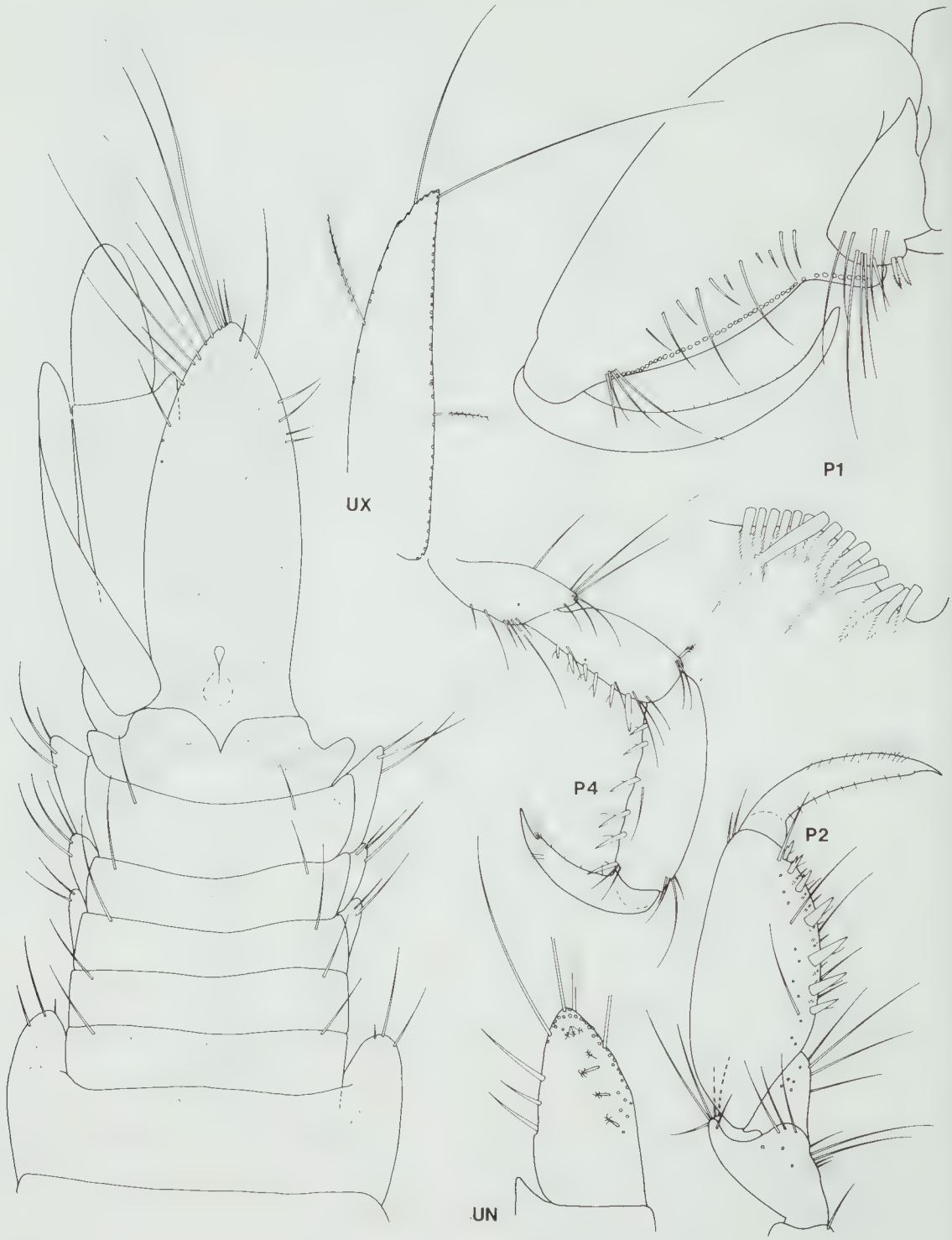

Figure 7. *Accalathura eulalia.* Holotype, 11.0 mm, NMV J10114.

Paratypes. NT. NW end of McCluer Is. (11°02′S, 132°58′E), brown algae on bommies, 8 m, G.C.B. Poore, 16 Oct 1982 (stn NT-32), NMV J10116(1 specimen); S end of McCluer Is. (11°06′S, 133°00′E), *Acropora* base, 8 m, P. Horner, 17 Oct 1982 (stn NT-59), NTM Cr006787(1); same locality, on *Seriotopora histrix*, J.K. Lowry (stn NT-61), NMV J10115(1).

Other material. NT, East Point, Darwin (12°25′S, 130°48.4′E), 22 Dec 1982, NTM Cr006788(1); Cootamundra Shoal (10°50.12′S, 129°13.09′E), 22 m, "Sirius" expedition station 2.8, 7 May 1982, NMT Cr000394(1).

Diagnosis. Dorsally pigmented. Telson lanceolate, margins evenly curved and tapering to an acute apex, 2.5 times as long as wide. Uropodal peduncle reaching 85% of length of telson, distally defined by an acute angle internally; endopod tapering distally, exceeding telson by half its length; exopod tapering from base, 4.3 times as long as wide, reaching beyond end of peduncle. Pereopod 1 propodus with proximal palmar lobe separated from palm by broad angle of 130°. Pereopod 2 propodus 2.3 times as long as wide, ovate, with 7 spines on convex palm. Pereopod 4 carpus and propodus each with 6 marginal spines; propodus 3.2 times as long as wide.

Distribution. Northern Territory, on various substrates, 8–14 m.

Accalathura oryza sp. nov.

Figure 8

Material examined. 2 juveniles, 2 mancas, 4.3–11.2 mm.

Holotype. Qld, Lizard Island (14°40′S, 145°28′E), lagoon shallows off Mangrove Beach, 1.5 m, C. Short, 30 Sep 1978, AM P29792, juvenile, 11.2 mm.

Paratype. Qld, Lizard Island, lagoon at S end, 3 m, A. Jones and C. Short, 10 Oct 1978, AM P29663 (1 specimen).

Other material. Qld, Britomart Reef lagoon (18°17′S, 146°38′E), 9 m, G.C.B. Poore and H.M. Lew Ton, NMV J12852(2).

Diagnosis. Not pigmented. Telson widest at midpoint, tapering to broadly angular, almost truncate apex, 2.4 times as long as wide. Uropodal peduncle reaching 70% of length of telson, distally defined by acute angle mesially and strongly produced lateral ridge; endopod strongly tapering, inner margin straight, exceeding telson by one-quarter its length; exopod strongly dorsally lobed, 1.8 times as long as wide, ventral lobe reaching about three-quarters along peduncle, dorsal lobe a flattened semicircle. Pereopod 1 propodus with proximal palmar lobe separated from palm by an acute angle. Pereopod 2 2.0 times as long as wide, ovate, with 9 spines on evenly convex margin. Pereopod 4 carpus and propodus each with 4 spines; propodus 4.0 times as long as wide.

Distribution. Queensland, northern Great Barrier Reef, coral lagoons.

Accalathura poa sp. nov.

Figure 9

Material examined. 1 female, 2 juveniles; 6.4–14.1 mm.

Holotype. Qld, Heron Island (23°27S′, 151°55′E), lagoon, in dead base of bommie, L. Thompson, 17 Oct 1979, QM W8762, ovigerous female, 14.1 mm.

Paratypes. Qld. Heron Island, reef flat, dead coral, 10 Apr 1976, NMV J10123(1 specimen); Heron Island, N.L. Bruce, 3 Jan 1979, QM W8113(1).

Diagnosis. Dorsally pigmented. Telson widest at midpoint, tapering to broadly-acute apex, 2.8 times as long as wide. Uropodal peduncle reaching 90% of length of telson, distally defined by strong mesial triangular projection; endopod distally tapering, exceeding telson by one-quarter its length; exopod tapering over distal half, 3.7 times as long as gretest width, reaching just beyond peduncle. Pereopod 1 propodus with proximal palmar lobe well defined and separated from palm by rounded right-angle. Pereopod 2 propodus 3.3 times as long as wide, elongate-ovate, with 7 marginal spines on mostly-straight palm. Pereopod 4 carpus and propodus with 4 and 7 spines; propodus 4.7 times as long as wide.

Distribution. Queensland, southern Great Barrier Reef (Heron Island, type locality only.)

Accalathura sehima sp. nov.

Figure 10

Material examined. 2 juveniles; 16.3–20.8 mm.

Holotype. WA, North-west Shelf between Port Hedland and Dampier (20°17′S, 116°38′E), very coarse sandy shell with crinoids, 42 m, epibenthic sled, G.C.B. Poore and H.M. Lew Ton on FRV "Soela", 10 Jun 1983 (stn NWA-43), NMV J10117, juvenile, 20.8 mm.

Paratype. WA, North-west Shelf between Port Hedland and Dampier (19°05′S, 117°26′E), 122 m, G.C.B. Poore and H.M. Lew Ton on FRV "Soela" (stn NWA-52), NMV J10118(1 specimen).

Diagnosis. Not pigmented. Telson widest at midpoint, tapering to broadly angular apex, 2.4 times as long as wide. Uropodal peduncle reaching 75% of length of telson, distally defined by acute angle mesially and strongly produced lateral ridge; endopod tapering over distal half,

Figure 8. *Accalathura oryza.* Holotype, 11.2 mm, AM P29792.

Figure 9. *Accalathura poa.* Holotype, 14.1 mm, QM W8762.

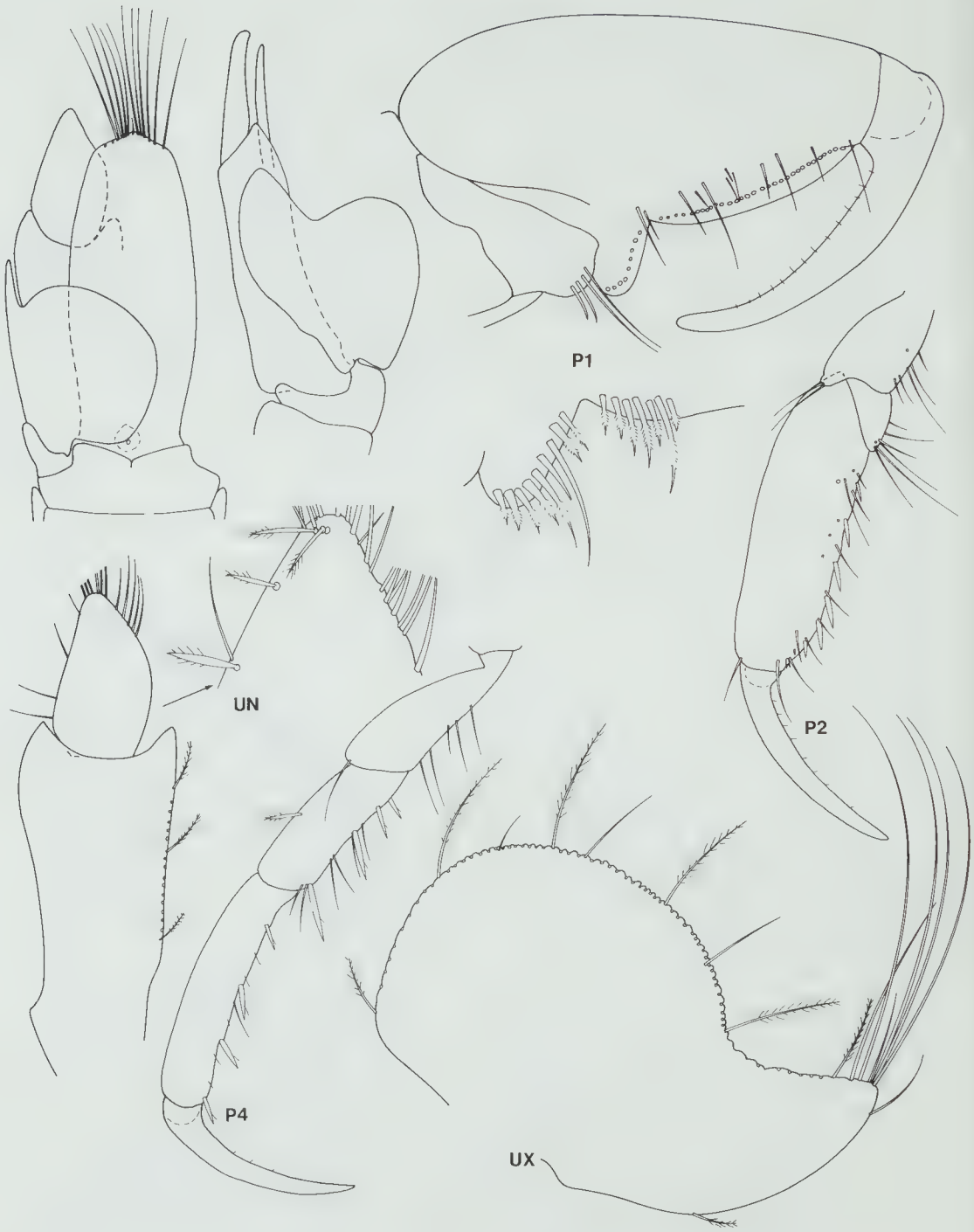

Figure 10. *Accalathura sehima.* Holotype, 20.8 mm, NMV J10117.

inner margin curved, exceeding telson by about one-quarter its length; exopod strongly dorsally lobed, 1.7 times as long as wide, ventral lobe reaching about three-quarters along peduncle, dorsal lobe semicircular. Pereopod 1 propodus with proximal palmar lobe separated from palm by an acute angle. Pereopod 2 propodus 3.2 times as long as wide, elongate, with 7 spines on mostly-straight palm. Pereopod 4 carpus and propodus each with 4 spines; propodus 5 times as long as wide.

Distribution. North-west Shelf, coarse sediments, 42–122 m.

Accalathura spathia sp. nov.

Figure 11

Material examined. 2 males, 2 juveniles, 17.1–21.6 mm.

Holotype. WA, North-west Shelf between Port Hedland and Dampier (18°50.5′S, 117°39.8′E), shell, mud, rock, 178-182 m, epibenthic sled, G.C.B. Poore and H.M. Lew Ton on FRV "Soela", 6 Jun 1983 (stn NWA-29), NMV J10119 with 1 slide, juvenile, 21.6 mm.

Paratypes. WA. Type locality, NMV J10120(1 male), J10121(1 juvenile), J10122 (1 male); North-west Shelf between Port Hedland and Dampier (18°41′S, 118°39′E), 134 m, epibenthic sled, G.C.B. Poore and H.M. Lew Ton on FRV "Soela", 4 Jun 1983 (stn NWA-21), NMV J12854(1 male, 1 juvenile).

Diagnosis. Not pigmented. Telson slightly wider at midpoint than at base, tapering to broadly-acute apex, 2.8 times as long as wide. Uropodal peduncle reaching 80% of length of telson, distally defined by a broad triangular projection mesially; endopod narrowly tapering, exceeding telson by half its length; exopod tapering from base, 4.5 times as long as greatest width, reaching beyond peduncle. Pereopod 1 propodus with proximal palmar lobe separated from palm by very shallow angle of 110°. Pereopod 2 2.2 times as long as wide, ovate, with 10 spines on convex palm. Pereopod 4 campus and propodus with 7 and 9 spines respectively; propodus 4 times as long as wide.

Male. Appendix masculina shorter than the pleopodal rami and has a sub-bifid apex.

Distribution. North-west Shelf, 134–182 m.

Accalathura triodea sp. nov.

Figure 12

Material examined. 1 male, 4 females, 7 juveniles, 9.0-16.2 mm.

Holotype. WA, NW of Bluff Point (27°18′S, 112°16′E), 97 m, 9 Oct 1963 (CSIRO stn 204), WAM 61-80, juvenile, 16.2 mm.

Paratypes. WA. Type locality, WAM 285-89(1 specimen), WAM 286-89(1 male). North-west Shelf between Port Hedland and Dampier (20°29′S, 117°20′E), 30 m, epibenthic sled, G.C.B. Poore and H.M. Lew Ton on FRV "Soela", 11 Jun 1983 (stn NWA-51), NMV J14499(1).

Other material. WA. North-west Shelf between Port Hedland and Dampier (19°25′S to 20°29′S, 116°38′E to 118°59′E), 30-48 m, CSIRO Division of Fisheries, 1983 (stns NWA-43, 180, 191, 271, 343), NMV J14498(1), J14500(1), J14601(1), J14602(3), J14603(2).

Diagnosis. Not pigmented. Telson tapering from near midpoint to an acute apex, 2.4 times as long as wide. Uropodal peduncle reaching 80% of length of telson, distally differentiated by an acute angle on inside; endopod of even width over proximal two-thirds, broadly angled apically, exceeding telson by one-fifth its length; exopod tapering to an oblique apex, 4.0 times as long as wide, reaching beyond peduncle. Pereopod 1 propodus broad (1.7 times greatest width), with proximal palmar lobe separated from palm by sharp right angle. Pereopod 2 2.7 times as long as wide, subrectangular, with 7 spines on straight palm. Pereopod 4 carpus and propodus with 4 and 5 spines respectively; propodus 3 times as long as wide.

Male. Appendix masculina reaching beyond endopod, ending with oblique blade. Distribution. Western Australia, shelf, 30-97 m.

Accalathura vulpia sp. nov.

Figure 13

Material examined. 1 male, 1 female, 11 juveniles, 3 mancas; 3.2–9.7 mm.

Holotype. Qld, Lizard Island (14°40′S, 145°28′E), B. Kensley, Jan 1982 (stn BK-122), NMV J12845, female, 9.7 mm.

Paratypes. Qld. Type locality, NMV J12846 (2 specimens), QM W15992(1). Lizard Island, various localities, B. Kensley, Jan 1982, NMV J12847(6), J12489(2), AM P39392 with 1 slide(1 male).

Other material. Qld, Lizard Island, NMV J12848(2), AM P39393(1).

Diagnosis. Not pigmented. Telson with convex lateral margins and broadly rounded apex, 2.3 times as long as wide. Uropodal peduncle reaching 80% of length of telson, distally defined by short internal angle; endopod about as wide as long, exceeding telson by about one-fifth its length; exopod with sinuate dorsal margin, 2.4 times as long as wide, reaching to end of peduncle. Pereopod 1 propodus with proximal palmar lobe separated from curved palm by right angle. Pereopod 2 2.5 times as long as wide, elongate-ovate, with 7 spines on convex margin. Pereo-

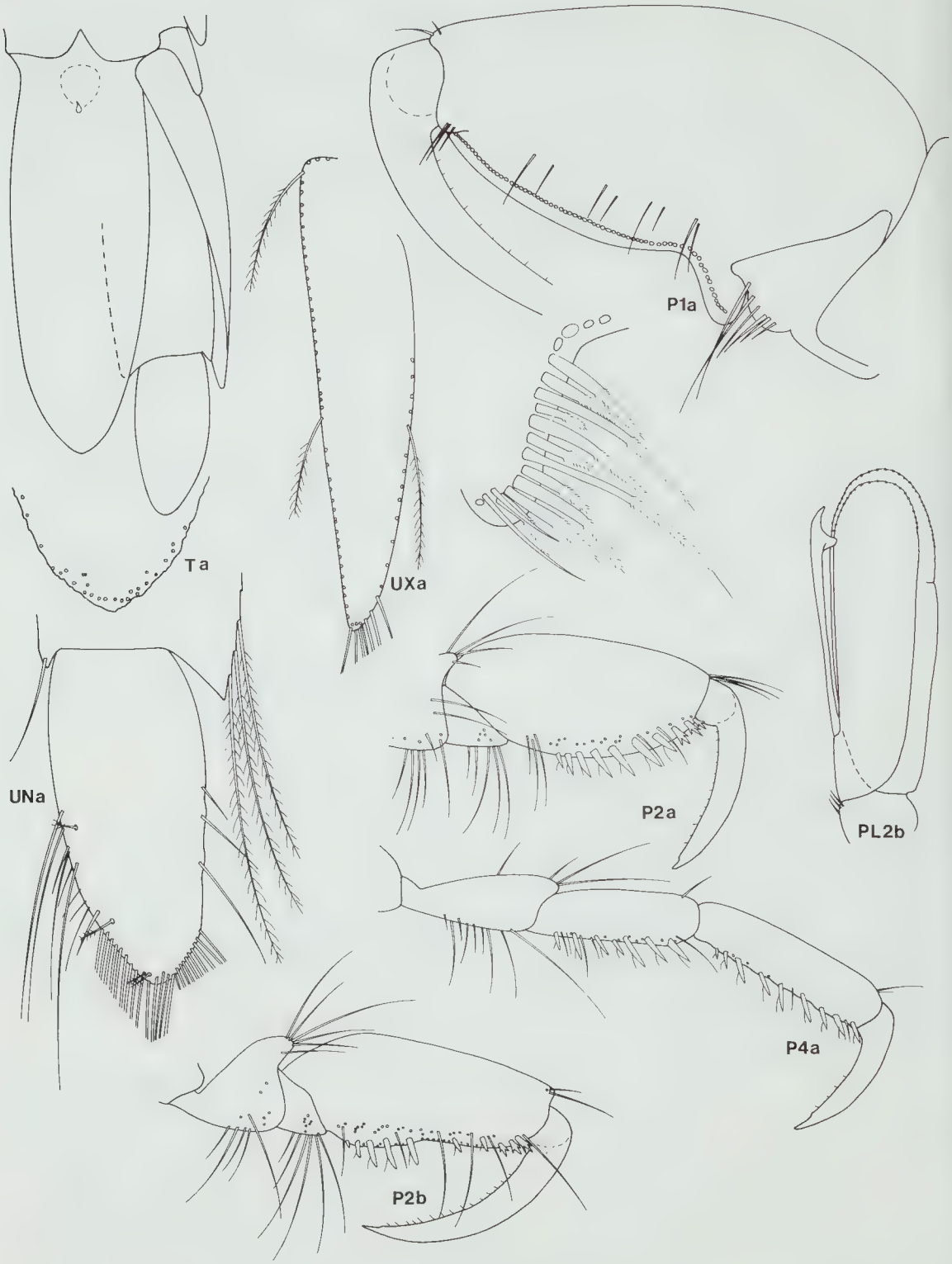

Figure 11. *Accalathura spathia*. a, holotype, 21.6 mm, NMV J10119. b, paratype male, 20.1 mm, NMV J10120.

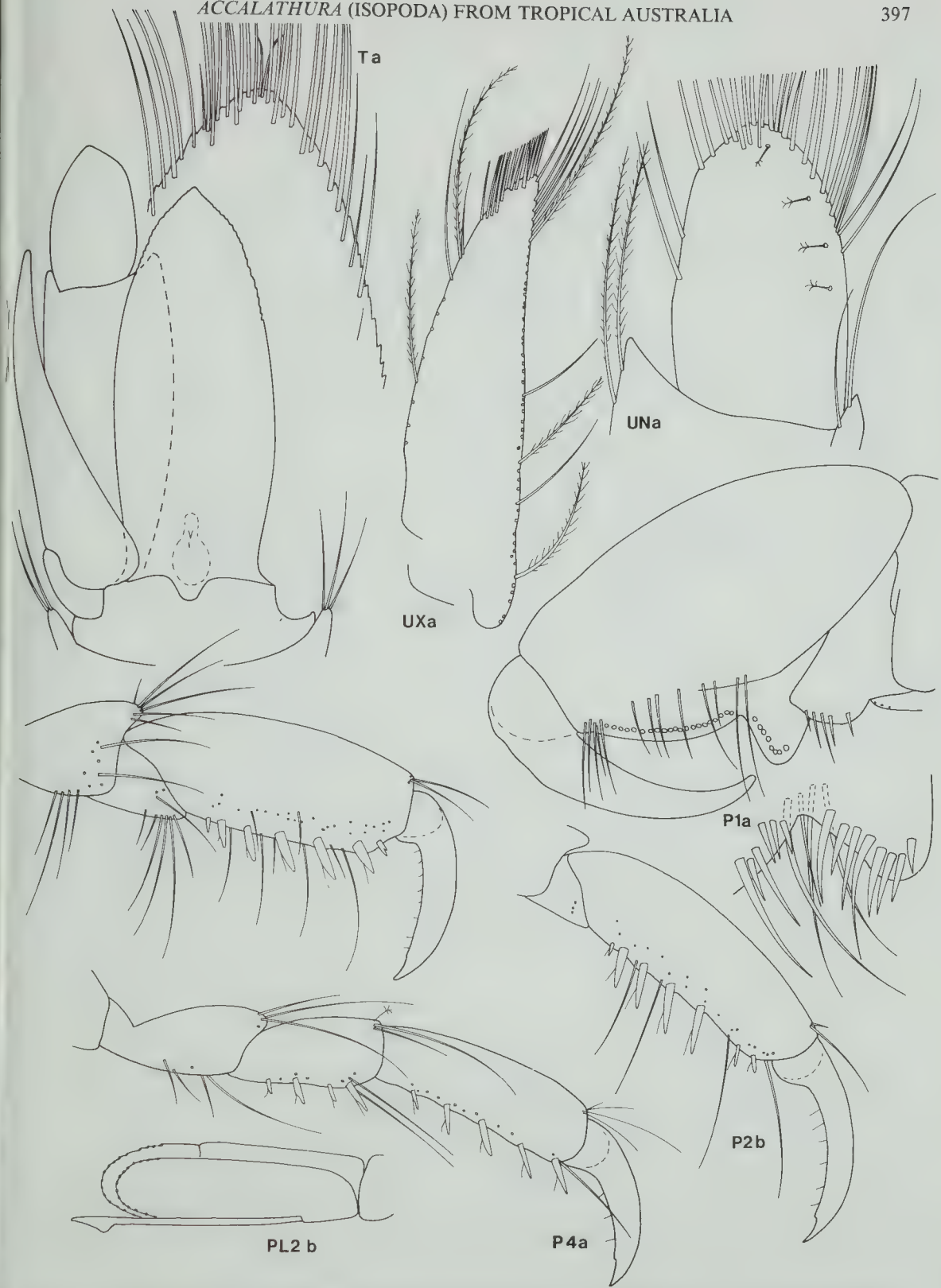

Figure 12. *Accalathura triodea.* a, holotype, 16.2 mm, WAM 61-80. b, paratype male, 12.2 mm, WAM 286-89.

Figure 13. *Accalathura vulpia.* Holotype, 9.7 mm, NMV J12845.

pod 4 carpus and propodus with 3 and 5 spines respectively; propodus 2.8 times as long as wide.

Male. Appendix masculina exceeding endopod by one-fifth its length, with simple apex.

Distribution. Queenland, Great Barrier Reef (Lizard Island only).

Accalathura zoisia sp. nov.

Figures 14, 15

Material examined. 1 male 29 mm, 1 juvenile 27 mm.

Holotype. WA, Houtman Abrolhos Islands (28°49′S, 114°04′E), 8 km NW of Gun Island, 57–61

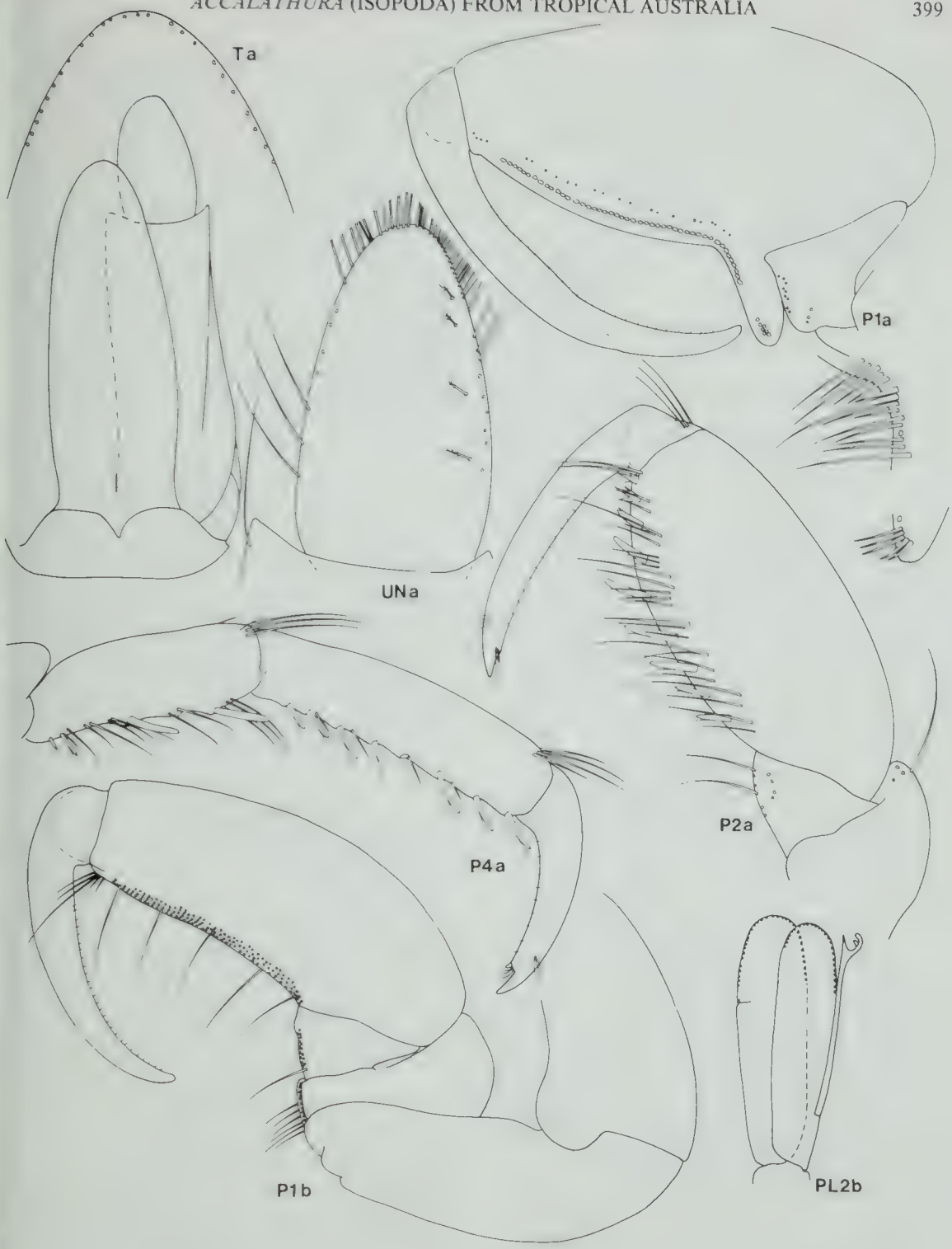

Figure 14. *Accalathura zoisia*. a, holotype, 27 mm, WAM 542-73. b, paratype male, 29 mm, WAM 550-73.

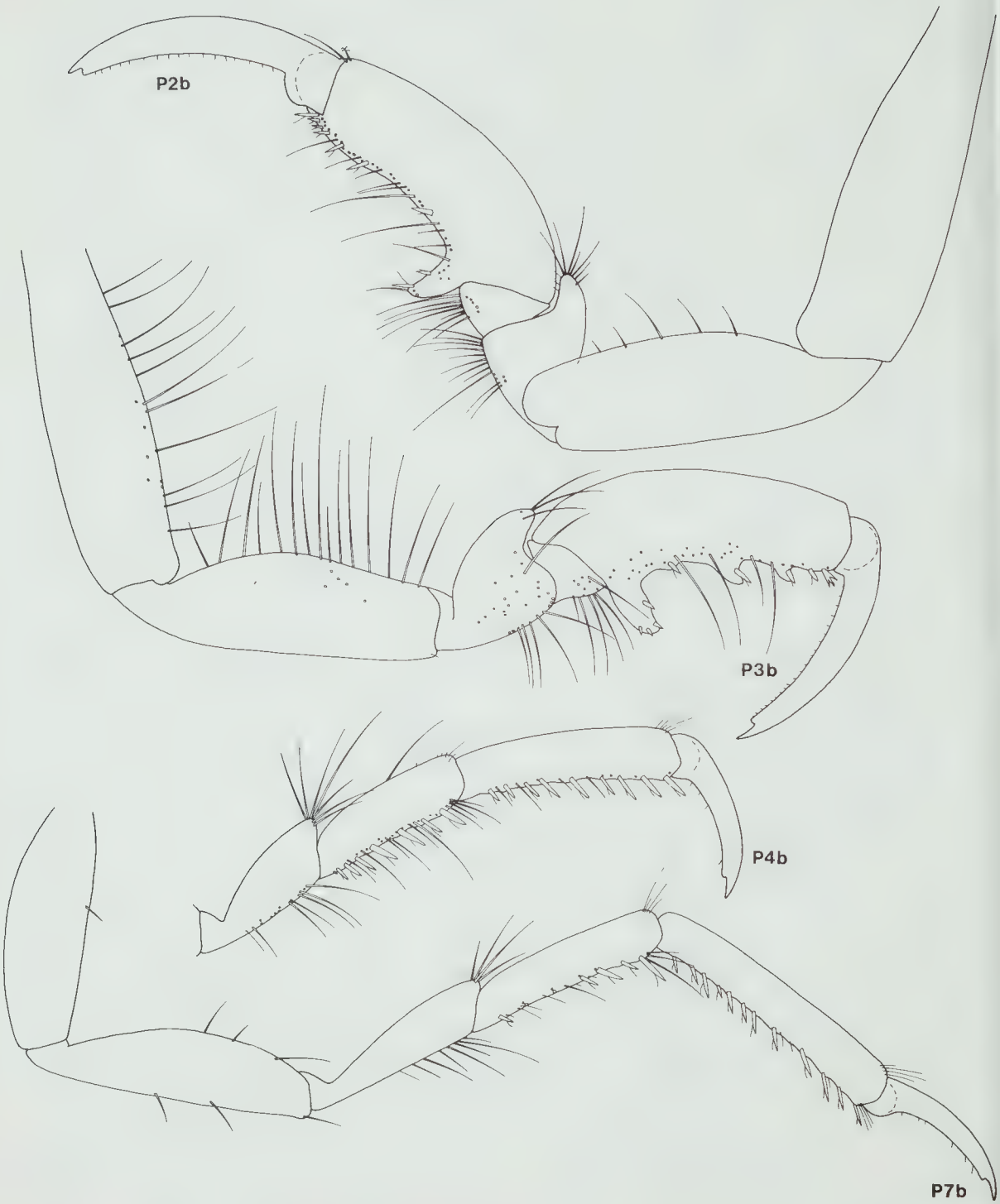

Figure 15. *Accalathura zoisia.* b, paratype male, 29 mm, WAM 550-73.

m, R.W. George on "Davena", 11 Nov 1951, WAM 542-73, juvenile, 27 mm.

Paratype. WA, NW of Bluff Point (27°18′S, 113°16′E), 97 m (CSIRO stn 204), 9 Oct 1963, WAM 550-73(1 male).

Diagnosis. Not pigmented. Telson bullet-shaped, tapering especially near apex to rounded-acute end, 3.0 times as long as wide. Uropodal peduncle reaching 95% length of telson, distally defined by broad internal angle; endopod long, distally rounded, exceeding telson by almost two-thirds its length; exopod presumed very narrow (lost). Pereopod 1 propodus with proximal palmar lobe separated from palm by rounded angle of 120°. Pereopod 2 propodus 2.3 times as long as wide, elongate-ovate, convex palm bearing 9 spines. Pereopod 4 carpus and propodus with 5 and 8 spines respectively; propodus 4 times as long as wide.

Male. Telson more tapering than in juvenile, uropodal endopod more elongate. Pereopod 1 propodus cylindrical, curved, with densely setose palm. Pereopod 2 propodus with strong proximal palmar lobe, with 9 marginal spines. Pereopod 3 propodus with strong proximal palmar lobe bearing 4 marginal spines, palm with 3 marginal projections and 5 spines. Pereopods 4-7 carpus and propodus each with several posterior setae. Appendix masculina shorter than endopod of pleopod 2, with complex 3-fingered apex.

Distribution. Central coast of Western Australia, shelf, 57–97 m.

Remarks. Accalathura zoisia is most notable for the complex secondary sexual characters of the male, especially of the anterior pereopods. A similar condition was noted in the holotype male of *A. normani* (ZMA Is.100.922) from the Flores Sea which possesses a pereopod 3 propodus with one strong spined palmar lobe. The appendix masculina of the latter is a lobed blade.

Acknowledgements

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We acknowledge too the assistance provided by A.J. Bruce, Northern Territory Museum, Peter Stevens, CSIRO Division of Fisheries, and Paul Sammarco, Australian Institute of Marine Science, who enabled us to take part in collecting expeditions.

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Memoirs of the Museum of Victoria 50(2): 403–415 (1990) ISSN 1814-0827

ABYSSIANIRIDAE, A SYNONYM OF PARAMUNNIDAE (CRUSTACEA: ISOPODA: ASELLOTA), WITH TWO NEW SPECIES OF *ABYSSIANIRA* FROM SOUTH-EASTERN AUSTRALIA

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Abstract

Just, J., 1990. Abyssianiridae, a synonym of Paramunnidae (Crustacea: Isopoda: Asellota), with two new species of *Abyssianira* from south-eastern Australia. *Memoirs of the Museum of Victoria* 50(2): 403–415.

Abyssianira bathyalis sp. nov. and *A. tasmaniensis* sp. nov. are described from bathyal depths of south-eastern Australia. The history and the concepts of the family name Abyssianiridae Menzies, 1956 are outlined. The antennae and uropods of *Abyssianira* are shown to be of identical construction to those of the Paramunnidae, those points being the only ones on which *Abyssianira* has been kept separate from the Paramunnidae in recent studies. On that basis, Abyssianiridae is placed in synonymy of Paramunnidae Vanhöffen, 1914.

Introduction

The janiroidean family Abyssianiridae was created by Menzies (1956) for the new genus and species *Abyssianira dentifrons* Menzies, 1956. Menzies' diagnosis of the new family did not include any apomorphic attributes to distinguish the new taxon from what he believed to be its closest relatives, the Schistosomatidae Hansen, 1916 (now Mictosomatidae Wolff, 1965, replacement name, homonymy) and the Thambematidae Stebbing, 1913. Both families were then poorly known and Menzies' brief comments are largely irrelevant. In connection with *A. dentifrons* having the last three pereonites set off from the slightly broader anterior pereonites, Menzies did mention the Munnidae Sars, 1899 (then including the paramunnid genera), but he did not recognize the close similarity in important characters between his new species and the paramunnid Munnidae.

Menzies (1962) described a second species, *A. argentenensis*, and presented a slightly modified family diagnosis. He added a new genus and species, *Xostylus parallelus*, to the family. In the same study Menzies stated that the Abyssianiridae "is closely allied to the Munnidae through the genus *Austrosignum*, [now in Paramunnidae], which may ultimately have to be transferred to the Abyssianiridae".

Wolff (1962) discussed the placement of several munnid-like genera which had been excluded from the Munnidae s.s. He concluded that *Abyssianira* belong in the Antiasidae and that the family name Abyssianiridae was a junior synonym of that family. Wolff excluded *Xostylus* from this new combination as he considered it "a typical janirid, closely related to *Ectias* Richardson and *Caecianiropsis* Menzies and Petit".

Sivertsen and Holthuis (1980) showed that the name *Antias* Richardson, 1906 was preoccupied and the family name Antiadidae (corrected spelling of Antiasidae) invalid. They proposed the replacement name *Santia* and, following Wolff's analysis (1962), replaced the family name with Abyssianiridae. Following Wilson (1980, see below) the name Antiadidae has recently been replaced by Santiidae Kussakin, 1988.

Wilson (1980) convincingly reintroduced the concept of a separate family Paramunnidae Vanhöffen, 1914 (as Pleurogoniidae by Wilson, but corrected for reasons of priority by Hooker, 1985) distinct from the Munnidae. The main apomorphic characters distinguishing the Paramunnidae are: a covered anus; article 3 of the peduncle of antenna 2 elongate; the male pleopod 1 sagittate; and the penile papillae subcuticular. Wilson (1980) discussed the relationships of the Paramunnidae and noted that in most respects *Abyssianira* is very similar to that family. He stated that *Abyssianira* can be separated from the Paramunnidae because it has: a short article 3 of antenna 2 and an uropodal protopod. He rejected Wolff's (1962) concept that *Abyssianira* belong in the Santiidae because all other species in that family have the anus exposed. He

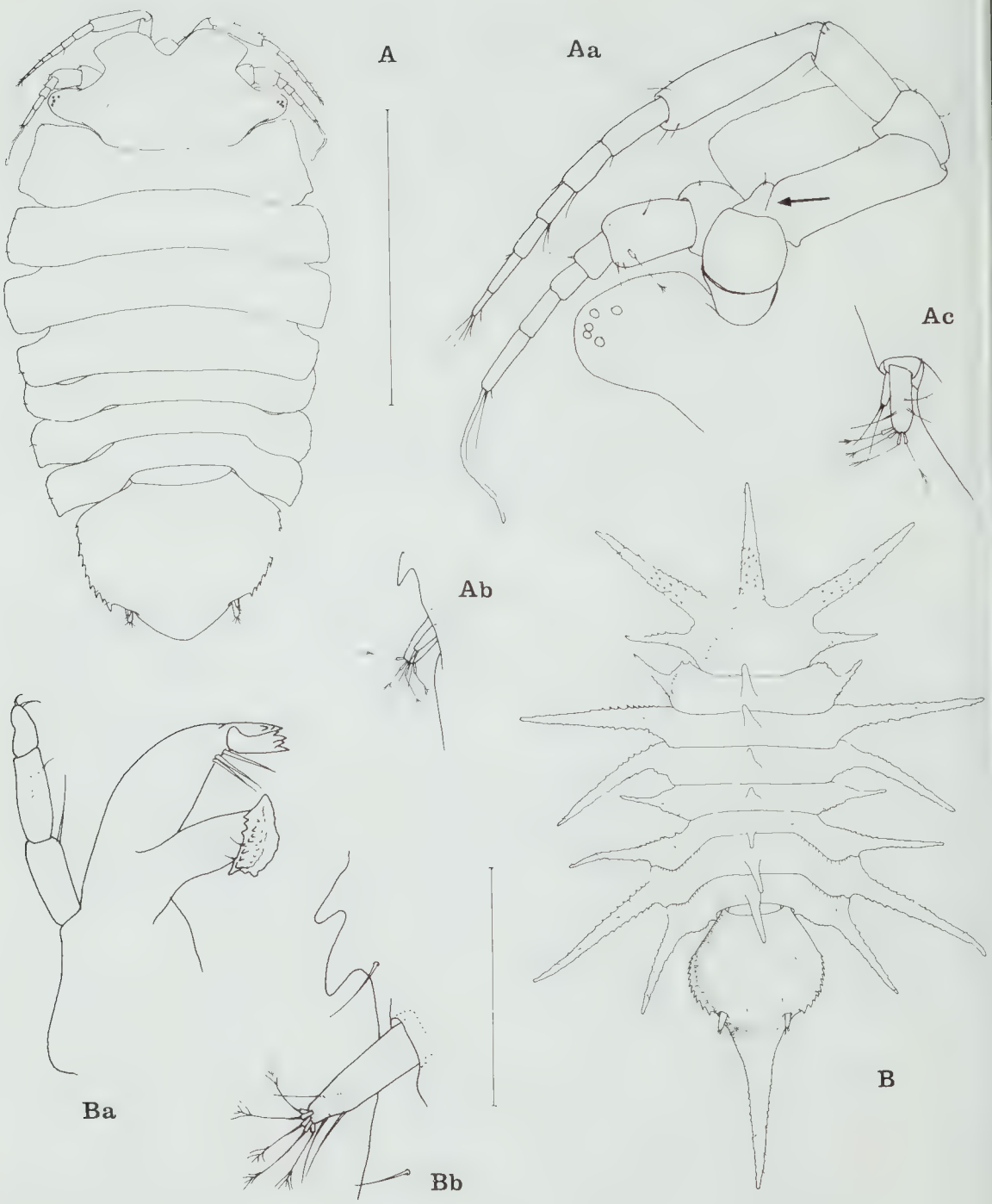

Figure 1. A, *Paramunna bilobata* G.O. Sars, male, Norway, ident. Sars, (Zoological Museum, Copenhagen); Aa, ventral view of right antennae, arrow: see text; Ab, left uropod, dorsal view; Ac, right uropod, ventral view. B, Paramunnidae, nov. gen. et sp., male, upper slope, south-eastern Australia, (Museum of Victoria, Melbourne); Ba, left mandible; Bb, left uropod, dorsal view. Habitus scales, 1 mm.

concluded that the family Abyssianiridae (sensu Menzies, 1956) should be retained, and followed Wolff (1962) in excluding *Xostylus*, an opinion which is fully supported by this study. A close relationship between the Paramunnidae and Abyssianiridae was further indicated by Wilson (1987: fig. 8); his view is consistent with that of several other workers (see Wilson, 1987: fig. 7, summary cladograms and references).

Re-evaluation of *Abyssianira*

The crucial point in assessing *Abyssianira* vis a vis the Paramunnidae is the peduncle of antenna 2, which has always been described as having four subequal short proximal articles in *Abyssianira* (the primitive janiroidean condition). This differs from the situation in Paramunnidae where article 3 is elongate. Furthermore, Wilson (1980) drew attention to the peculiar geniculate antenna 2 of the Paramunnidae: article 3 articulates with the short and compact articles 1 and 2 complex almost at a right angle and points towards the midline. The short article 4 articulates in the opposite way, at a more flexible angle directing the long articles 5 and 6 and the flagellum laterally and upwards. Wilson discussed functional aspects of this arrangement. However, the length of article 3 varies considerably within the family, from being at least three times as long as broad in, e.g., *Paramunna bilobata* (type species of the genus, see Fig. 1A) and *Austrosignum maltinii* Schiecke and Fresi, 1972, to barely longer than broad in, e.g., *Coulmannia* Hodgson, 1910 (Nordenstam, 1933; Kussakin, 1982). More consistent than the elongation of article 3 is its form. In all species of Paramunnidae this article has a distinctive proximolateral bulge carrying a single simple seta. The bulge, which may in addition be ornamented with short cuticular spines or, rarely, stout setae, is set off from the remainder of article 3 by an oblique cuticular line running some way around the ventral and dorsal surfaces of the article (Fig. 1 Aa, arrow), occasionally all the way to article 2 (in older specimens of heavily calcified species the line may not be visible without decalcification). There is certainly no flexibility between the bulge and the rest of the article and the derivation of the oblique line cannot be evaluated on the evidence of external morphology alone. Hooker (1985) suggested that in his new species, *Munnogonium wilsoni* in which the oblique line reaches article 2, the setae-carrying bulge represents a modified antennal scale. It seems, however, to be in the wrong position. Where present, the antennal scale is invariably on the lateroapical margin of article 3 of the peduncle although it may often be displaced proximally. In the Paramunnidae the bulge is at the base of article 3 and the apex of that article has a simple, circular margin.

In *Abyssianira*, the interesting point is that although article 3 of the peduncle is only slightly longer than broad, a distinct seta-bearing bulge and an oblique line reaching article 2 are present (Fig. 2Aa, Ba), and the various peduncular articles articulate in exactly the way described by Wilson (1980) and above.

The *Abyssianira* uropods are not as different from those of Paramunnidae as Wilson suggested. The uropodal protopod in species of *Abyssianira* is at most only marginally longer than in some paramunnids and the two rami are similar in length, proportions, and setation to that of many paramunnids. In the Paramunnidae, the uropodal configuration range from biramous with a small protopod (e.g., *Paramunna bilobata*, Fig. 1Ab) to uniramous without a protopod (e.g., several undescribed species from Australia, Fig. 1Bb). Whenever a small protopod is present it is completely or nearly completely inserted into a cuticular fold. The fold may be a thin, hyaline cover very difficult to observe, or, in heavily calcified species, completely opaque, in which case clearing of the cuticle is necessary before the exact uropodal configuration can be observed. In *P. bilobata* the uropods are inserted on the pleotelson margin; in most other paramunnids the insertion is more or less clearly dorsal. Figs 3 and 6 show that the uropodal protopod in *Abyssianira* is also inserted dorsally and has a small partly hidden protopod.

With regard to the other diagnostic characters for the Paramunnidae mentioned by Wilson (1980, see above), *Abyssianira* has a covered anus, and the male pleopod 1 and the internal 'penes' are identical to the Paramunnidae. The mandibular palp of *A. dentifrons* is similar to that of most paramunnids (e.g., Fig. 1Ba), viz., markedly reduced in length with the short article 3 carrying two small apical setae (Menzies, 1956: fig. 6F). In the new species described below the palp is longer and stouter, and article 3 carries two rather strong apical setae and a number of small stiff grooming setae and setules more posteriorly. However, the palp conforms to Wilson's diagnosis (1980) of the Paramunnidae: "... never longer than body of mandible ... with few setae and cuticular combs." Otherwise the mouthparts, pereopods, and other pleopods in *Abyssianira* are similar to those of the Paramunnidae. Antenna 1 in *Abyssianira* is a typical

paramunnid appendage composed of six articles, with article 5 longer than 4 and longer than or equal to 6, and with article 6 carrying a few short and one long apical setae and a single apical aesthetasc, (I have found that pattern to be constant in c. 35 species, new and 'old' in recently collected material from Australian shelves and slopes).

I conclude that *Abyssianira* belongs in the Paramunnidae as defined by Wilson (1980). The family name Abyssianiridae Menzies, 1956 thus becomes a synonym of Paramunnidae Vanhöffen, 1914.

I retain *Abyssianira* as a separate genus for the time being mainly on account of the peculiar and presumably apomorphic structure of the cephalon. Otherwise the four species currently known: *A. dentifrons* Menzies, 1956, *A. argentenensis* Menzies, 1962, and the new species *Abyssianira bathyalis* and *A. tasmaniensis* described below, appear to possess mainly plesiomorphic paramunnid attributes. *Abyssianira* shares with several paramunnid genera dorsally visible coxal plates on at least pereopods 5–7 and a more or less clear distinction between the anterior four and posterior three pereonites. The study of a number of new species related to that complex may lead to the erection of new genera and a redistribution of known species (Just, in preparation). On this background, further discussions of the relationships of *Abyssianira* and attempts to polarize in more detail the evolutionary direction in characters of the Paramunnidae seem premature.

Paramunnidae Vanhöffen, 1914

New synonymy. Pleurogoniini Nordenstam, 1933.
Pleurogonidae, Menzies, 1962.
Pleurogoniidae, Wilson, 1980, diagnosis.
Abyssianiridae Menzies, 1956.

Type genus. Paramunna G.O. Sars, 1866.

Additional genera. See Wilson (1980: Table 1), plus *Bathygonium* Kussakin and Vasina, 1984, and *Abyssianira* Menzies, 1956.

Abyssianira Menzies, 1956

Diagnosis. Paramunnidae with moderately vaulted body and pleotelson. Pereonites 5–7 set apart from anterior four pereonites, with lateral parts cylindrical, backward pointing. Coxal plates visible in dorsal view on at least pereonites 5–7. Cephalon and pereonite 1 joined along a nearly straight line (cephalon not deeply recessed into pereonite 1 as often found in the family). Eye stalks prominent, broad, barely overreaching pereonite 1, (ocelli have not been observed). Cephalon anteriorly between insertion of antennae 1 dipping steeply downward and curving into thin, horizontal, convex, marginally serrate frontal plate. Antenna 2 article 3 not much longer than broad, about as long as articles 1 and 2 combined. Mandible with 3-articulate palp, molar cylindrical with truncate apex. Uropods biramous, with distinct protopod about as long as broad. Pleon with two segments; pleotelson with lateral margins serrate.

Type species. Abyssianira dentifrons Menzies, 1956.

Additional species. A. argentenensis Menzies, 1962, *A. bathyalis* sp. nov. *A. tasmaniensis* sp. nov.

Abyssianira bathyalis sp. nov.

Figures 2–5

Material examined. Holotype. Bass Strait S of Point Hicks, 38°16.40′S, 149°27.60′E to 38°17.70′S, 149°26.10′E, 800 m, coarse shell and biogenic sediments, WHOI epibenthic sled, RV "Franklin" stn SLOPE-34, 23 Jul 1986, M.F. Gomon et al., Museum of Victoria (NMV) J15772 (male, 2.5 mm, with 3 slides).

Paratypes (66 specimens in all). Same data as holotype, NMV J15773 (3 males, 2 ovigerous females, 2 preparatory females, 3 young females); Zoological Museum, Copenhagen (1 male, 1 female). Bass Strait S of Point Hicks, 38°19.60′S, 149°24.30′E to 38°19.00′S, 149°27.30′E, 930–951 m, rock, rubble, clay, sand, biogenic sediments, WHOI epibenthic sled, RV "Franklin" stn SLOPE-33, 23 Jul 1986, M.F. Gomon et al. NMV J15774 (2 males, 2 ovigerous females, 5 post breeding females, 2 preparatory females). Bass Strait S of Point Hicks, 38°21.90′S, 149°20.00′E to 38°21.40′S, 149°20.90′E, 1000 m, clay, shell, coarse biogenic sand, WHOI epibenthic sled, RV "Franklin" stn SLOPE-32, 23 Jul 1986, G.C.B. Poore et al., NMV J15775 (3 males, 5 ovigerous females, 5 post breeding females, 3 young females). Eastern Tasmania off Freycinet Peninsula, 42°02.20′S, 148°38.70′E, 800 m, coarse shelly sand, WHOI epibenthic sled, RV "Franklin" stn SLOPE-45, 27 Jul 1986, M.F. Gomon et al., NMV J15776 (1 male, 1 ovigerous female, 3 preparatory females, 1 young female). Eastern Tasmania off Freycinet Peninsula, 41°58.60′S, 148°38.80′E, 500–600 m, coarse shell, large sponges, WHOI epibenthic sled, RV "Franklin" stn SLOPE-47, 27 Jul 1986, M.F. Gomon et al., NMV J15777 (1 male, 3 preparatory females). Eastern Tasmania off Freycinet Peninsula, 41°57.50′S, 148°37.90′E, 400 m, coarse shell, RV "Franklin" stn SLOPE-48, 27 Jul 1986, M.F.Gomon et al., NMV J15778 (1 male, 2 ovigerous females, 4 young females). Eastern Bass Strait slope, 67 km S of Point Hicks, Victoria, 38°23.95′S, 149°17.02′E to 38°23.78′S, 149°15.24′E, 1277–1119 m, fine mud,

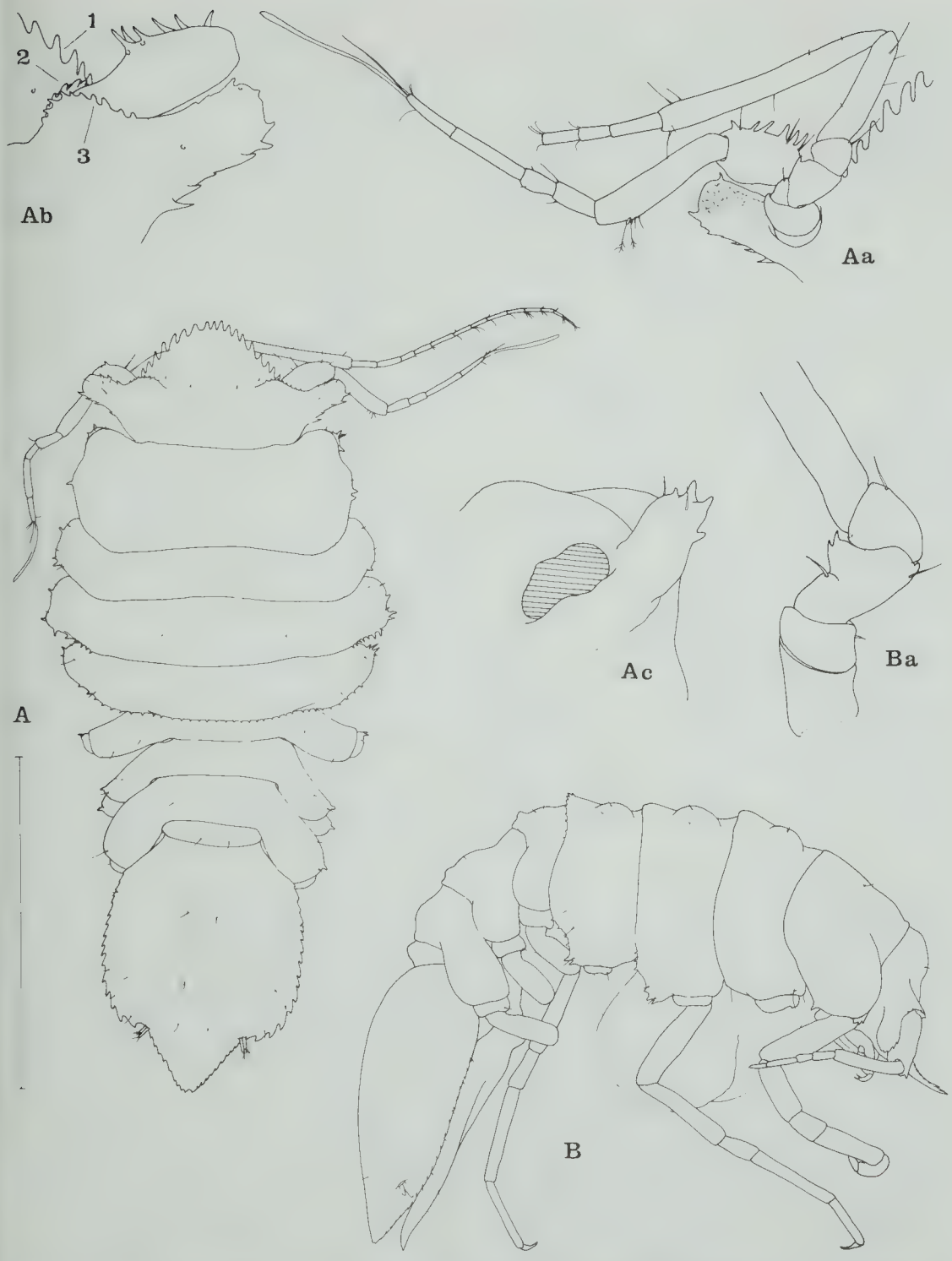

Figure 2. *Abyssianira bathyalis* sp. nov. A, holotype, male; Aa, ventral view of right antennae; Ab, dorsal view of right side of cephalon: 1, frontal plate, 2, spinose ridge, 3, 'brow'; Ac, ventral view of left coxa 1 with spinose projection. B, female paratype, ovigerous, SLOPE-34; Ba, ventral view of right antenna 2 peduncle. Habitus scale, A and B, 1 mm.

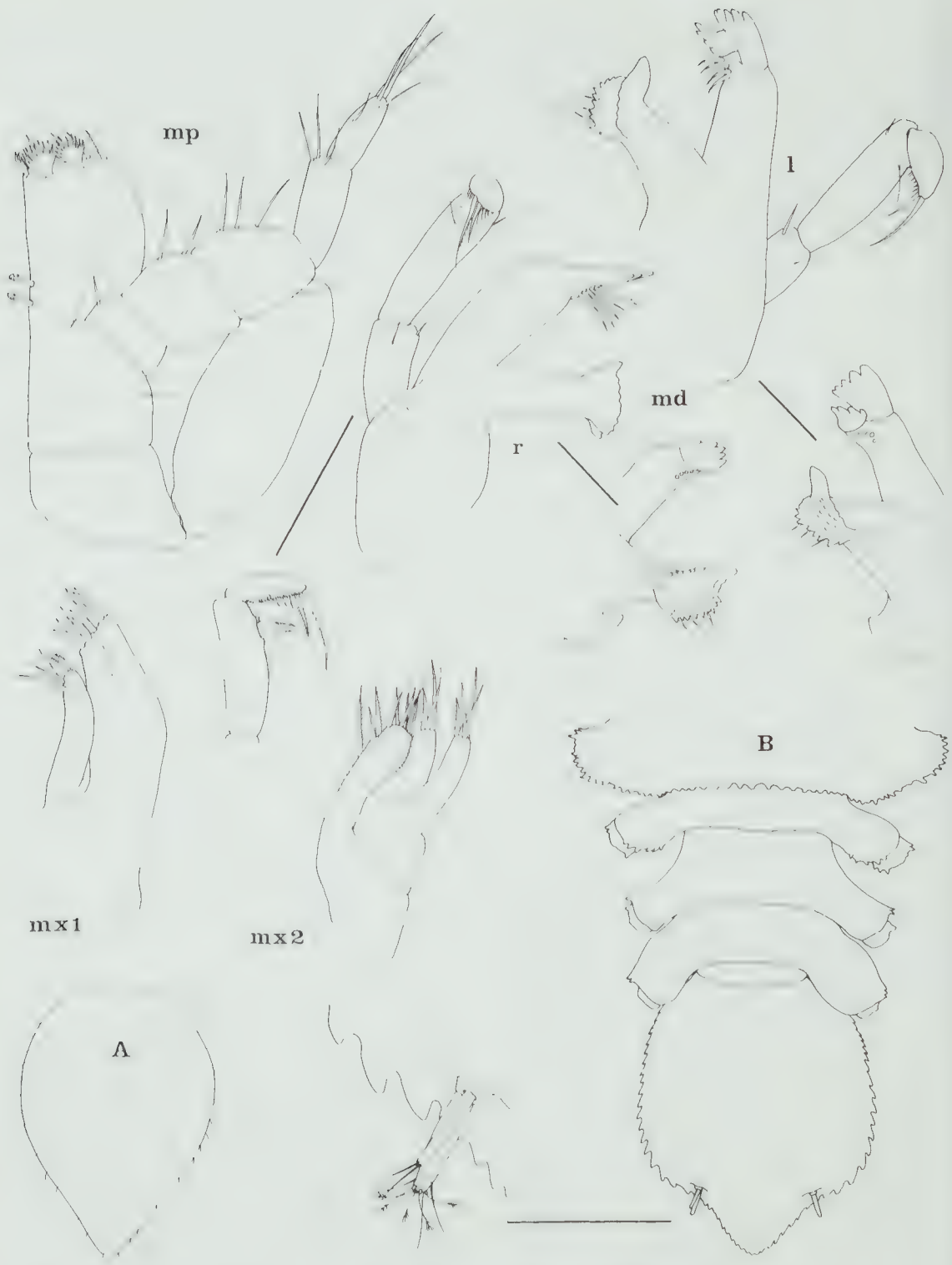

Figure 3. *Abyssianira bathyalis* sp. nov. Mouthparts, holotype: md, mandibles, l and r, left and right; mx1, maxilla 1; mx2, maxilla 2; mp, maxilliped. A, female paratype, see Fig. 2, pleopod 2. B, variant male, see text, SLOPE-32, pereonites 4–7 and pleon.

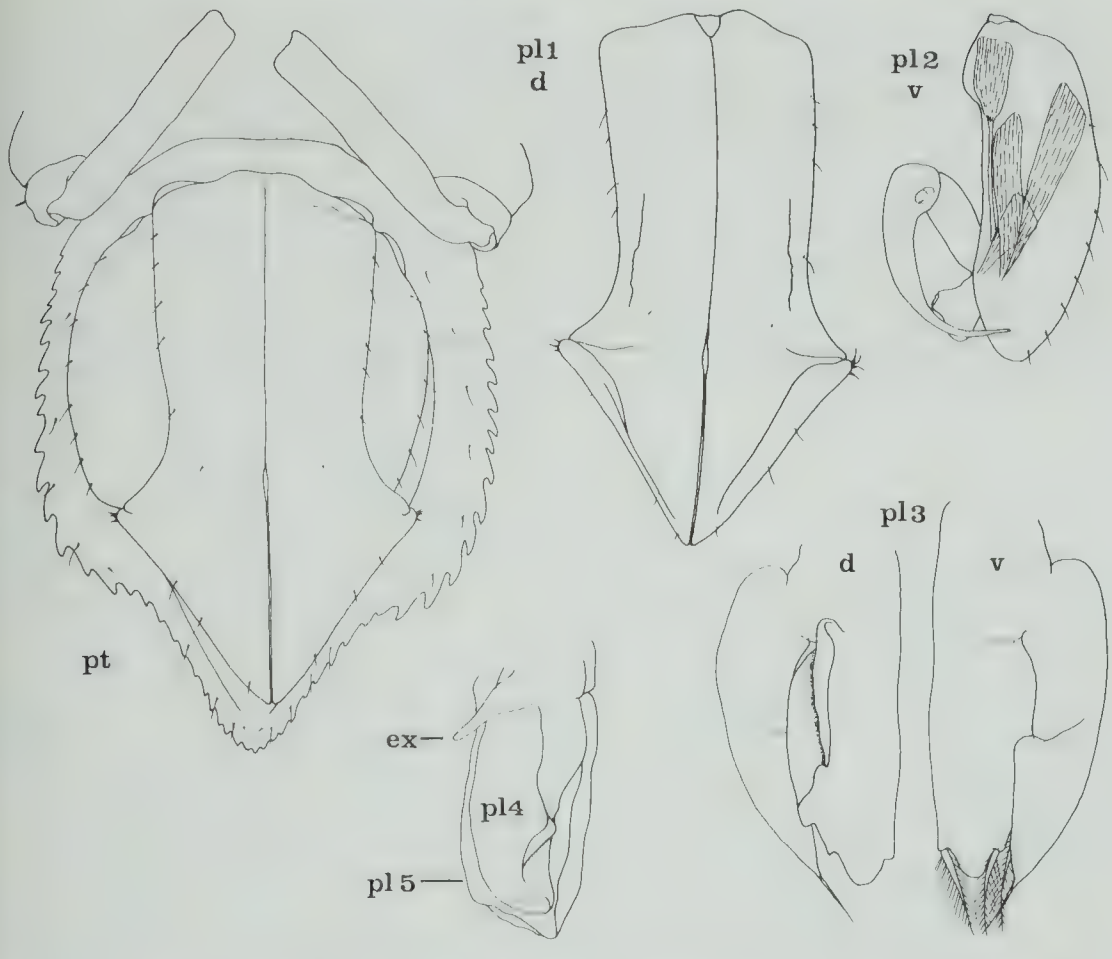

Figure 4. *Abyssianira bathyalis* sp. nov., holotype, male. pt, pleotelson, ventral view; pl 1–5, pleopods 1–5; d, dorsal view; v, ventral view; ex, exopod of pleopod 4.

WHOI epibenthic sled, RV "Franklin", stn SLOPE-67, 25 Oct 1988, G.C.B. Poore et al., NMV J16791 (1 ovigerous female, 1 juvenile). Eastern Tasmania off Freycinet Peninsula, 42°00.25′S, 148°43.55′E to 41°57.77′S, 148°42.08′E, 1264 m, gravel with sandy mud aggregate, WHOI epibenthic sled, RV "Franklin" stn SLOPE-81, 30 Oct 1988, G.C.B. Poore et al.; NMV J15779 (5 preparatory females, 2 males, 1 juvenile).

Description. Frontal plate strongly convex, coarsely serrate with up to 17–23 marginal teeth visible in dorsal view in mature specimens. Eye-stalks prominent, slightly overreaching pereonite 1 in dorsal view, forward pointing at an angle of c. 25° and curving downwards, anterior and posterior margins parallel with small spines, apex rounded or with a few small spines. Antenna 1 inserted under spinose brow-like overhang (Fig. 2Ab3) continuous with anterior margin of eye-stalk. Cephalon with spinose ridge on each side running from median extension of 'brow' downwards to lateral margin of frontal plate (Fig. 2Ab2) along medial margin of article 1 of antenna 1.

Pereonite 1 with small dorsally visible spinose anterolateral coxal projection. Pereonite 1 distinctly longer than succeeding ones, about as long as 2 and half of 3 combined, with small lateral spines. Pereonites 2–4 of equal length, 3 the broadest, all with low, rounded, transverse keel dorsally, rounded lateral margins with small scattered spines, especially prominent on slightly projecting, rounded posterior corner of pereonite 3; pereonite 4 with more or less distinct small spines along entire posterior margin. Pereonite 5 shorter than 6 and 7, lateral parts of pereonite 7 broader than equal 5 and 6.

Pleon as long as pereonites 2–7 combined (dorsal view, flattened); pleotelson broadest in distal third, with serrate margins faintly convex, nearly parallel, with low, broadly rounded mid-dorsal keel, posteriorly produced into blunt, serrate triangle.

Antenna 1, article 1 with slender spines along medial surface, article 2 as long as 3–5 combined, c. 4 times longer than wide, article 6 two-thirds length of 5. Antenna 2, peduncular articles 1 and 2 of subequal length, article 3 c. 50% longer than greatest width, expanded in distal half, with a few distolateral spines; flagellum with up to 15 articles.

Mouthparts: 3-articulate mandibular palp barely reaching tip of incisor, article 3 short, curved, with 2 long apical, pectinate setae, a subapical row of short setae, and field of fine setules, articles 1 and 2 with a few distal setae, article 2 with distal cuticular combs; long cylindrical molar strongly expanded in distal third, apex truncate with serrate margins, a few setae on dorsoanterior margin, and a strong tooth pointing towards incisor. Maxillipedal epipod slender, oval.

Pereopod 1 slender, article 2 with anterior row of small sharp spines (probably more than shown in Fig. 5), article 3 little more than twice

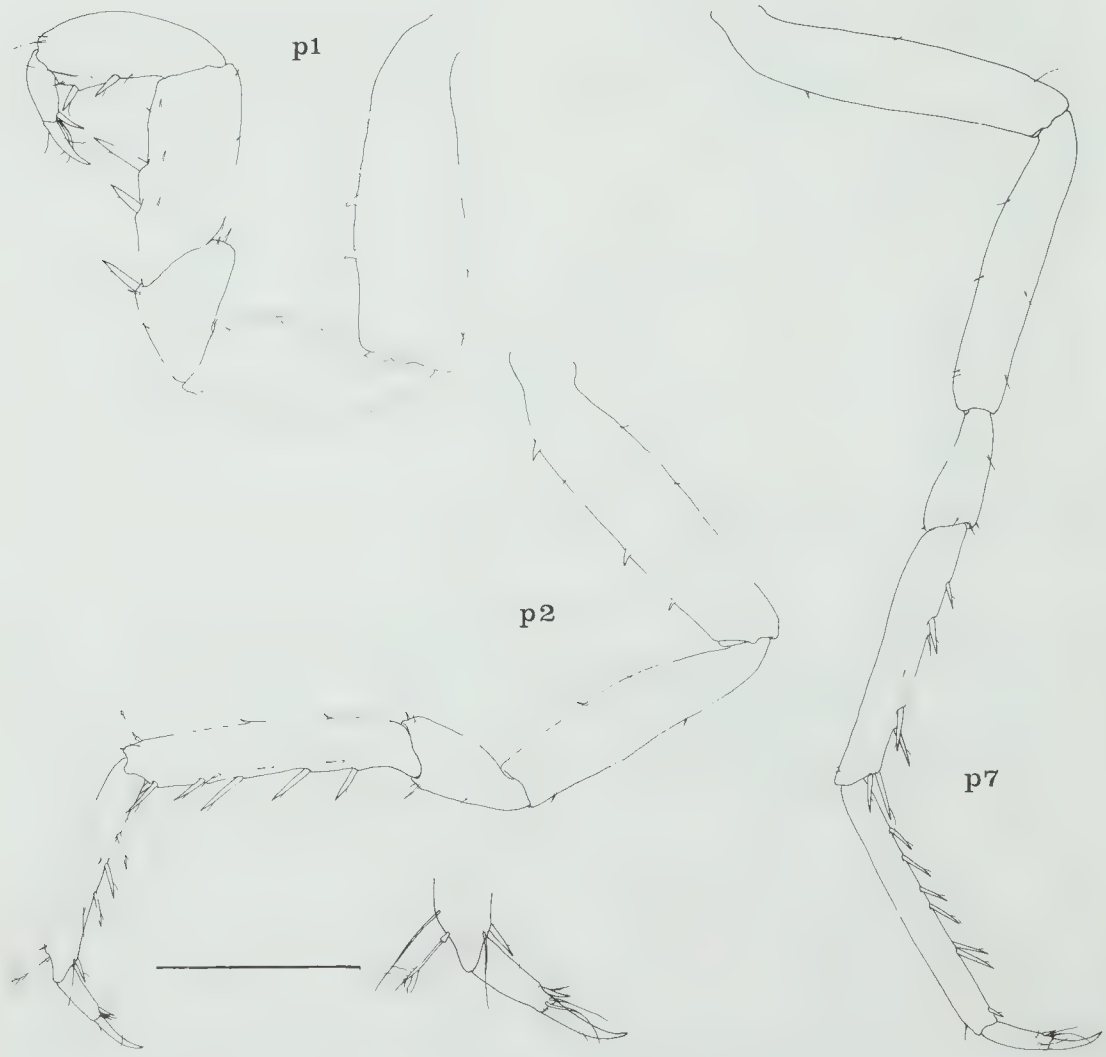

Figure 5. *Abyssianira bathyalis* sp. nov., holotype. p1, p2, p7, pereopods 1, 2 (both left), and 7 (right).

as long as wide, article 4 distally expanded, simple, triangular, with 1 posterodistal spine-like seta, article 5 about twice as long as wide, straight, with 2 midposterior spine-like setae, article 6 slightly curved and distally widening, nearly 3 times longer than wide, with 2 posterior spine-like setae, article 7 including unguis about two-thirds length of article 6. Pereopod 2 similar to 3–7 except article 2 with anterior row of small sharp spines (probably more than shown in Fig. 5). Pereopods slightly increasing in length from 2 to 7, articles 5 and 6 with posterior row of spine-like setae.

Pleopod 2 of male, protopod 3 times longer than broad, nearly straight, apex broadly rounded, lateral margin with short setae, endopod rather short, article 2 moderately curved, exopod distally bilobed. Female operculum ovoid, distally tapering towards bluntly pointed apex, lateral margins with short setae. Pleopod 3, exopod articles not fully separated, distal article sharply pointed with terminal simple seta, endopod with 3 plumose setae, lateral margin expanded into dorsally (functionally) pointed ear-like lobe, (an ongoing study will show that this is a commonly occurring feature of many paramunnid species). Pleopod 4 with short, bluntly pointed exopod. Uniramous pleopod 5 slightly larger than 4.

Uropods inserted dorsally just inside lateral margin, protopod half hidden, about as long as broad, exopod four-fifths length of endopod, endopod ca. 4 times length of protopod.

Size. Largest female: 3.8 mm; largest male: 3.0 mm; smallest ovigerous female: 2.2 mm.

Distribution. South-eastern Australia; 400–1277 m.

Variation. The frontal plate is often slightly longer than in the holotype. A few specimens have more lateral spines on pereonites, including pereonite 5 (Fig. 3B), than in the holotype.

Remarks. Abyssianira bathyalis differs from the two Atlantic species in its much more strongly convex frontal plate, its straight, nearly laterally pointing eye-stalks, the long pereonite 1 relative to 2 and 3, and the longer more setose mandibular palp. *A. dentifrons* has strongly convex pleotelson margins and no spines on the posterior projection. *A. argentenensis* has a more pentagonal pleotelson with a very wide-angled short posterior projection. In *A. dentifrons* the mandibular molar is nearly unexpanded distally (not known for *A. argentenensis*). In *A. argentenensis* article 1 of antenna 1 is expanded distally with a row of medial spines on the expanded part. There are minor differences in the shape and setation of pereopods and uropods, and in the male pleopod 2 in at least *A. dentifrons*, but the two Atlantic species are still inadequately known.

A. bathyalis differs from *A. tasmaniensis* below primarily in having the frontal plate more densely serrate, the eyestalks broader and pointing more laterally, cephalic 'brows' with spines, antenna 1 with peduncular spines, pereonite 3 with posterolateral spinose lobes, and the mandibular molar more strongly expanded distally.

Abyssianira tasmaniensis sp. nov.

Figures 6, 7

Material examined. Holotype. Eastern Tasmania off Freycinet Peninsula, 41°58.60′S, 148°38.80′E, 500–600 m, coarse shell, large sponges, WHOI epibenthic sled, RV "Franklin" stn SLOPE-47, 27 Jul 1986, M.F.Gomon et al., NMV J15780 (preparatory female, 2.3 mm, with 3 slides).

Paratypes (16 specimens). Same data as holotype, NMV J15781 (1 ovigerous female, 1 post breeding female). Eastern Tasmania off Freycinet Peninsula, 41°57.50′S, 148°37.90′E, 400 m, coarse shell, WHOI epibenthic sled, RV "Franklin" stn SLOPE-48, 27 Jul 1986, M.F.Gomon et al., NMV J15782 (1 preparatory female). Eastern Tasmania off Freycinet Peninsula, 41°57.30′S, 148°58.54′E to 41°56.86′S, 148°57.96′E, 1735–1770 m, sandy mud, fine shell, WHOI epibenthic sled, RV "Franklin" stn SLOPE-82, 30 Oct 1988, G.C.B. Poore et al., NMV J15783 (7 post breeding females, 4 preparatory females, 2 males).

Description. Frontal plate strongly convex, coarsely serrate with 13–15 marginal teeth visible in dorsal view in mature specimens. Eyestalks slender, not overreaching pereonite 1 in dorsal view, forward pointing at an angle of c. 50° and curving downward, anterior and posterior margins parallel with small spines, apex with irregular spination. Antenna 1 inserted under small, smooth brow-like overhang. Cephalon with spinose ridge on each side running from median extension of 'brow' downwards to lateral margin of frontal plate along medial margin of article 1 antenna 1.

Pereonite 1 with anterolateral spinose coxal projection visible in dorsal view, coxa poorly delimited from sternite, pereonite 1 as long as 2 and half of 3 combined, with small midlateral spines. Pereonites 2–4 of equal length, with a few small spines on rounded lateral margins, pereonite 4 with posterior margin smooth between lateral insertion points of pereonite 5. Pereonite

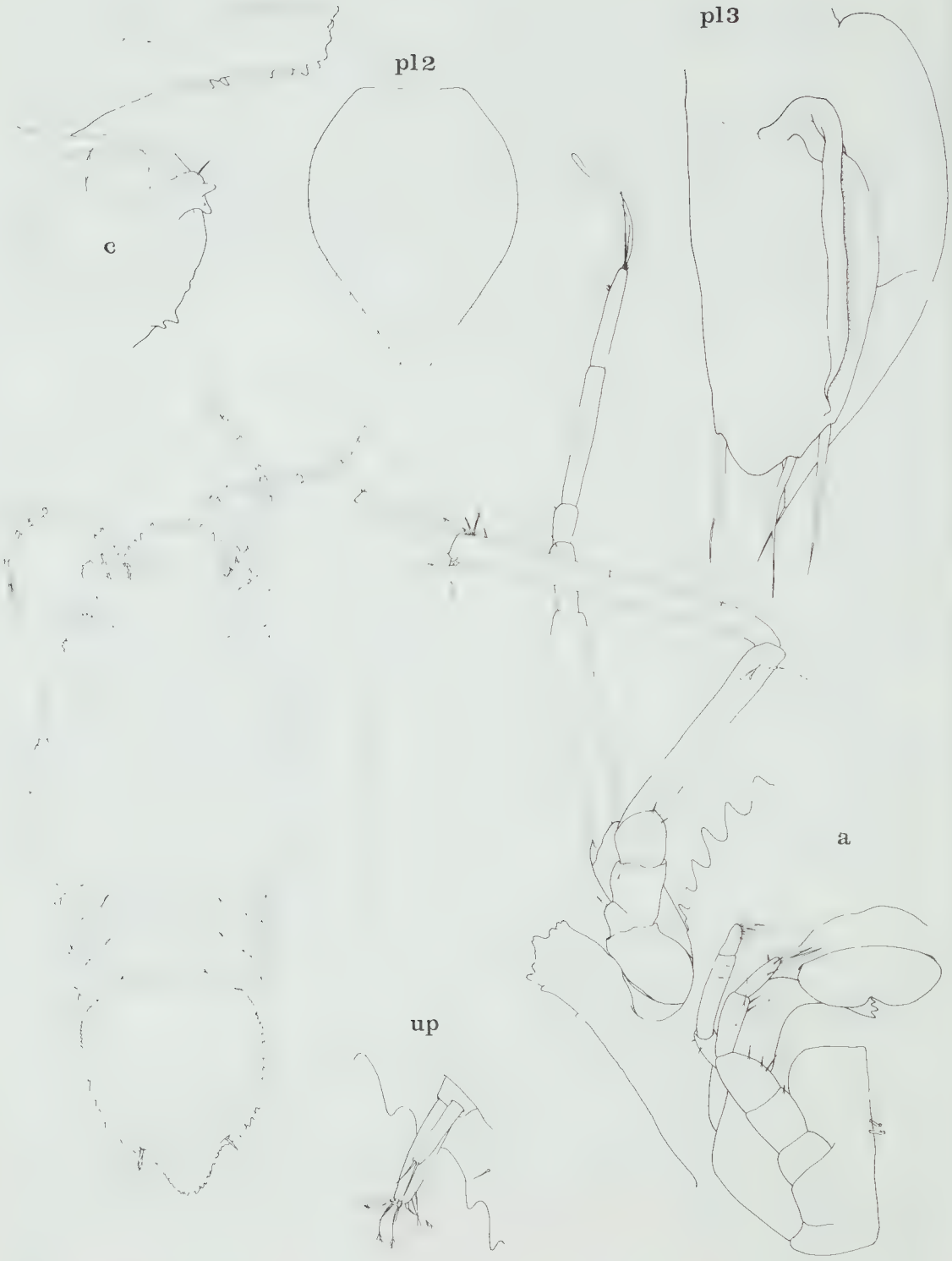

Figure 6. *Abyssianira tasmaniensis* sp. nov., holotype, female. a, ventral view of right side of cephalon; c, ventral view of right coxa 1 with spinose projection; pl2, pleopod 2; pl3, pleopod 3, dorsal view; up, left uropod, dorsal view. Habitus scale, 1 mm.

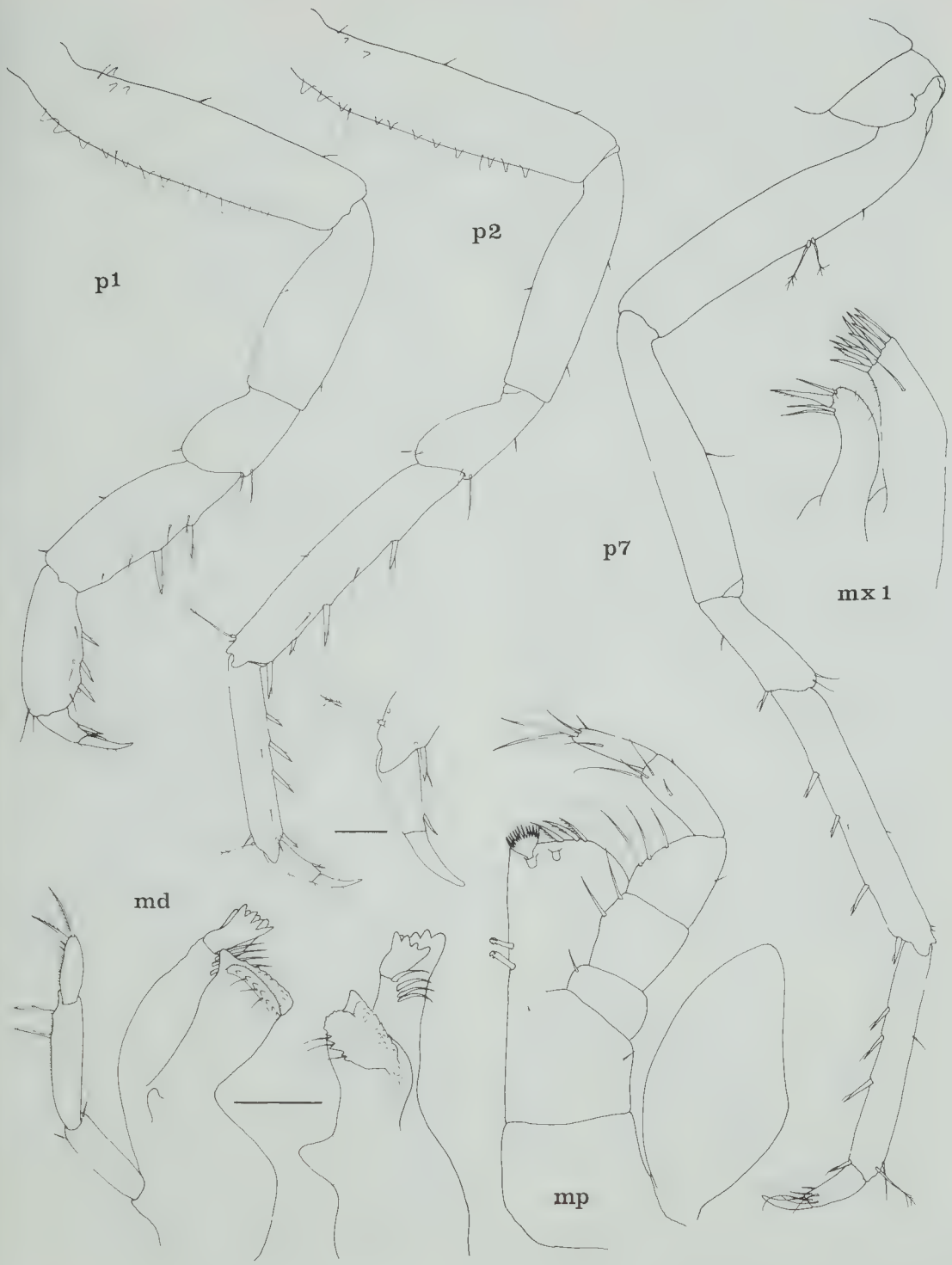

Figure 7. *Abyssianira tasmaniensis* sp. nov., holotype. p1, p2, p7, pereopods 1, 2, and 7 (all left); md, left mandible; mp, maxilliped; mx1, maxilla 1.

5 shorter than 6 and 7, lateral parts of 7 broader than equal 5 and 6.

Pleon as long as pereonites 2–6 combined (dorsal view, flattened); pleotelson broadest proximally, with serrate margins faintly convex, posteriorly produced into rounded serrate triangle; pleotelson with evenly curved dorsal surface in transverse section.

Antenna 1 article 1 without spines, article 2 about as long as 3–5 combined, nearly 6 times longer than wide, article 6 two-thirds length of 5. Antenna 2 peduncular articles 1 and 2 joined at strongly oblique articulation (Fig. 6a), 2 longer than 1, article 3 without spines, about one-fifth longer than wide, about two-thirds length of article 2 (ventral view).

Mouthparts similar to *A. bathyalis*, except mandibular molar less strongly expanded distally and maxillipedal epipod with rounded, angular lateral margin.

Pereopods similar to *A. bathyalis*, but pereopod 1 more slender, articles 3 and 5 nearly 3 times longer than wide, article 6 with 3 posterior spine-like setae. Pereopods 1 and 2 article 2 with row of small fragile spines along entire anterior margin and proximoposterior group of similar spines. Pereopods 3–4 with short midanterior row of similar spines and proximoposterior group of spines.

Female operculum ovoid, distally tapering towards bluntly pointed apex, with short marginal setae. Male pleopods 1–2 as in *A. bathyalis*. Pleopods 3–5 as in *A. bathyalis*.

Uropods inserted dorsally just inside lateral margin, protopod half hidden, about as long as broad, endopod 3 times longer than protopod, exopod about three-fifths length of endopod.

Size. Largest male: 3.6 mm; largest female: 4.0 mm; smallest ovigerous female: 2.4 mm.

Distribution. South-eastern Australia; 400–1770 m.

Remarks. Abyssianira tasmaniensis differs from the two Atlantic species in the same way as *A. bathyalis* (see above), except for its forward pointing eyestalks which are similar to those of *A. argentenensis* although more slender. The main differences between *A. tasmaniensis* and *A. bathyalis* were discussed in the remarks on the latter species.

Discussion

The two Atlantic species of *Abyssianira* have been found at abyssal depths only (*A. dentifrons*: 4618–5293 m, Central and South Atlantic; *A. argentenensis*: 2681 m, South Atlantic). In contrast, the two Australian species are from upper to mid-bathyal depths (*A. bathyalis*: 400–1277 m; *A. tasmaniensis*: 400–1770 m). In spite of extensive sampling over many years the genus has never been reported from the Antarctic. The two Australian species have similar plesiomorphic mandibular palps compared to the reduced, more typical paramunnid palp in at least *A. dentifrons*, (Menzies, 1962 did not note any deviation from *A. dentifrons* in this character in his very brief description of *A. argentenensis*).

Taken together, these distributional and morphological data suggest that ancestral *Abyssianira* evolved in cold water, but not of present day polar temperatures, at moderate depths of the upper bathyal, perhaps even the lower shelf. The occurrence in the deep central and southern Atlantic as well as in more shallow water of the south-eastern Australian slope indicates that the origin of the genus should be sought in the southern hemisphere, and more specifically in the cold-water Weddellian Province of late Cretaceous or early Tertiary Gondwana. If that scenario is correct, it is entirely likely that additional species of *Abyssianira* may be discovered on the mid to upper slopes of South America and New Zealand.

It is not possible at present to evaluate whether or not ancestral *Abyssianira* had functional eyes. One positive indication is the presence, at least in some preserved specimens of *A. bathyalis*, of scattered dark matter (?pigment) in the eye stalks (Fig. 2Aa). If the above hypothesis of a shallow water origin of the genus is correct, functional eyes were most likely present and species with a few functional ocelli may still be in existence, (Paramunnidae with eyes typically have a few ocelli only). The discovery of such species would lend support to the shallow water origin hypothesis as against the alternative, an abyssal-deep bathyal origin with subsequent emergence into shallower depths. In this case one would suppose *Abyssianira* evolved from a paramunnid stock which had already lost functional eyes.

The shallow water hypothesis invokes vicariance through continental drift, with subsequent local dispersal into deep water, *in casu* from the eastern South American slope into the Atlantic abyss. The alternative scenario includes no vicariance element and relies solely on an unspecified centre of origin and unlimited horizontal and vertical dispersal, – which for paramunnids in general means *walking*.

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TERRESTRIAL ISOPODA FROM THE KRAKATAU ISLANDS, SOUTH SUMATRA AND WEST JAVA

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Abstract

Green, A.J.A., Ferrara, F. and Taiti, S., 1990. Terrestrial Isopoda from the Krakatau Islands, South Sumatra and West Java. *Memoirs of the Museum of Victoria* 50(2): 417–436.

Seventeen species of terrestrial Isopoda are recorded from the Krakatau Islands, South Sumatra and West Java. Five species are described as new: *Burmoniscus orientalis, B. rakataensis, B. veliger, B. vaughani* and *B. thorntoni*. Four species are redescribed and illustrated: *Alloniscus pallidulus* Budde-Lund, 1885, *Pseudotyphloscia alba* (Dollfus, 1898) comb. nov., *Saidjahus guttatus* (Dollfus, 1898) and *"Spherillo" velutinus* (Dollfus, 1898). *Pseudotyphloscia pallida* Verhoeff, 1928 is considered to be a junior synonym of *P. alba*. Comments on the distributions of all the species are given.

Introduction

This paper deals with the Oniscidea collected during the Zoological Expeditions to the Krakataus by the Department of Zoology, La Trobe University, Bundoora, Victoria, Australia, in 1984, 1985 and 1986. The material was collected in the Krakatau Islands and surrounding areas of Sumatra and Java (see Thornton, 1985).

It is the first time that the Krakatau Archipelago has been investigated properly. In fact, only three species of terrestrial isopods were known from a single island (Krakatau I. = Rakata I.). They were collected by E. Jacobson in 1908, identified by the late G. Budde-Lund and published by Richardson Searle (1922), i.e. *Alloniscus brevis* Budde-Lund, 1885 (= *A. oahuensis* Budde-Lund, 1885), *Nagara cristata* [= *Nagurus cristatus* (Dollfus, 1889)] and *Cubaris murina* Brandt, 1833. According to Dammerman (1948: 510) other specimens were collected between 1919 and 1922, and in 1933, but no identifications were published.

Unfortunately the Oniscidea of both Sumatra and Java (and in general of all of the Oriental Region) are poorly known because of both lack of investigations and outmoded literature. This prevents any reliable zoogeographical comments. Only 29 species have been reported from Java and 23 from Sumatra (Budde-Lund, 1885, 1912a; Dollfus, 1898; Richardson Searle, 1922; Herold, 1931; Arcangeli, 1927, 1935, 1954; Schultz, 1985). These numbers certainly are far from their actual oniscidean populations.

In studying this material we came across numerous taxonomic problems due to the confused literature. In order to identify most of the specimens correctly it was necessary to re-examine much of the type material studied by previous authors (Dollfus, 1898; Richardson Searle, 1922; Verhoeff, 1928; Herold, 1931).

For names of the different Krakatau Islands and localities visited by the Zoological Expeditions to the Krakataus, see Thorton (1985).

Abbreviations. BM, British Museum (Natural History), London; MF, Museo Zoologico "La Specola" (Sezione del Museo di Storia Naturale) dell'Università, Firenze; MZB, Museum Zoologicum, Bogor; NHMB, Naturhistorisches Museum, Basel; NMV, Museum of Victoria, Melbourne; RMNH, Rijksmuseum van Natuurlijke Historie, Leiden; TM, Tasmanian Museum and Art Gallery, Hobart; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; ZMA, Zoölogisch Museum, Amsterdam; ZMB, Zoologisches Museum, Berlin; ZMH, Zoologisches Museum, Hamburg.

Scyphacidae

Alloniscus Dana, 1854

Alloniscus oahuensis Budde-Lund, 1885

Alloniscus brevis.—Richardson Searle, 1922: 1.
Alloniscus oahuensis.—Vandel, 1973a: 23.—1973b: 30.

Type material re-examined. "Indes": 1 male (Holotype of *Alloniscus brevis* Budde-Lund, 1885), leg. J. Ray (Budde-Lund Collection, BM).

Material examined. Krakatau Islands: 1 male juv., 1 female (MZB), 1 male juv., 1 female (NMV J16158), 1 male juv. (MF), Sertung, Spit, 7 Sep 1984.

Distribution. Littoral species widely distributed along the coasts of Indian and Pacific Oceans.

Remarks. Ferrara and Taiti (1985) tried to solve the entangled taxonomy of *Alloniscus* species. Some of them were revised but the authors were not able to clarify *A. brevis* Budde-Lund, 1885, and *A. pallidulus* Budde-Lund, 1885. We have re-examined the holotype of *A. brevis* deposited in the British Museum (Natural History). It is a male which lacks pereopods 7 and pleopod 1 exopods, so it is not sufficient to solve the identity of this species with certainty. However, the general shape of the body and pleopod 1 endopod are identical to those of *A. oahuensis*. Moreover, material from Krakatau Island (= Rakata I.) was identified by Budde-Lund (in Richardson Searle, 1922) as *A. brevis*. The specimens from Sertung Island examined here certainly belong to *A. oahuensis*. It appears from these facts that it is wise to support Jackson's (1933) opinion and consider *A. brevis* as a junior synonym of *A. oahuensis*. This will serve to avoid any future confusion about a species which otherwise is impossible to recognize.

Alloniscus pallidulus Budde-Lund, 1885

Figure 1

Material examined. Krakatau Islands: 1 male, 1 female (MZB), 1 male (NMV J16101), 1 male (MF), Sertung, Spit, 7 Sep 1984.

Description. Dimensions: male, 9.5 × 5 mm; female, 7.5 × 3 mm. Grey or brown, often with isolated chromatophores. Body convex with numerous tiny triangular scale-spines. Gland pores (7–15) along lateral margins of pereonites, more numerous on posterior ones. Eye with about 20 ommatidia. Cephalon with profrons slightly protruding frontwards; triangular lateral lobes with rounded apex; frontal line slightly visible, supra-antennal line clearly visible, straight. Pereonites 1–4 with posterior margin straight and postero-lateral corners rounded; pereonites 5–7 with posterior margin concave and postero-lateral corners acute. Pleonites 3–5 with epimera well developed, falciform. Telson with straight sides and truncated or broadly rounded apex, with a slight longitudinal impression on dorsal surface. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 6:4:7. Exopods of pleopods with respiratory areas typical of the genus. Uropod with protopod flattened and surpassing tip of telson; insertion of endopod proximal to that of exopod.

Male. Pereopods 1–5 with brushes of trifid spines on carpus and merus. Pereopod 7 ischium with a depression on the proximal half of sternal margin. Pleopod 1 exopod cordiform; endopod straight with apical part without modifications (sharply pointed and distinctly bent outwards in juvenile and subadult specimens). Pleopod 2 with endopod shorter than exopod.

Distribution. Pahang and Sabah (Malaysia) (dat. ined.), Krakatau Islands, Sulawesi (dat. ined.), Moluccas and Australia.

Remarks. These specimens are ascribed tentatively to *A. pallidulus*. This species was described by Budde-Lund (1885) on two specimens (probably females: see Arcangeli, 1960) from Amboina Island (Moluccas). The type specimens of *A. pallidulus* were to be deposited in the Zoologisches Museum, Berlin, but they seem to be no longer present (H.-E. Gruner, pers. comm.). No illustrations of *A. pallidulus* exist so a safe identification of this species is not possible. These specimens from Sertung Island correspond quite well to Budde-Lund's description. Moreover we have examined specimens pertaining to the same species from several other localities in the Sunda Archipelago area (Pahang, West Malaysia; Sabah, East Malaysia; Sulawesi). Thus the species has a wide distribution in the area from which *A. pallidulus* was originally described so the identification of these specimens with *A. pallidulus* is probable. Accepting this identification will also avoid the institution of another new species. Already the genus includes many species which are extremely close to each other and which can be identified only after examination of adult males. The new description of this species provided here is based on the specimens examined.

Budde-Lund (1908; 1912b; 1913) identified as *A. pallidulus* specimens from Madagascar and Australia. The specimens from Madagascar certainly belong to a different species, *A. nacreus*

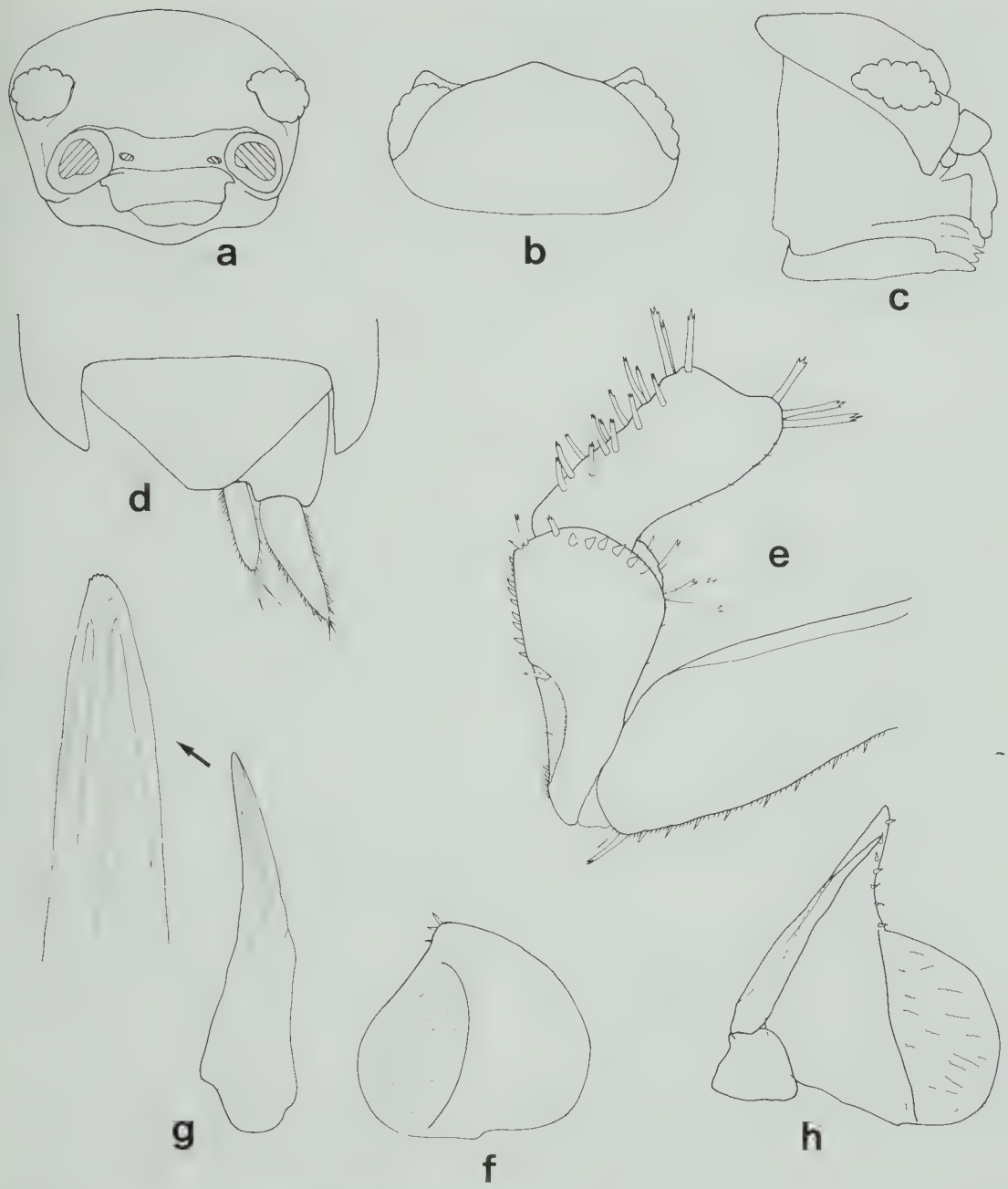

Figure 1. *Alloniscus pallidulus* Budde-Lund, 1885, male: a, cephalon in frontal view; b, cephalon in dorsal view; c, cephalon in lateral view; d, pleonite 5, telson and right uropod; e, pereopod 7; f, pleopod 1 exopod; g, pleopod 1 endopod; h, pleopod 2.

Collinge, 1922 (Ferrara and Taiti, 1985). Re-examination of the specimens from Denham, Western Australia (1 male, 2 females, ZMH), identified by Budde-Lund (1912b: 40) showed that the identification was correct.

We re-examined also specimens from Western Australia [Fremantle (1 male, 1 juv., ZMH) and Rottnest Island (2 males, 1 female, TM)] identified as *A. nicobaricus* Budde-Lund, 1885, by Budde-Lund (1912b: 40) and Bunn and Green

(1982: 149) respectively. These specimens proved to be identical to those from Denham and belong to *A. pallidulus*.

A. pallidulus is characterized by the cephalon with profrons slightly protruding frontwards, triangular lateral lobes with rounded apex, frontal line slightly visible; telson with truncated or broadly rounded apex; male pereopod 7 ischium with a depression on the proximal half of sternal margin; male pleopod 1 exopod cordiform, endopod straight with apical part without evident modifications.

Philosciidae

Pseudotyphloscia Verhoeff, 1928

Type species. Pseudotyphloscia pallida Verhoeff, 1928 (= *Philoscia alba* Dollfus, 1898).

Diagnosis. Sulcus marginalis and gland pores absent. Each pereonite with one nodulus lateralis per side; d/c co-ordinates with one evident peak on pereonite 4 and two smaller peaks on pereonites 2 and 7. Frontal line absent; supraantennal line present. Epimera of pleon reduced, adpressed, without posterior points visible in dorsal view. Molar penicil of mandible consisting of a single unbranched seta. Outer branch of maxillule with 4+5 (4 slightly incised) + 2 very small teeth; inner branch with two unequal penicils. Endite of maxilliped with a penicil. Exopods of pleopods without respiratory areas. Uropodal protopod grooved on outer margin; insertion of endopod proximal to that of exopod.

Remarks. Pseudotyphloscia was erected by Verhoeff (1928) to accommodate the new species *P. pallida* from Formosa. Re-examination of the type material of this species (see below) allowed us to redefine the genus according to modern criteria. The genus appears to be very close to *Burmoniscus* Collinge, 1914, from which it differs only in the maxillular teeth [4+5 (4 slightly incised) + 2 small accessory teeth instead of 5+6 (5 deeply cleft)]. The absence of gland pores and insertion of uropodal endopod proximal to that of exopod are characters present also in some species of *Burmoniscus*. With only one known species, we are not able to judge the importance of this distinctive character. Waiting for a better knowledge of the philosciids from the Oriental Region, we keep *Pseudotyphloscia* as a valid genus.

Pseudotyphloscia alba (Dollfus, 1898) comb. nov.

Figures 2, 3

Type material re-examined. Sulawesi: 1 male, 2 females (syntypes of *Philoscia alba* Dollfus), Tomshou, leg. F. and P. Sarasin (Dollfus Collection, NHMB).

Taiwan: 1 male, 2 females (syntypes of *Pseudotyphloscia pallida* Verhoeff), Takao, leg. H. Sauter (Verhoeff Collection, ZMB).

Material examined. West Java: 4 males, 2 females (MZB), 1 male, 6 females (NMV J16135), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Krakatau Islands: 2 males, 2 females (MF), Sertung, Spit, 18 Aug 1985; 1 male (TM), Anak Krakatau, 10 Sep 1984.

Description. Maximum length: male, 4 mm; female 6 mm. Body elongated and colourless. Eye with 4 or 5 ommatidia (in the largest specimens). Co-ordinates of noduli laterales as in Fig. 2a. Pereonite 7 with postero-lateral corner almost a right angle. Telson triangular, with sides almost straight, apex obtuse. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 4:3:3; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively.

Male. Antenna with fifth joint of peduncle distinctly swollen. Pereopods without sexually dimorphic modifications. Pleopod 1 exopod cordiform with rounded apex; endopod with apical part slightly bent outwards, narrowed before apex. Pleopod 2 as in Fig. 3d.

Distribution. Sulawesi, Java, Krakatau Islands, Bali (dat. ined.) and Taiwan.

Remarks. Comparison with type materials has shown that the specimens from the Krakataus and West Java correspond with certainty to *Philoscia alba* Dollfus, 1898, from Celebes and to *Pseudotyphloscia pallida* Verhoeff, 1928, from Formosa. *P. pallida* is a junior synonym of *P. alba* which must be transferred to the genus *Pseudotyphloscia*.

Anchiphiloscia Stebbing, 1908

Anchiphiloscia pilosa (Budde-Lund, 1913)

Material examined. Krakatau Islands: 9 males, 21 females (MZB), Panjang, 14 Sep 1984; 3 males, 1 female (NMV J16133), same locality, 27 Aug 1985; 3 males, 4 females (MF), Rakata, Zwarte Hoek, 1 Sep 1984; 5 males, 4 females (TM), same locality, 12 Sep 1984; 4 females, 2 juvs (MZB), same locality, 15 Sep 1984; 1 female (MZB), Rakata, 280 m, 14 Sep 1984; 1 female (MZB), Rakata, West Ridge, 259 m, 14 Sep 1984; 4 males, 1 juv. (NMV J16132), 1 female (MZB), Sertung, 18 Aug 1985; 3 females, 1 juv. (MZB), same locality, 19 Aug 1985; 1 male (MZB), Sertung, Spit, 16 Aug 1985; 2 males, 2 females (NMV J16134), same locality, 18 Aug 1985.

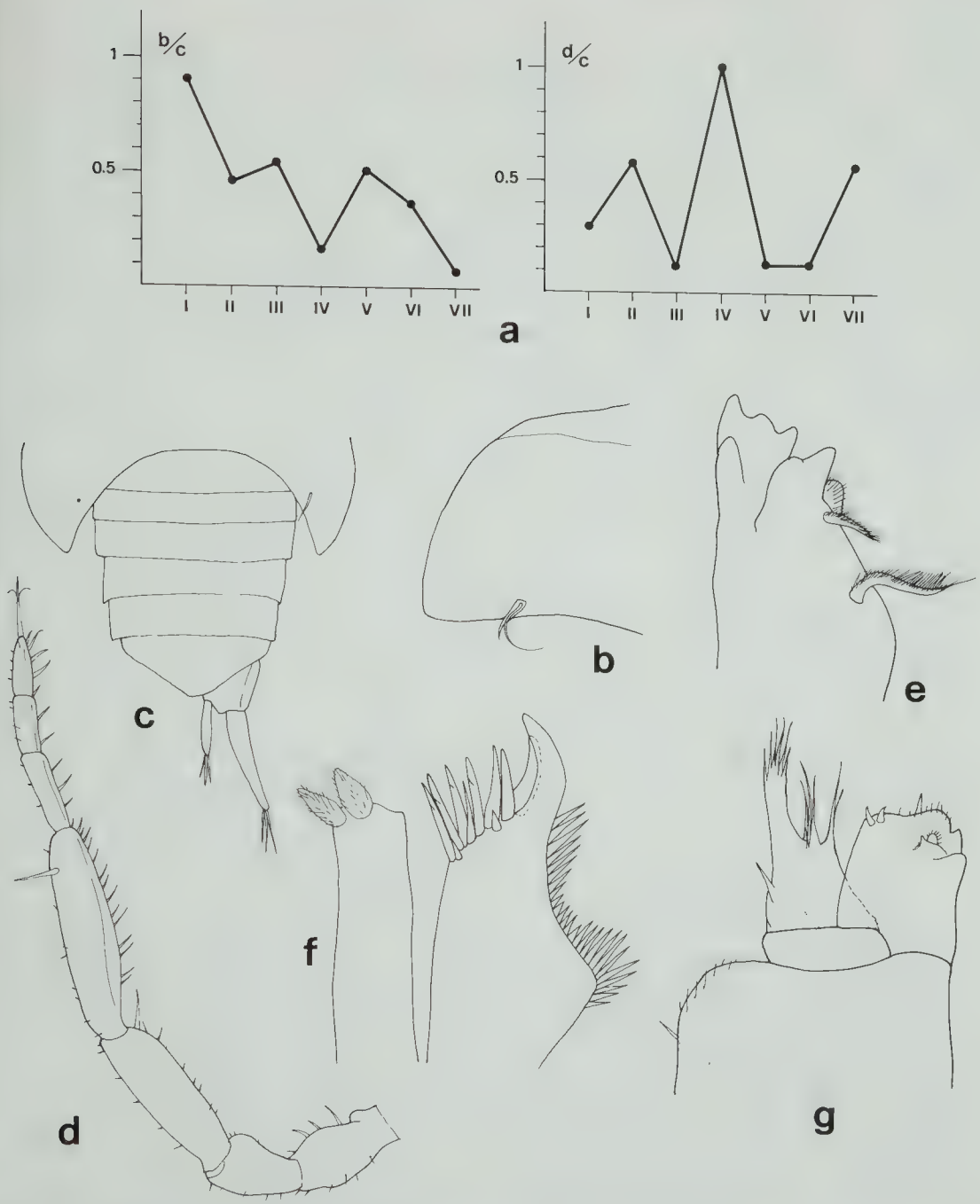

Figure 2. *Pseudotyphloscia alba* (Dollfus, 1898), male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pereonite 7, pleon, telson and right uropod; d, antenna; e, mandible; f, maxillule; g, maxilliped.

Distribution. Chagos Archipelago, West Malaysia (dat. ined.), Java, Bali (dat. ined.), Krakatau and Hawaiian Islands (dat. ined.).

Remarks. A. pilosa has been redescribed recently and given its correct taxonomic position (Ferrara and Taiti, 1986).

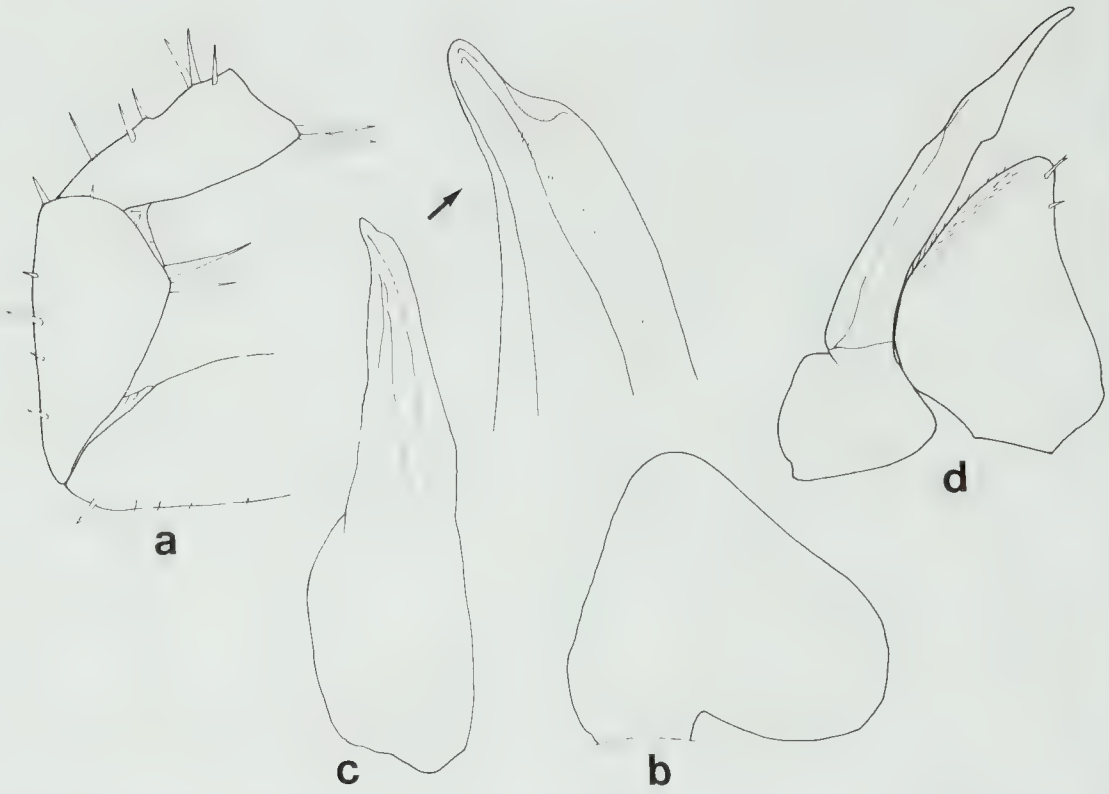

Figure 3. *Pseudotyphloscia alba* (Dollfus, 1898), male: a, pereopod 7; b, pleopod 1 exopod; c, pleopod 1 endopod; d, pleopod 2.

Burmoniscus Collinge, 1914

Burmoniscus orientalis sp. nov.

Figures 4, 5

Material examined. Holotype: Krakatau Islands: male (MZB), Rakata, Zwarte Hoek, 12 Sep 1984.

Paratypes: Krakatau Islands: 10 males, 30 females (MZB), Rakata, Zwarte Hoek, 12 Sep 1984; 1 male, 1 female (NMV J61126), same locality, 1 Sep 1984; 3 males, 1 female (NMV J16127), same locality, 31 Aug–4 Sep 1984; 2 males, 1 female (NMV J16128), same locality, 15 Sep 1984; 1 female (MZB), 1 male (MZB), Rakata, West Ridge, 5 Sep 1984; 2 males, 5 females (MF), same locality, 19 Sep 1984; 1 male, 3 females (MZB), same locality, 22 Sep 1984; 3 females (MZB), same locality, 14 Sep 1984; 3 males, 2 females (TM), Rakata, summit, 18–19 Sep 1984; 3 males, 1 female (MF), same locality, 22 Sep 1984; 1 female (MZB), same locality, 24 Aug 1985; 1 male (NMV J16131), same locality, 23 Aug 1985; 5 females (MZB), Rakata, South Face, 24 Aug 1985; 5 males, 5 females (NMV J16137), Rakata, Owl Bay, 26 Aug 1985; 7 males, 19 females (MF), Rakata, 259 m, 19 Sep 1984; 19 males, 47 females (TM), Panjang, 14 Sep 1984; 2 males, 2 females (NMV J16130), same locality, 17 Aug 1985.

West Java: 1 male, 1 female (MZB), 1 male, 3 females (NMV J16129), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Description. Maximum length: male and female, 7 mm. Brown with yellowish muscle spots; an oval pale spot at the base of each pereonal epimeron. Many gland pores along the whole lateral margin of pereonal epimera. Noduli laterales with b/c and d/c co-ordinates as in Fig. 4a. Eye with about 16 ommatidia. Cephalon with distinct supra-antennal line; frontal line absent. Pereonite 7 with postero-lateral corner right angled. Pleonal epimera reduced, adpressed, without posterior points visible in dorsal view. Telson with concave sides and apical part consisting of a small point. Antenna with fifth joint of peduncle slightly longer than flagellum; ratio of flagellar joints 7:4:4; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively. Mandible with molar penicil consisting of a single unbranched seta. Maxillular outer branch with 4 + 6 (5 cleft) teeth; inner branch with two unequal penicils and a small posterior point. Endite of maxilliped with a penicil. Uropodal protopod

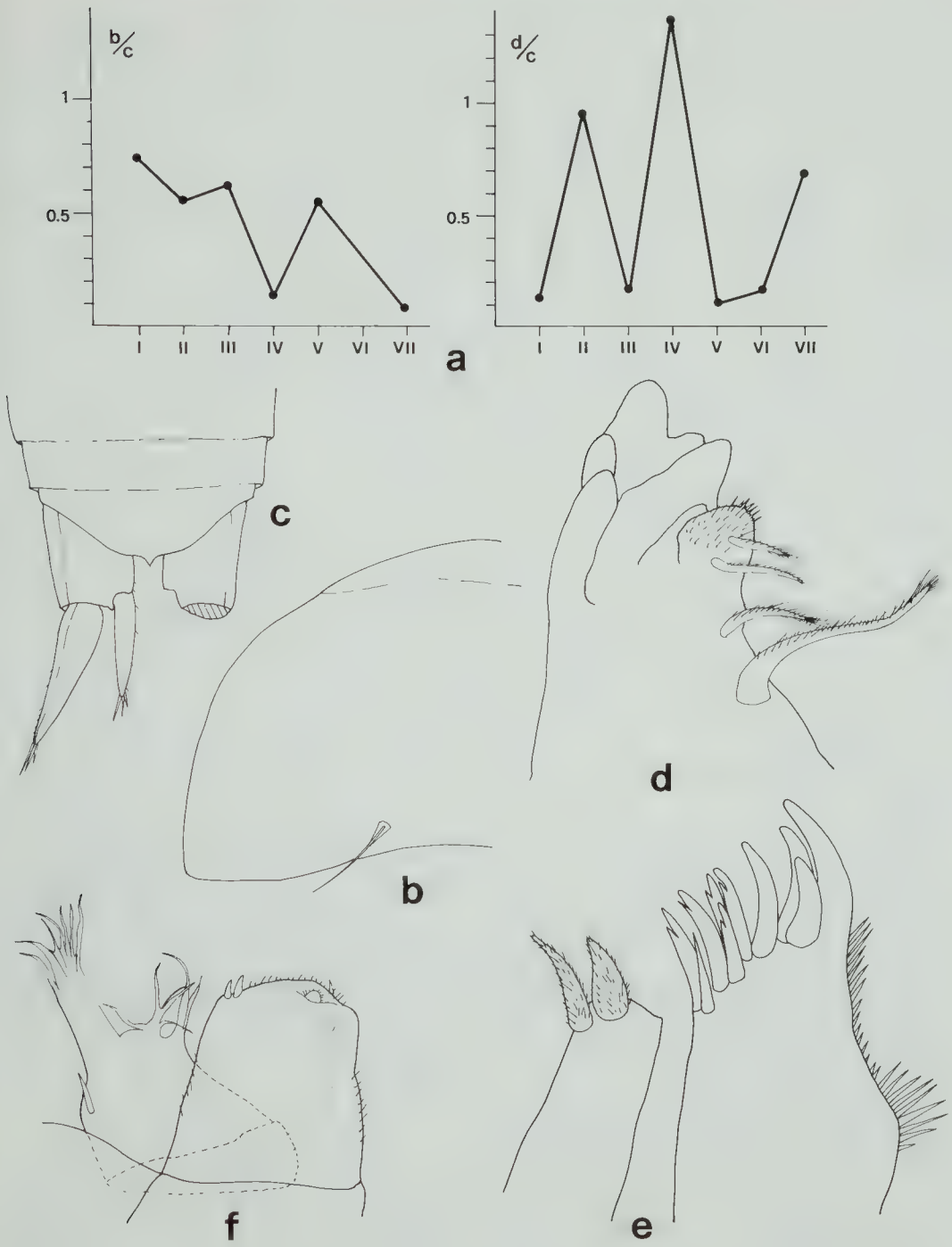

Figure 4. *Burmoniscus orientalis* sp. nov., male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pleonites 4–5, telson and uropods; d, mandible; e, maxillule; f, maxilliped.

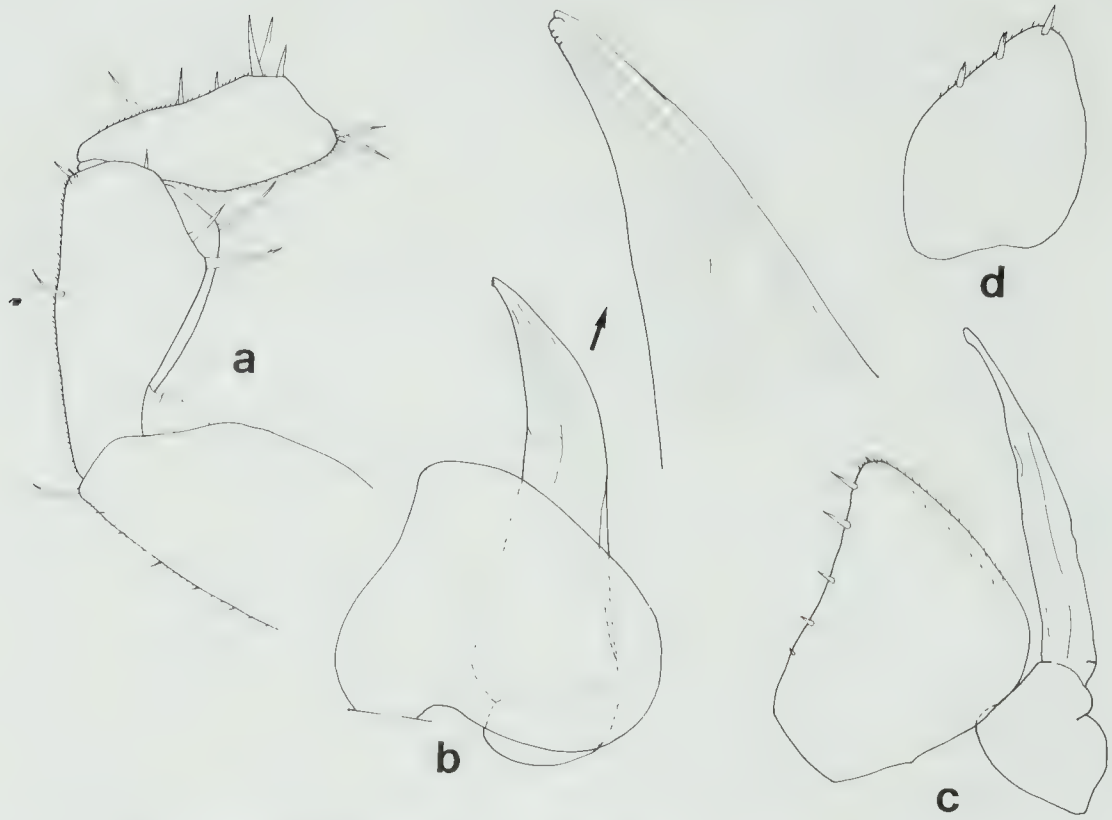

Figure 5. *Burmoniscus orientalis* sp. nov., male: a, pereopod 7; b, pleopod 1; c, pleopod 2; d, pleopod 5 exopod.

grooved on outer margin; insertion of endo- and exopods almost at the same level.

Male. Pereopods without evident sexually dimorphic modifications. Pleopod 1 exopod with outer margin slightly sinuous, apex rounded; endopod with distal third stout and bent outwards, apex without evident modifications. Pleopod 2 endopod longer than exopod; exopod with some short spines on outer margin. Pleopod 5 exopod as in Fig. 5d.

Distribution. South Thailand (dat. ined.), West Malaysia (dat. ined.), Java, Krakataus and Bali (dat. ined.).

Etymology. L. *orientalis* = oriental. The name refers to the wide distribution of this species in the Oriental Region.

Remarks. In the shape of the telson, *B. orientalis* is very similar to *B. comtus* (Budde-Lund, 1895) from Burma, *B. mucronatus* (Vandel, 1973) and *B. micropunctatus* Taiti and Manicastri, 1988. It differs from *B. comtus* in the male pereopod 7 without modifications; from *B. mucronatus* in the fifth joint of the antennal peduncle not swollen and from both *B. mucronatus* and *B. micropunctatus* in the shape of the male pleopod 1. Another species of philosciid, *"Philoscia" tenuissima* Collinge, 1915, from Madras, India, has the same shape of telson but a real comparison is impossible due to its uncertain description and taxonomic status (Taiti and Manicastri, 1988: 62).

Burmoniscus rakataensis sp. nov.

Figure 6

Material examined. Holotype: Krakatau Islands: male (MZB), Rakata, West Ridge, 707 m, 5 Sep 1984.

Paratypes: Krakatau Islands: 1 male (MF), 1 female (NMV J16136), Rakata, summit, 24 Aug 1985; 1 female (MZB), same locality, summit, 813 m, 4 Sep 1984; 1 female (NMV J16125), same locality, 259 m, 19 Sep 1984.

Description. Maximum length: male and female, 4 mm. Colourless body. Gland pores not visible.

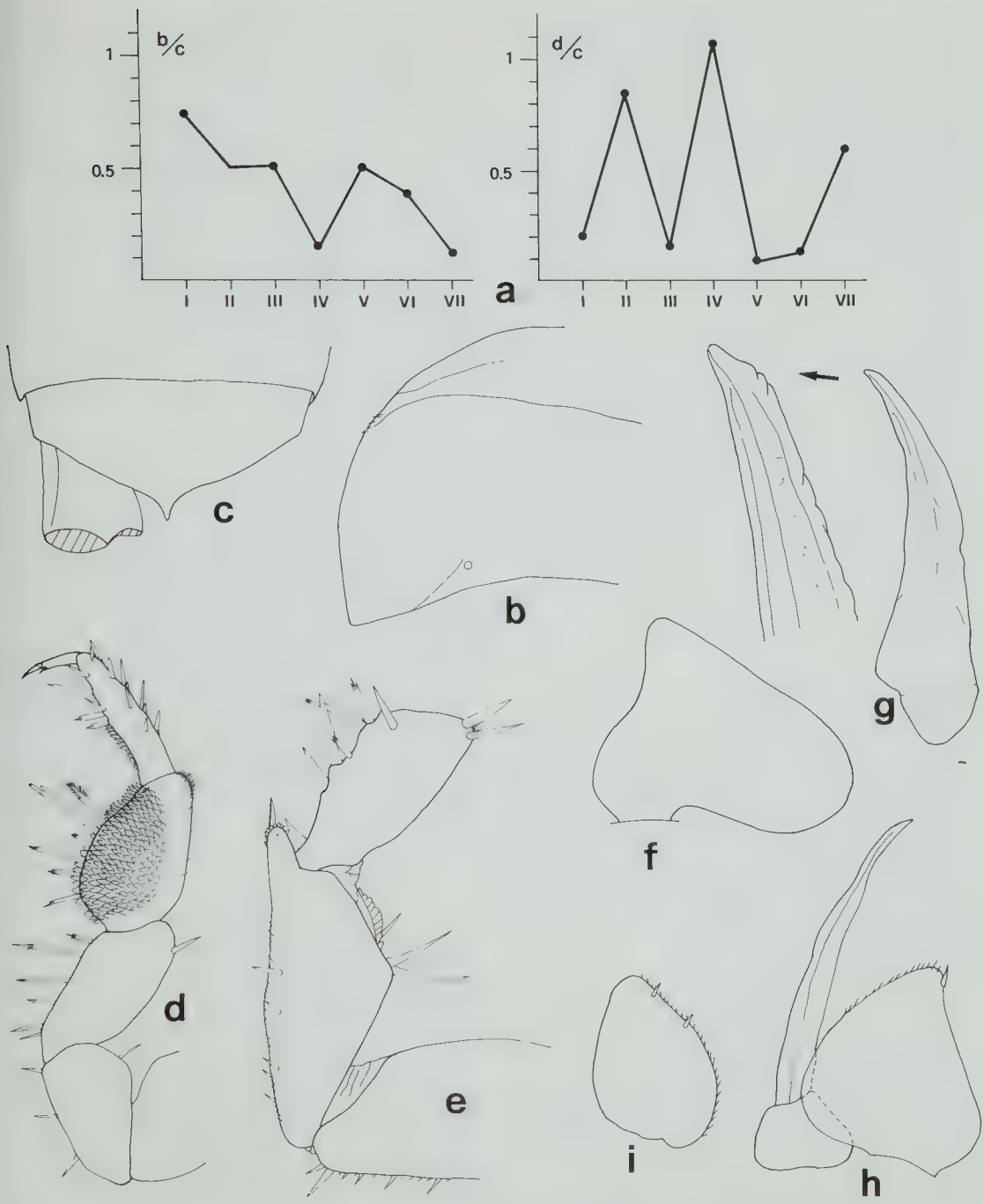

Figure 6. *Burmoniscus rakataensis* sp. nov., male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pleonite 5, telson and left uropodal protopod; d, pereopod 1; e, pereopod 7; f, pleopod 1 exopod; g, pleopod 1 endopod; h, pleopod 2; i, pleopod 5 exopod.

Noduli laterales with b/c and d/c co-ordinates as in Fig. 6a. Eye with 6–7 ommatidia. Cephalon and buccal pieces as in *B. orientalis*. Pereonite 7 with postero-lateral corners acute angled. Pleonal epimera reduced, adpressed, without visible posterior points. Telson with straight sides ending with an acute point. Antenna with fifth joint of peduncle slightly longer than flagellum; ratio of flagellar joints 4:3:3; flagellar joints 2 and 3 with 4 and 1 aesthetascs respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

Male. Antenna with fifth joint of peduncle slightly swollen. Carpus of pereopod 1 and, to a lesser extent, 2 enlarged, flattened and covered with short setae on rostral surface. Pereopod 7 ischium with a distal rounded lobe. Pleopod 1 exopod triangular, with sinuous outer margin and rounded posterior point; endopod with distal part bent outwards, without particular specialization at apex. Pleopod 2 endopod much longer than exopod. Pleopod 5 exopod as in Fig. 6i.

Distribution. Known only from the type locality.

Etymology. The name refers to the type locality, Rakata I. in the Krakataus.

Remarks. This species belongs to the group characterized by the male pereopods 1 and 2 with enlarged and flattened carpus, i.e. *B. coecus* (Budde-Lund, 1895), *B. ferrarai* (Schmalfuss, 1983) and *B. mossambicus* (Ferrara and Taiti, 1985). It is readily distinguished from all by the characteristic shape of telson, with an acute pointed apex, and male pereopod 7 ischium with a distal process.

Burmoniscus veliger sp. nov.

Figure 7

Material examined. Holotype: South Sumatra: male (MZB), Liwa, 5 Sep 1984.

Paratypes: South Sumatra: 1 male, 2 females (NMV J16123), 1 male (MF), 1 male (TM), Liwa, 5 Sep 1984; 3 females (MZB), same locality, 6 Sep 1984; 1 female (MF), same locality, 5–7 Sep 1984.

Description. Maximum length: male, 6 mm; female, 8 mm. Brown with yellowish muscle spots; a round pale spot at the base of each pereonal epimeron; postero-lateral corners of pereonites colourless. Gland pores not visible. Noduli laterales with b/c and d/c co-ordinates as in Fig. 7a. Eye with about 23 ommatidia. Cephalon and buccal pieces as in *B. orientalis*. Pereonite 7 with postero-lateral corners obtuse angled. Pleonal epimera reduced, adpressed, without visible posterior points. Telson with straight sides, apex an obtuse angle. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 7:5:4; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

Male. Pereopod 7 merus with a recurved spine at the base of sternal margin. Pleopod 1 exopod with a small rounded posterior point; endopod straight with a triangular hyaline lobe on medial margin near apex. Pleopod 2 endopod much longer than exopod; exopod with some short spines on outer margin. Pleopod 5 exopod as in Fig. 7g.

Distribution. Sumatra.

Etymology. L. *velum* = sail + stem of *gerere* = to bear.

Remarks. The new species is characterized by the male modifications of pereopod 7 and pleopod 1. Due to the presence of a hyaline lobe at the apex of pleopod 1 endopod, *B. veliger* appears close to *B. microlobatus* (Vandel, 1973) from Bismarck and Solomon Archipelagos. It is distinguished by the apex of telson obtuse angled instead of rounded, presence of a recurved spine on the male pereopod 7 merus, male pleopod 1 endopod with triangular instead of rounded subapical lobe, and shape of the male pleopods 1–2 exopods.

Burmoniscus vaughani sp. nov.

Figure 8

Material examined. Holotype: South Sumatra: male (MZB), Liwa, 5 Sep 1984.

Paratypes: South Sumatra: 3 males, 1 female (MZB), 3 males, 1 female (NMV J16124), 3 males, 1 female (MF), Liwa, 5 Sep 1984; 3 males, 1 female (NMV J16150), 1 male, 5 females (MZB), same locality, 1 Sep 1984; 1 male (MF), same locality, 5–7 Sep 1984; 1 female (MZB), 2 females (NMV J16149), 3 males , 1 female (TM), same locality, 6 Sep 1984.

Description. Maximum length: male, 4.5 mm; female, 5.5 mm. Light brown with yellowish muscle spots; postero-lateral corners of pereonites or all pereonal epimera colourless. Several gland pores along the whole lateral margin of pereonal epimera. Noduli laterales with b/c and d/c co-ordinates as in Fig. 8a. Eye with 22–24 ommatidia. Cephalon and buccal pieces as in *B. orientalis*. Pereonite 7 with postero-lateral corners acute angled. Pleonal epimera reduced,

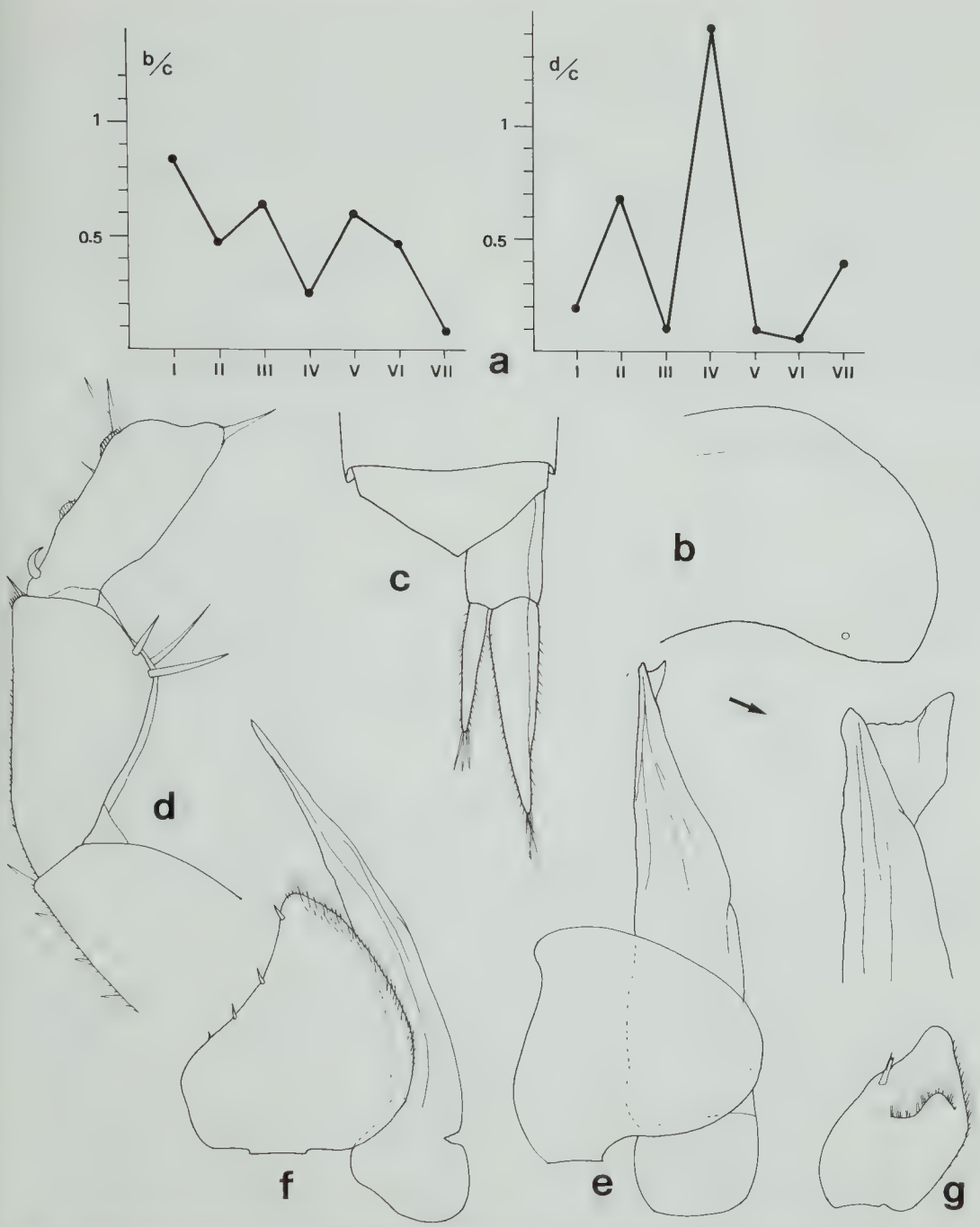

Figure 7. *Burmoniscus veliger* sp. nov., male: a, co-ordinates of noduli laterales; b, right epimeron of pereonite 7; c, pleonite 5, telson and right uropod; d, pereopod 7; e, pleopod 1; f, pleopod 2; g, pleopod 5 exopod.

adpressed, without visible posterior points. Telson with slightly sinuous sides, apex rounded. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 5:4:3; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

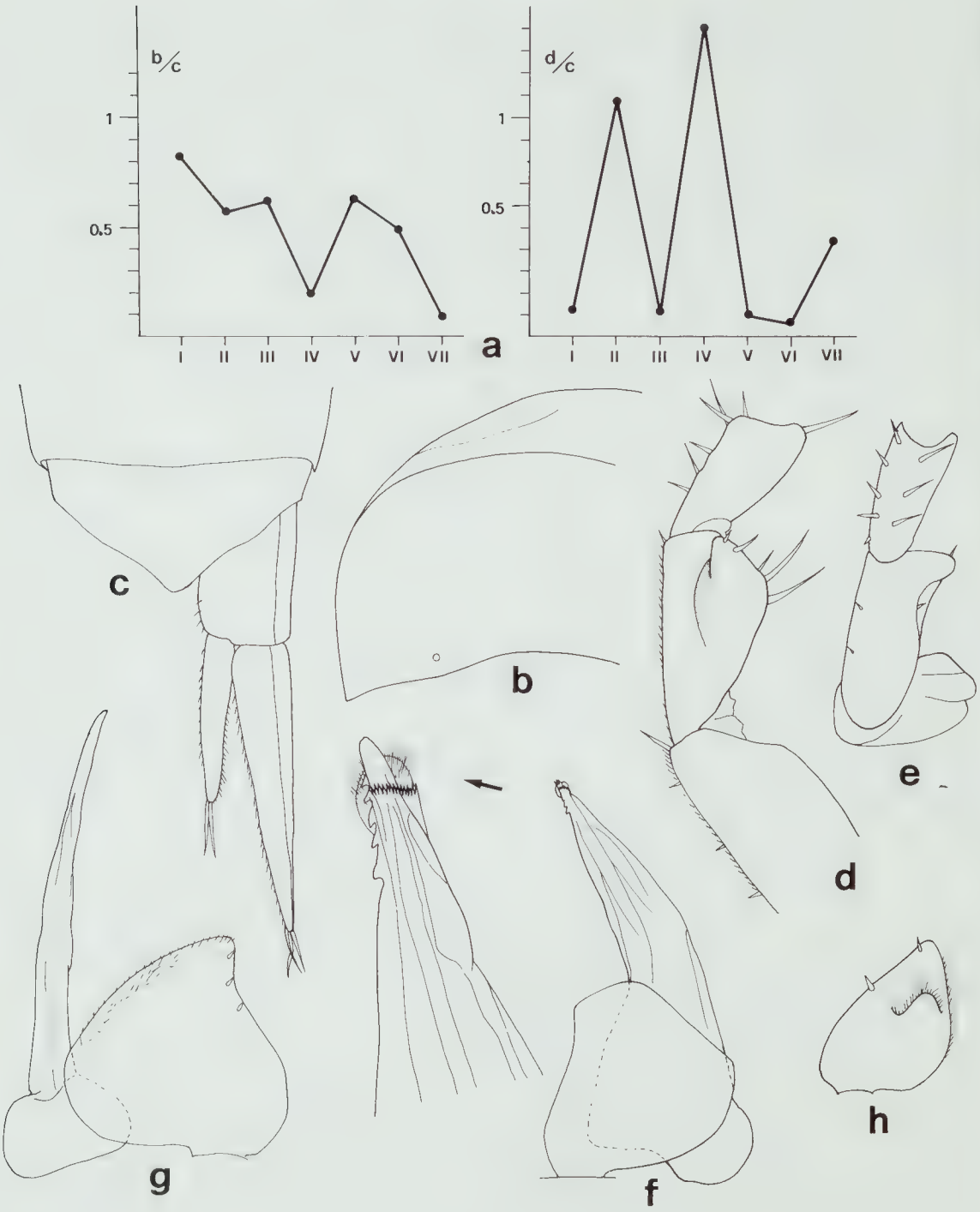

Figure 8. *Burmoniscus vaughani* sp. nov., male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pleonite 5, telson and right uropod; d, pereopod 7, rostral surface; e, pereopod 7, sternal surface; f, pleopod 1; g, pleopod 2; h, pleopod 5 exopod.

Male. Pereopod 7 ischium with a concavity on rostral surface and a distal lobe protruding transversely. Pleopod 1 exopod truncated distally; endopod with apical part triangular with some denticles on outer margin and a rounded setose lobe on caudal surface. Pleopod 2 endopod about twice as long as exopod. Pleopod 5 exopod as in Fig. 8h.

Distribution. Sumatra.

Etymology. The new species is named after Mr P.J. Vaughan, Department of Zoology, La Trobe University, Bundoora.

Remarks. B. vaughani is easily distinguished from all the other species of *Burmoniscus* by the male pereopod 7 ischium with a concavity and a transverse lobe, and male pleopod 1 exopod truncated and endopod with apical part very complex.

Burmoniscus thorntoni sp. nov.

Figure 9

Material examined. Holotype: West Java: male (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Paratypes: West Java: 2 males, 2 females (NMV J16120), 1 male, 1 female (MF), 1 male, 1 female (TM), 4 females (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Description. Maximum length: male, 4 mm; female, 5 mm. Brown with yellowish muscle spots. Gland pores not visible. Noduli laterales with b/c and d/c co-ordinates as in Fig. 9a. Eye with about 18 ommatidia. Cephalon and buccal pieces as in *B. orientalis.* Pereonite 7 with postero-lateral corners broadly rounded. Pleonal epimera reduced, adpressed, without small posterior points visible in dorsal view. Telson short, with straight sides, apex bluntly rounded. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 4:3:3; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

Male. Pereopod 7 ischium with sternal margin convex. Pleopod 1 exopod with a triangular acute posterior point bent outwards, outer margin sinuous; endopod straight without evident modifications. Pleopod 2 exopod with a small protrusion near the base of outer margin (present also on exopods of pleopods 3 and 4); endopod much longer than exopod. Pleopod 5 exopod as in Fig. 9g.

Distribution. Java.

Etymology. The new species is named after Prof. I.W.B. Thornton, Head of the Department of Zoology, La Trobe University, Bundoora.

Remarks. B. thorntoni is characterized by the rounded postero-lateral corners of pereonite 7, short and obtuse telson, and male pleopod 1 exopod with an acute posterior point bent outwards. The new species is close to *B. bartolozzii* Taiti and Manicastri, 1988, from Sri Lanka, from which it is distinguished by the shorter telson, convex instead of straight sternal margin of male pereopod 7 ischium, male pleopod 1 exopod with more acute posterior point and endopod without apical modifications.

Serendibia Manicastri and Taiti, 1987

Serendibia sp.

Material examined. South Sumatra: 2 females (MZB), 3 females (NMV J16122), 2 females (MF), Liwa, 5 Sep 1984.

Remarks. These specimens belong to the genus *Serendibia* as defined by Manicastri and Taiti (1987). The lack of males does not permit a specific identification.

Trachelipidae

Nagurus Holthuis, 1949

Nagurus nanus (Budde-Lund, 1908)

Nagara nana.—Richardson Searle, 1922: 1.

Material examined. South Sumatra: 1 male (MZB), Krui, 7 Sep 1984.

Krakatau Islands: 1 male, 1 female (MF), Anak Krakatau, 2 Sep 1984; 1 male, 1 female (MZB), 2 males, 1 female (NMV J16119), same locality, 10 Sep 1984.

Distribution. Pantropical.

Nagurus cristatus (Dollfus, 1889)

Nagara cristata.—Richardson Searle, 1922: 1.

Porcellio (*Nagara*) *cristata.*—Wahrberg, 1922: 178.

Material examined. South Sumatra: 1 female (MZB), Liwa, 1 Sep 1984; 1 female (NMV J16106), same locality, 5 Sep 1984; 2 females (MZB), Krui, 7 Sep 1984.

Krakatau Islands: 1 female (NMV J16105), Sertung, 19 Aug 1985; 1 female, 2 juv. (MZB), 1 female, 1 juv. (NMV J16108, J16110), Panjang, 14 Sep 1984; 1 juv. (MZB), same locality, 20 Sep 1984; 6 females (MZB), Panjang, Mid Ridge, 25 Sep 1986; 6 females (NMV J16109), Panjang, Central, 17 Aug 1985; 3 females (MZB), Rakata, West Ridge, 5 Sep 1984; 1 female (MZB), same locality, 12 Sep 1984; 1 female (NMV J16165), 4 females (MZB), same locality, 19 Sep 1984;

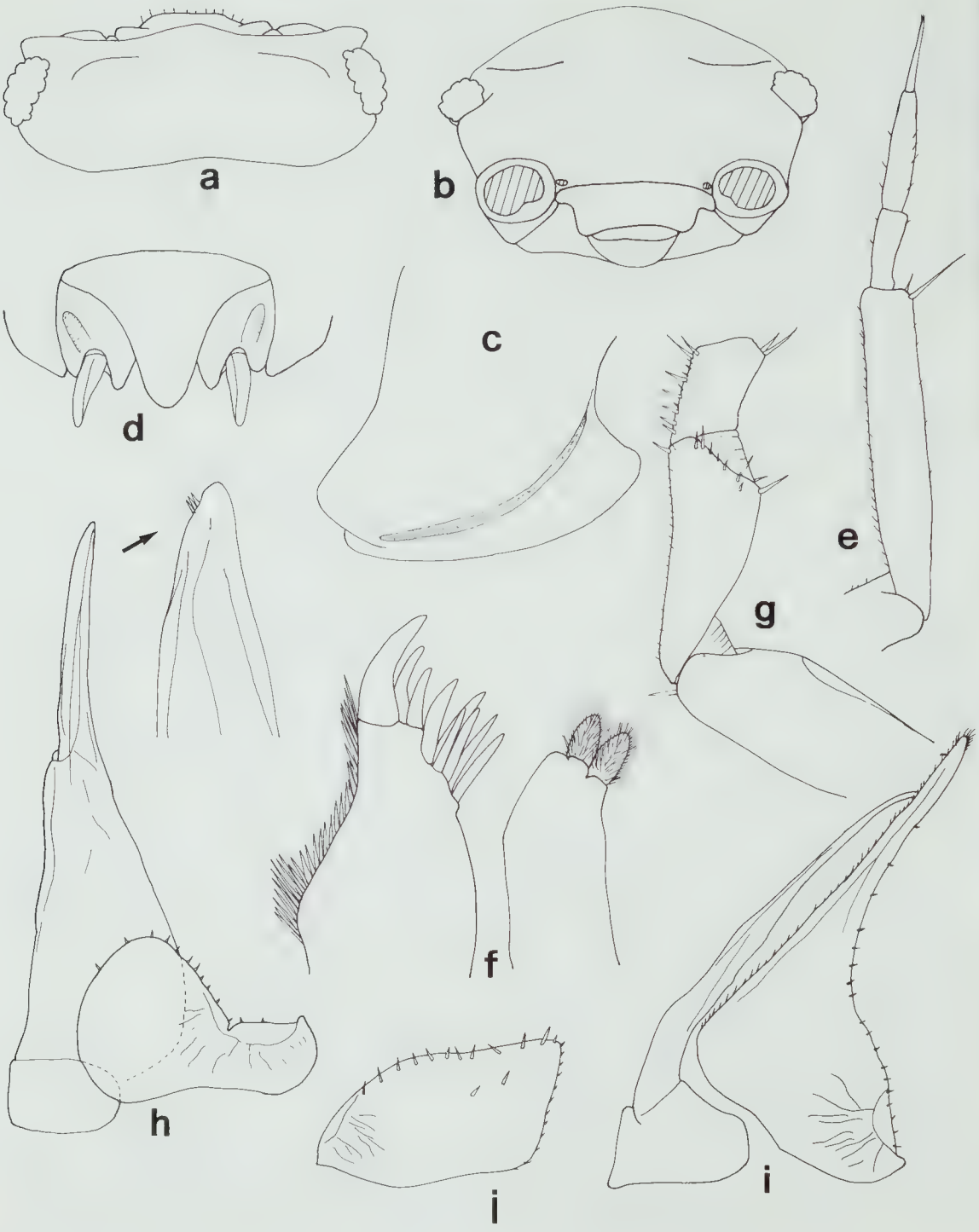

Figure 10. *Saidjahus guttatus* (Dollfus, 1898): a, cephalon in dorsal view; b, cephalon in frontal view; c, right epimeron of pereonite 1; d, pleonite 5, telson and uropods; e, antenna; f, maxillule; g, pereopod 7 male; h, pleopod 1 male; i, pleopod 2 male; j, pleopod 5 exopod male.

5 females (NMV J16107), Rakata, Zwarte Hoek, 5 Sep 1984; 1 female (MZB), Rakata, South Beach, 18 Sep 1984; 24 females (MZB), Rakata, summit, 18–19 Sep 1984; 2 females (NMV J16114), 6 females, 8 juvs (TM), same locality, 23 Aug 1985; 9 females, 9 juvs (MF), same locality, 24 Aug 1985; 1 female (MZB), Rakata, Owl Bay, 22 Sep 1984; 1 female (MZB), same locality, 26 Aug 1985; 11 females, 1 juv. (MZB), 11 females (NMV J16115, J16117, J16118), Rakata, South Face, 24 Aug 1985; 1 female (NMV J16103), same locality, 25 Aug 1985; 1 juv. (NMV J16116), Rakata, 259 m, 19 Sep 1984.

West Java: 4 females (MZB), 1 female (NMV J16113), Ujung Kulon, Pulau Peucang, 11 Sep 1984; 1 female (NMV J16112), same locality, 13 Sep 1984; 2 females (NMV J16111), same locality, 15 Sep 1984; 1 female (MZB), 1 female (NMV J16104), same locality, 19 Sep 1984; 2 females (MZB), Gunung Payung, 12–13 Sep 1984; 1 female (NMV J16102), Cibunar, 20 Sep 1984.

Distribution. Pantropical.

Remarks. As far as can be judged from the description and illustrations, it is very probable that the specimens from Ranu Bedali, Java, and Tjurup, Sumatra, identified by Herold (1931: 355, figs 111–114) as *Nagara modesta* (Dollfus, 1898), also belong to *N. cristatus*.

Eubelidae

Saidjahus Budde-Lund, 1904

Saidjahus guttatus (Dollfus, 1898)

Figure 10

Mesarmadillo guttatus Dollfus, 1898: 370, figs 15, 15a–d.

Saidjahus guttatus.—Budde-Lund, 1904: 51.

Type material re-examined. Sumatra (?): 1 female (holotype of *Mesarmadillo guttatus* Dollfus), leg. M. Weber, 1888 (Dollfus Collection, ZMA).

Material examined. South Sumatra: 1 male, 1 female (MZB), 2 females (NMV J16159), 1 female (TM), 1 female (MF), Liwa, 5 Sep 1984; 1 male (MF), same locality, 6 Sep 1984; 1 female (MZB), same locality, 5–7 Sep 1984.

West Java: 1 male (NMV J16160), 1 female (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Description. Maximum dimensions: male, 8 × 3.5 mm; female, 9 × 4.5 mm. Brown-grey with pale muscle spots and a large pale spot on each epimeron of pereonites. Dorsum very convex, smooth with inconspicuous scale-spines. Eye with 18 ommatidia. Cephalon with profrons slightly protruding frontwards; lateral lobes small, rounded; interocular line widely interrupted in the middle. Pereonite 1 with lateral margin thickened and slightly grooved; sulcus arcuatus deep and narrow; outer lobe of schisma clearly protruding backwards compared with inner one. Pereonites 2-3 with a transverse thickening on ventral surface of epimera. Telson triangular, with sides regularly incurved; bluntly rounded apex which surpasses the rear margin of the uropods. Antenna with first joint of flagellum shorter than second. Maxillular outer branch with simple teeth; inner branch with two stout penicils. Pleopods with pseudotracheae in all exopods. Uropodal protopod deeply indented on posterior margin; exopod well developed, clearly surpassing tip of telson.

Male. Pereopods 1–3 with brushes of short trifid spines on carpus and merus. Pereopod 7 without evident modifications. Pleopod 1 exopod with ovoid medial part; endopod straight, without modifications at apex. Pleopod 2 exopod as long as endopod. Pleopod 5 exopod as in Fig. 10j.

Distribution. Sumatra and Java.

Remarks. Comparison with type material proves that the specimens examined belong to *S. guttatus*. The redescription provided here is based on the present material.

Armadillidae

Cubaris Brandt, 1833

Cubaris murina Brandt, 1833

Armadillo murinus.—Dollfus, 1898: 359.—Budde-Lund, 1885: 27.— 1904: 119.

Cubaris murina.—Richardson Searle, 1922: 1.

Nesodillo murinus.—Herold, 1931: 319

Material examined. South Sumatra: 1 female juv. (MZB), Krui, 7 Sep 1984.

Distribution. Pantropical.

Cubaris sp.

Material examined. Krakatau Islands: 1 female (MF), 1 juv. (MZB), Rakata, Owl Bay, 22 Sep 1984; 1 juv. (NMV J16161), Rakata, South Face, 25 Aug 1985.

Remarks. These specimens are not *C. murina* but the material is insufficient for a certain identification.

Venezillo Verhoeff, 1927

Venezillo parvus (Budde-Lund, 1885)

Material examined. Krakatau Islands: 4 males, 6 females, 6 juvs (MZB), 4 males, 6 females (NMV J16164), 4 males, 6 females (MF), Sertung, 11 Sep 1984; 1 male, 1 female (TM), Sertung, East Ridge, 19 Aug 1985; 1 male (NMV J16162), Sertung, South-East Ridge, 27 Sep 1986.

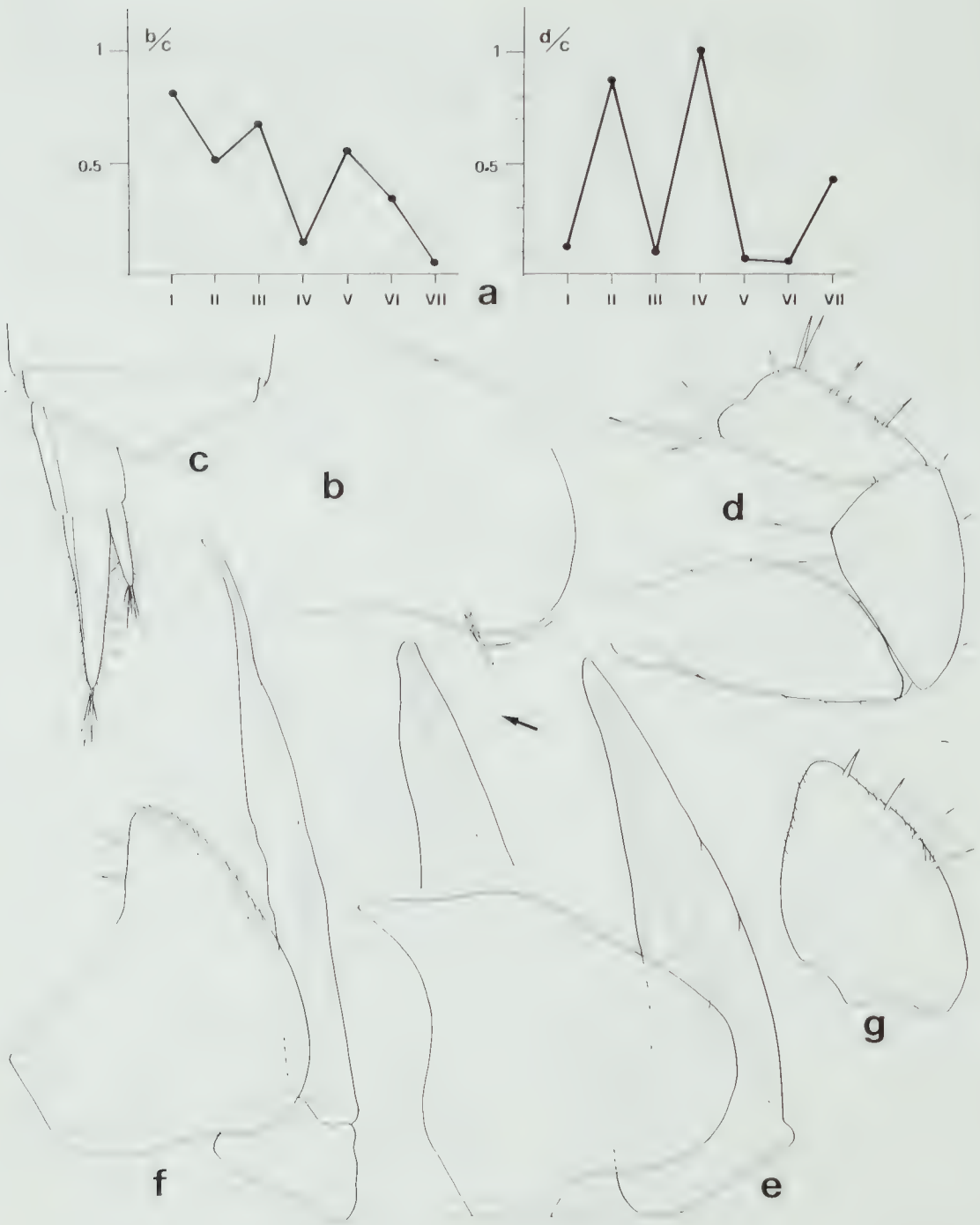

Figure 9. *Burmoniscus thorntoni* sp. nov., male: a, co-ordinates of noduli laterales; b, right epimeron of pereonite 7; c, pleonite 5, telson and left uropod; d, pereopod 7; e, pleopod 1; f, pleopod 2; g, pleopod 5 exopod.

Distribution. Lands encompassed by the Indian and Pacific Oceans; Ascension I. in the Atlantic Ocean.

Spherillo Dana, 1853

"Spherillo" velutinus (Dollfus, 1898)

Figure 11

Armadillo velutinus Dollfus, 1898: 363 (partim).
Spherillo velutinus.—Budde-Lund, 1904: 94 (partim).

Type material re-examined. Sulawesi: 1 male, 1 female (syntypes of *Armadillo velutinus* Dollfus), Macassar, leg. F. and P. Sarasin (Dollfus Collection, NHMB); 1 female (syntype of *Armadillo velutinus* Dollfus), Loewoe, leg. M. Weber (Dollfus Collection, ZMA).

Sumatra: 1 male juv., 1 female (syntypes of *Armadillo velutinus* Dollfus), Singalang, leg. M. Weber (Dollfus Collection, ZMA).

Material examined. West Java: 1 male (MF), 1 female (NMV J16163), 1 female, 1 juv. (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1985.

Description. Dimensions: male, 4.5 × 1.8 mm; female, 6.5 × 2.5 mm. Brown with yellowish muscle spots. Body convex, able to roll into a perfect ball. Dorsum smooth with numerous tiny dark brown scale-spines. Eye with about 13 ommatidia. Cephalon with frontal shield sepa-

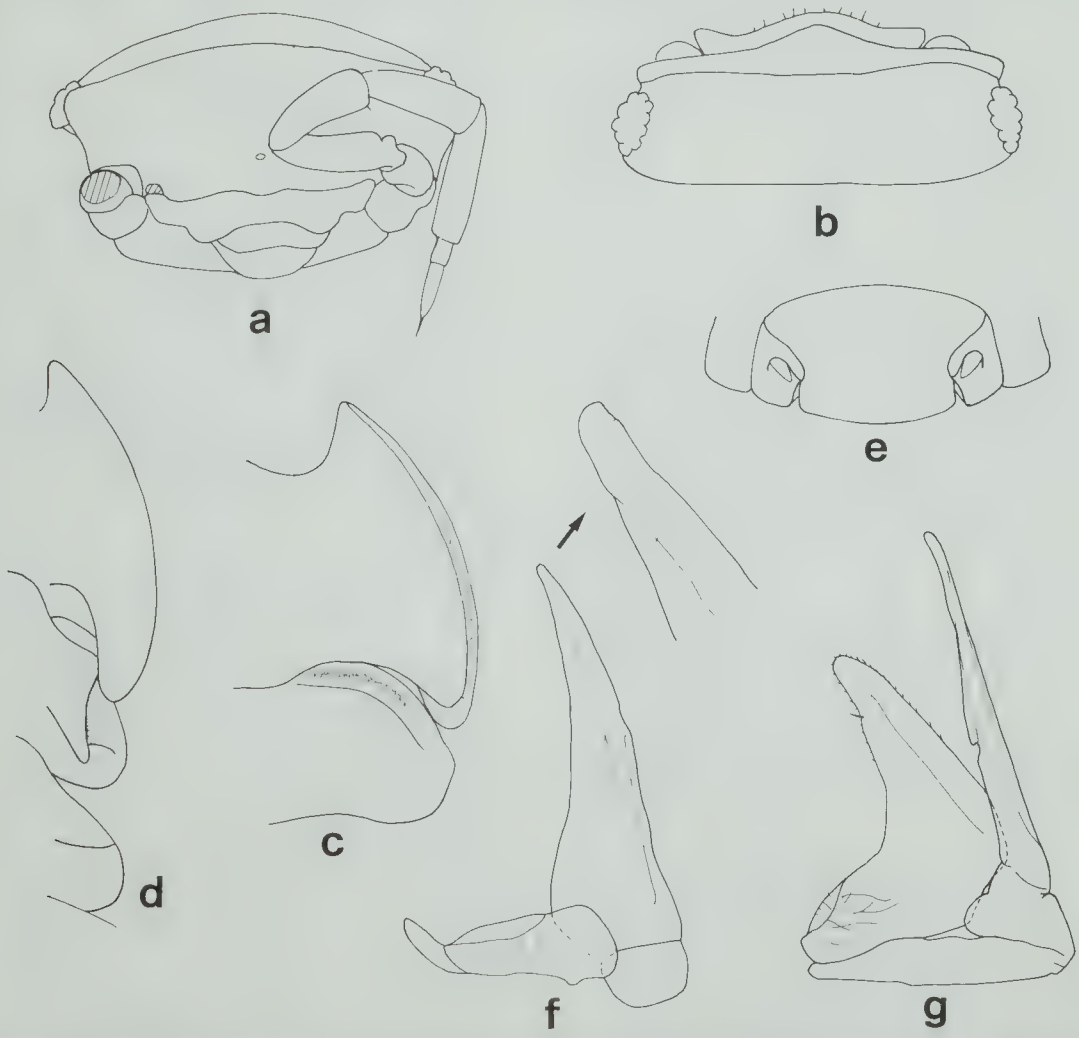

Figure 11. *"Spherillo" velutinus* (Dollfus, 1898): a, cephalon and left antenna in frontal view; b, cephalon in dorsal view; c, right epimera of pereonites 1–2 in dorsal view; d, left epimera of pereonites 1–3 in ventral view; e, pleonite 5, telson and uropods; f, pleopod 1 male; g, pleopod 2 male.

rated from vertex by a continuous line but not protruding over it; profrons slightly protruding frontwards with a V-shaped mark in the middle. Pereonite 1 with distal margin sinuous; lateral margin with a shallow but distinct groove along its whole length; schisma with inner lobe rounded, clearly protruding backwards compared with outer one. Pereonite 2 dorsally with a deep excavation on anterior margin of epimeron where the posterior margin of pereonite 1 folds in when the animal rolls up; ventral surface of epimeron with a sharp triangular tooth. Pereonite 3 with a lobe and pereonites 4–5 with a transverse thickening on ventral surface of epimera. Telson hour-glass-shaped, wider than long with distal margin convex. Antenna short, with second joint of flagellum about twice as long as first. Uropods with quadrangular protopod (as visible in dorsal view); exopod inserted dorsally and directed obliquely.

Male. Pereopods without modifications. Pleopod 1 exopod very small, triangular, about twice wider than long; endopod slightly bent outwards, without evident modifications at the apex. Pleopod 2 as in Fig. 11g.

Distribution. Sulawesi and Java.

Remarks. Armadillo velutinus was described by Dollfus (1898) on specimens from Sulawesi and Sumatra. Re-examination of the type materials proves that:

(a) the specimens from Sulawesi (Macassar and Loewoe) are probably those on which Dollfus based the description of this species. We designate the male specimen from Macassar as lectotype and give a new description of this species; and

(b) the specimens from Sumatra (Singalang) certainly belong to a different species and genus (probably *Dryadillo* Herold, 1931).

The specimens from Java examined here are conspecific with those from Sulawesi.

Armadillo velutinus was transferred by Budde-Lund (1904) to the genus *Spherillo* Dana, 1853, and since then no author has dealt with this species.

The problem of the definition and composition of *Spherillo* Dana, 1853 (= *Sphaerillo* Verhoeff, 1926) has been discussed often but never clarified. The proposal of Jackson (1941) and Vandel (1973b) to consider *Spherillo* Dana as a nomen nudum and to replace it with *Sphaerillo* Verhoeff can not be accepted as it goes against the rules of zoological nomenclature. The only way for unequivocally redefining the genus *Spherillo* is to re-examine the four species (*S. monolinus, S. vitiensis, S. hawaiensis* and *S. spinosus*) described by Dana (1853) and to designate one of these as type species of the genus. Awaiting such a revision, we are keeping *A. velutinus* in *Spherillo* as stated by Budde-Lund (1904).

Discussion

Seventeen species of terrestrial isopods were collected in the Krakatau Islands and surrounding areas of Java and Sumatra by the Zoological Expeditions to the Krakataus (1984–1986):

(1) *Alloniscus oahuensis* Budde-Lund, 1885;
(2) *A. pallidulus* Budde-lund, 1885;
(3) *Pseudotyphloscia alba* (Dollfus, 1898);
(4) *Anchiphiloscia pilosa* (Budde-Lund, 1913);
(5) *Burmoniscus orientalis* sp. nov.;
(6) *B. rakataensis* sp. nov.;
(7) *B. veliger* sp. nov.;
(8) *B. vaughani* sp. nov.;
(9) *B. thorntoni* sp. nov.;
(10) *Serendibia* sp.;
(11) *Nagurus nanus* (Budde-Lund, 1908);
(12) *N. cristatus* (Dollfus 1889);
(13) *Saidjahus guttatus* (Dollfus, 1898);
(14) *Cubaris murina* Brandt, 1833;
(15) *Cubaris* sp.;
(16) *Venezillo parvus* (Budde-Lund, 1885);
(17) *"Spherillo" velutinus* (Dollfus, 1898).

This collection certainly represents only a small part of the oniscidean fauna present in this area. It is typical of the Oriental Region, being characterized by the presence of species of *Pseudotyphloscia, Burmoniscus, Serendibia, Nagurus, Saidjahus* and *Cubaris*.

However, the collection is interesting because it includes five new species and adds four species to the fauna of Java (*Pseudotyphloscia alba, Burmoniscus orientalis, B. thorntoni, Saidjhaus guttatus*) and five to that of Sumatra (*Burmoniscus veliger, B. vaughani, Serendibia* sp., *Nagurus nanus* and *N. cristatus*).

At present 11 species are known from the Krakataus (Table 1). *Alloniscus oahuensis* and *A. pallidulus* are strictly littoral while all the others are common in different biotopes. Of the three species from the Krakataus listed by Richardson Searle (1922), only *Cubaris murina* was not collected in the recent surveys. With the exception of *Burmoniscus rakataensis*, at present known only from Rakata, and *Cubaris* sp., due to taxonomic uncertainties, all the other species are widespread in the Oriental Region or have a pantropical distribution. All of these species have a great facility for dispersal, most of them

Table 1. Distribution of terrestrial isopods in the Krakataus.

	Sertung	Rakata	Panjang	Anak Krakatau
Alloniscus oahuensis	×	o		
A. pallidulus	×			
Pseudotyphloscia alba	×			×
Anchiphiloscia pilosa	×	×	×	
Burmoniscus orientalis		×	×	
B. rakataensis		×		
Nagurus nanus				×
N. cristatus	×	×o	×	
Cubaris murina		o		
Cubaris sp.		×		
Venezillo parvus	×			
	6	7	3	2

o = Species recorded by Richardson Searle (1922).
× = Species collected by the Zoological Expeditions to the Krakataus (1984–1986), La Trobe University, Bundoora.

are euryoecious and have certainly been introduced (with driftwood, human activities, etc.).

The peculiar history of these volcanic islands (see Thornton, 1985) provides an unique opportunity for studying problems like recolonisation and turnover of species. Unfortunately lack of previous reliable data on the presence of terrestrial isopods does not allow any conclusion. The present list of species from the Krakataus can be considered as a good starting point for future research.

Acknowledgements

We wish to thank Prof. I.W.B. Thornton and Mr P.J. Vaughan of the Department of Zoology, La Trobe University, Bundoora, for the loan of the material collected during the Zoological Expeditions to the Krakataus (1984–1986).

We are indebted to the following people for the loan of type material and facilities provided during visits to their instititions: Dr R.J. Lincoln and Miss J.P. Ellis (BM), Dr M. Brancucci and Mrs C. Stocker (NHMB), Dr H.-E. Gruner (ZMB), Dr L.B. Holthuis (RMNH), Dr B. Kensley (USNM), Dr S. Pinkster and Mr D. Platvoet (ZMA), and Prof. G. Hartmann (ZMH).

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Memoirs of the Museum of Victoria 50(2): 437–441 (1990) ISSN 0814-1827

MYSIDELLA AUSTRALIANA SP. NOV. FROM BASS STRAIT, AUSTRALIA (CRUSTACEA: MYSIDAE: MYSIDELLINAE)

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Abstract

Fenton, G.E., 1990. *Mysidella australiana* sp. nov. from Bass Strait, Australia (Crustacea: Mysidae: Mysidellinae). *Memoirs of the Museum of Victoria* 50(2): 437–441.

Mysidella australiana sp. nov. is described from material collected in Bass Strait, southern Australia. Its occurrence represents the first record of this subfamily and genus from the Southern Hemisphere.

Introduction

A study of mysid fauna from Bass Strait, southern Australia has revealed a new species belonging to the genus *Mysidella*. The species *M. australiana* sp. nov., described here, represents the first record of the genus from Australian waters and from the Southern Hemisphere. Diagnostic details of the subfamily Mysidellinae and the genus *Mysidella* are given here since they are not readily available.

Mysidellinae

Diagnosis. (Based on definitions given in Tattersall and Tattersall, 1951 and Ii, 1964). Labrum posteriorly produced into a large plate divided by deep incision forming 2 unequal lobes. Mandibles with cutting lobe expanded greatly with straight edge and without teeth. Maxillule with lobes bending strongly inward: outer lobe large with numerous spines; inner lobe small bearing plumose setae. Sixth segment of first thoracic endopod expanded and armed with spines. Carpo-propodus of thoracic legs 3–8 divided by 1–2 transverse articulations. Pleopods of both sexes rudimentary. Exopod of uropod entire; outer margin with setae and no spines. Telson with distal cleft. Female with 3 pairs of brood lamellae.

Remarks. The subfamily Mysidellinae, established by Norman 1892, is unusual within the Order Mysidacea since it consists of only the genus *Mysidella* G.O. Sars. This subfamily is easily recognised by the distinctive form of the labrum.

Mysidella G.O. Sars

Mysidella G.O. Sars, 1872: 266. Type species *Mysidella typica* G.O. Sars, 1872 by original designation.

Diagnosis. (Based on definitions given in Tattersall and Tattersall, 1951 and Ii, 1964). Eyes well developed or rudimentary. General body form short and robust. Antennular peduncle of male with setose lobe small and nodular. Antennal scale small, setose along lateral and medial borders; small distal articulation. Maxilla small and feeble, exopod well-developed. Genital appendage of male at base of eighth thoracic legs forwardly directed, long and cylindrical. Endopod of uropod with spines on inner margin. Telson cleft armed with spines.

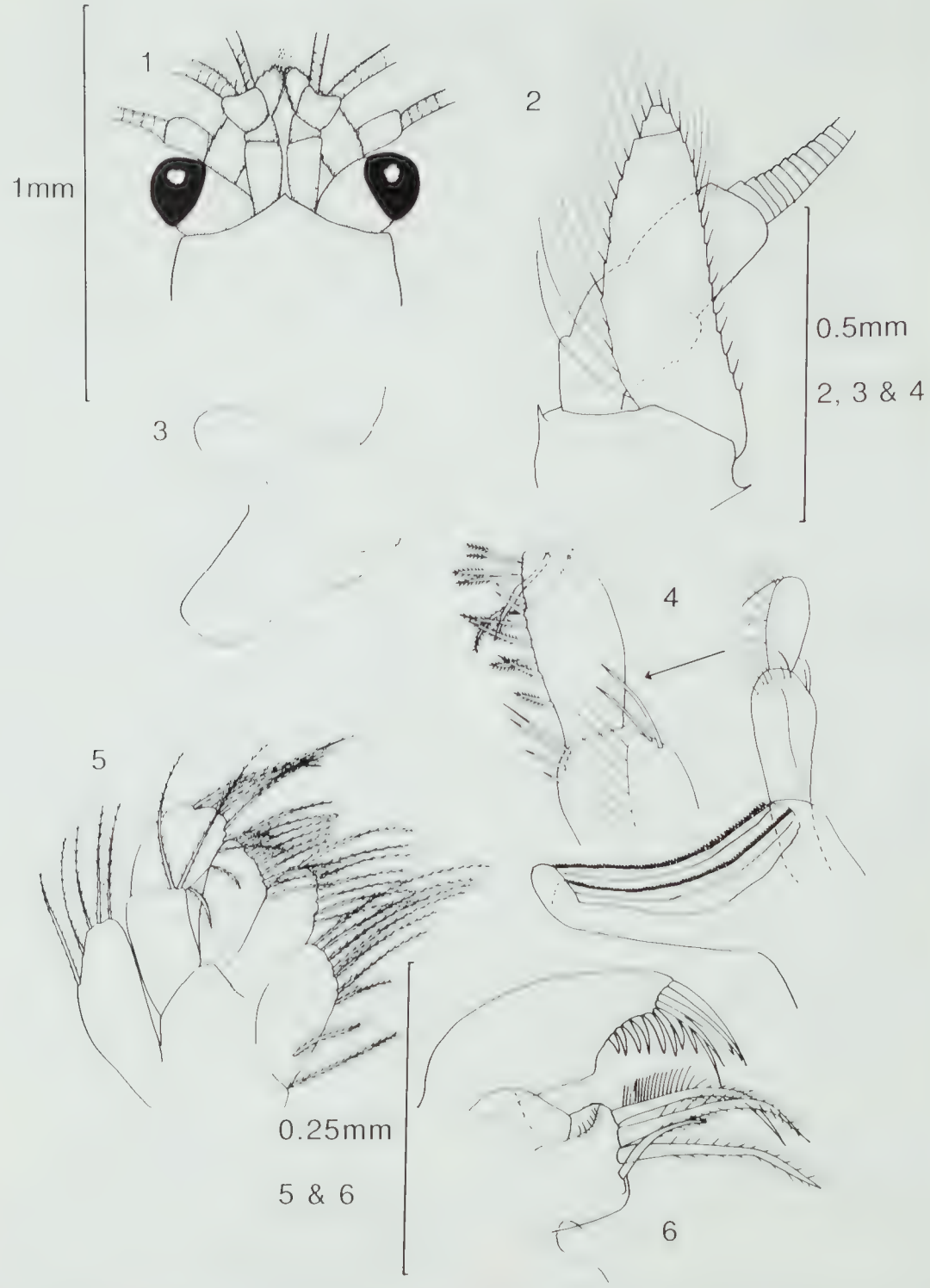
Remarks. This genus was established by G.O. Sars in 1872 for two species, *M. typica* from the north-eastern Atlantic and *M. typhlops* from Norway. It was not until 1948 that another species *M. americana* Banner, 1948 from Canada was described. The next two species described were both from Japan, *M. tanakai* Ii, 1964 and *M. nana* Murano, 1970. Two further species have been described, *M. minuta* Brattegard, 1973 from the Caribbean coast of Columbia, and *M. biscayensis* Lagardére and Nouvel, 1980 from the Gulf of Gascogne. The addition of *M. australiana* n. sp., described here, brings the total number of species belonging to this genus to eight.

Mysidella australiana sp. nov.

Figures 1–14

Type material. Holotype: male, 6 mm long, Central Bass Strait, 5 km N of North Point, Tasmania (40°40.3′S, 145°15′E), 33 m, medium shell, grab, sled or trawl (see label), M. Gomon and G.C.B. Poore on FV Sarda, 4 Nov 1980 (stn BSS 115), NMV J11046.

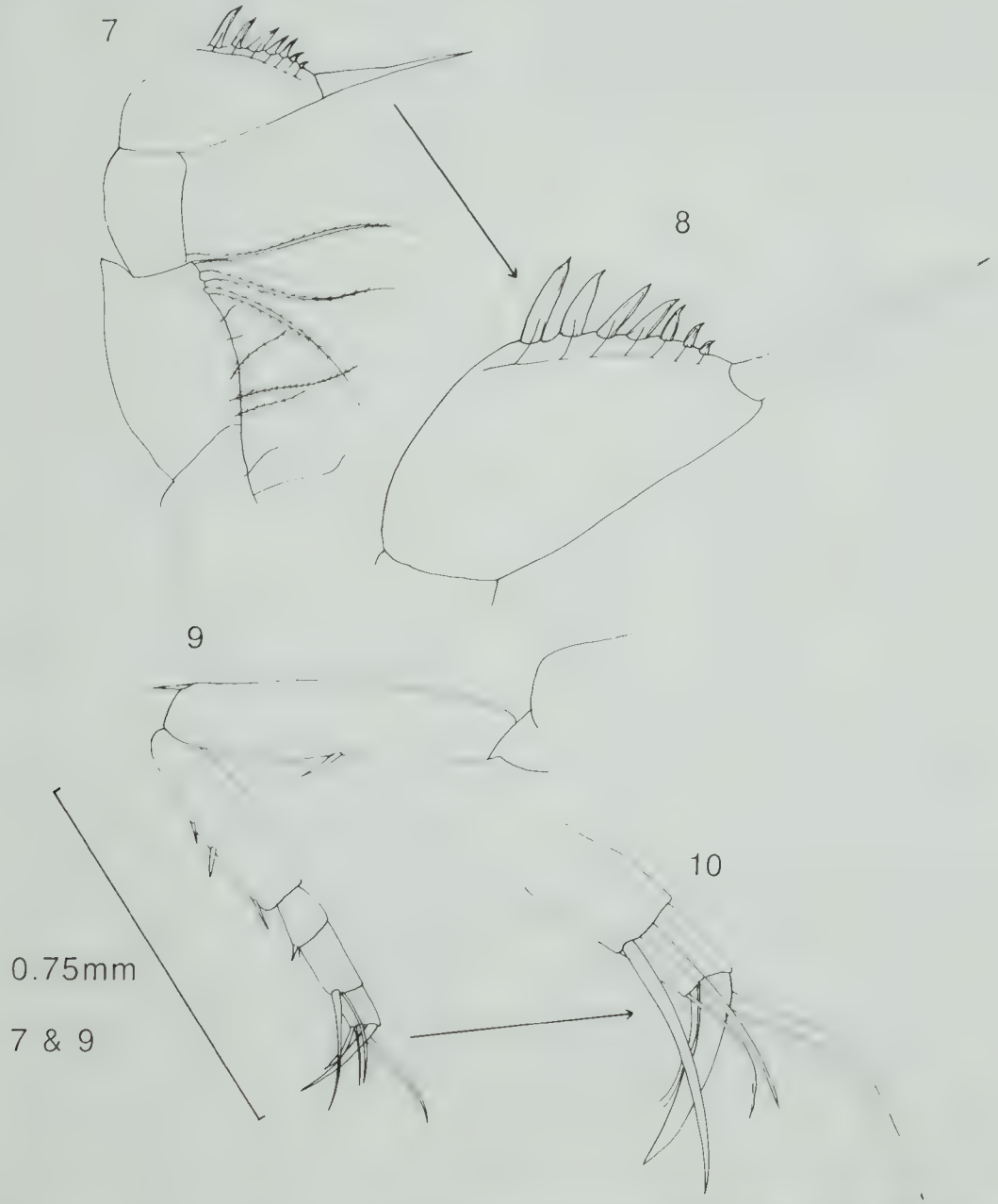
Paratypes. Eastern Bass Strait, 42 km SW of Babel Island, Tasmania (40°13.8′S, 148°39.6′E), 60 m, muddy sand, WHOI epibenthic sled, R. Wilson on RV



Figures 1–6. *Mysidella australiana* sp. nov.: fig. 1, anterior of male; fig. 2, antennal scale; fig. 3, labrum; fig. 4, mandible; fig. 5, maxilla; fig. 6, maxillule.

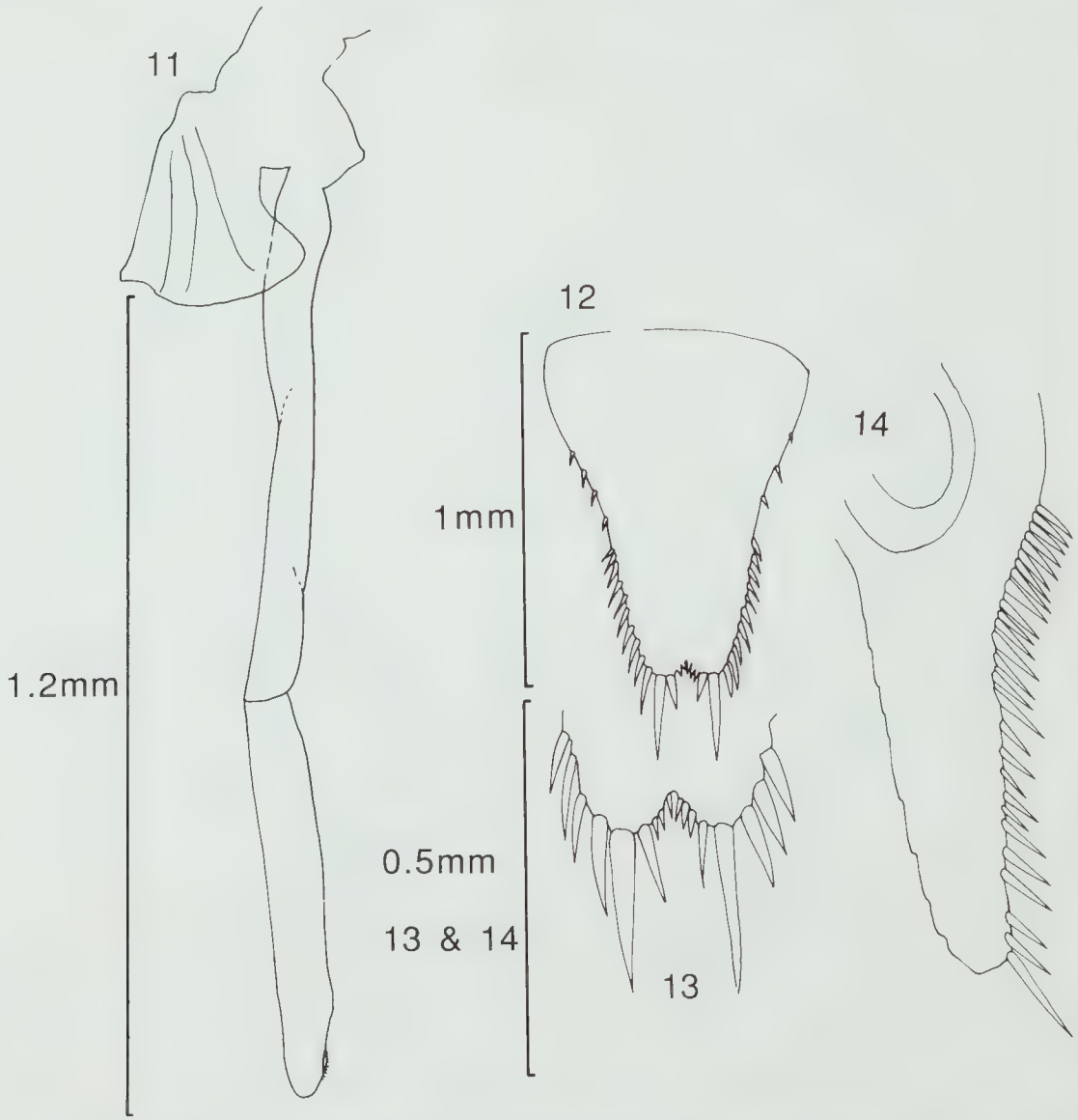
Tangaroa, 14 Nov 1981 (stn BSS-S 165), NMV J11047 (3 females, 1 male).

Other material. Type locality, NMV J17261 (4). Central Bass Strait, 100 km SSE of Cape Liptrap, Victoria (39°45.9′S, 145°33.3′E), 74 m, muddy fine sand, R. Wilson on RV Tangaroa, 13 Nov 1981 (stn BSS 156), NMV J11243 (6); Western Bass Strait, 30 km ESE of Cape Otway, Victoria (38°56.4′S, 143°51.0′E), 79 m, fine sand, Smith-McIntyre grab or WHOI sled, R. Wilson on RV Tangaroa, 19 Nov 1981 (stn BSS-Q 654), NMV J5402 (3). Plus other material from BSS stations 118 and 184.



Figures 7–10. *Mysidella australiana* sp. nov.: fig. 7, first thoracic endopod; fig. 8, terminal segment of first thoracic endopod; fig. 9, sixth thoracic leg; fig. 10, dactylus of sixth thoracic leg.

Description. Description of male holotype with female characters given (where appropriate) from paratype material. General body form compact and robust. Eyes spherical, extending to end of second segment of antennular peduncle, cornea occupies approximately half stalk in dorsal view; pigment red in alcohol (Fig. 1). Carapace with acute apex extending over eyestalk slightly; anterolateral edges rounded; posterior edge dorsally emarginate exposing last thoracic segment. Antennular peduncle of male with setose lobe small and nodular; peduncle of both sexes of similar size. Antennal scale lanceolate in shape, extending beyond antennular peduncle; with distal articulation, setose medial and lateral borders (Fig. 2). Labrum large, obtusely rounded in front; posteriorly produced into 2 unequal lobes (Fig. 3). Mandible with cutting lobe expanded and flattened without teeth; mandibular palp small (Fig. 4). Maxillule with lobes inwardly curved; outer lobe large bearing 13–15 spines; inner lobe with 4–5 plumose setae



Figures 11–14. *Mysidella australiana* sp. nov.: fig. 11, genital appendage; fig. 12, telson; fig. 13, cleft of telson; fig. 14, endopod of uropod.

(Fig. 6). Maxilla small, terminal endopod bearing plumose setae (Fig. 5). First thoracic limb: propodus of endopod expanded, larger than carpus; outer distal margin armed with row of 7 spines (Fig. 7); strong terminal claw approximately same length as propodus (Fig. 8). Thoracic legs 3–8 mostly missing in specimens, 6th thoracic leg as in Figs 9 and 10. Male genital appendage present on base of 8th thoracic limb: long cylindrical and directed forward (Fig. 11). Female with 3 pairs of brood lamellae. Pleopods of both sexes rudimentary and simple. Telson triangular, approximately 1.5 times as long as broad; shallow apical cleft occupying only 4% of the total length of telson. Lateral margins with hiatus separating 10 closely spaced spines arming the distal half and 3–4 widely spaced proximally. Two spines arm each apical lobe, outer spines twice as long as the inner (Fig. 12). Cleft armed with 3 spines on either side (Fig. 13). Uropods: endopod bearing row of approximately 27 spines on inner margin extending from statocyst to apex (Fig. 14). Exopod slightly longer than endopod. Both endopod and exopod setose along lateral and medial borders.

Adult length 4.5–6.0mm, measured from the tip of the rostrum to the end of the exopod of the uropods.

Etymology. For Australia.

Distribution. Known only from Bass Strait, Australia, where it was collected at depths between 32–95 m and from a range of sediment types i.e. from muddy sand to medium shelly sand.

Remarks. Mysidella australiana sp. nov. is easily distinguished from the other species in the genus by the presence of seven spines on the outer distal margin of the propodus of the first thoracic endopod. Most species in the genus have three, but *M. typhlops* has four and *M. nana*, five spines (Brattegard, 1973; Lagardére and Nouvel, 1980). *M. australiana* sp. nov., therefore, with respect to this feature, bears a greater resemblance to *M. nana* than to other species of *Mysidella*. However, the telson of *M. nana* is quite different from that of *M. australiana* sp. nov. in that it has a deep cleft armed with 22 spines compared to the shallow cleft with 2–3 spines of *M. australiana* sp. nov.

The telson of *M. australiana* sp. nov. is distinctive with a hiatus separating the numerous closely spaced spines on the distal half from the widely spaced spines on the proximal half. All other species have spines occupying the distal half of the telson only. Also, the telson of *M. australiana* sp. nov. has a very shallow apical cleft occupying approximately 1/24 of the length of the telson. The cleft is deeper in all other species (occupying between 1/5–1/12 of the telson length) except *M. typhlops*, where the cleft is also shallow occupying 1/19 of the telson. *M. typhlops* is, however, distinctive since it is the only species in the genus with rudimentary eyes.

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Thanks are extended to Gary Poore at the Museum of Victoria for the loan of the mysid material collected during the Bass Strait Survey and also to the Australian Museum for a Post-Graduate Research Grant which partly funded this taxonomic study.

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HAPLOSTYLUS TATTERSALLI SP. NOV. FROM BASS STRAIT, AUSTRALIA (CRUSTACEA: MYSIDAE: GASTROSACCINAE)

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Abstract

Fenton, G.E., 1990. *Haplostylus tattersalli* sp. nov. from Bass Strait, Australia (Crustacea: Mysidae: Gastrosaccinae). *Memoirs of the Museum of Victoria* 50(2): 443–450.

Haplostylus tattersalli sp. nov. is described from material collected in Bass Strait, southern Australia. The current status of the genus *Haplostylus* is discussed with respect to its closely allied genus *Gastrosaccus*. A key for the identification of the Australian species of *Haplostylus* and *Gastrosaccus* is provided.

Introduction

The new species *Halplostylus tattersalli* sp. nov. described here was collected during the Bass Strait Survey conducted by the Museum of Victoria. *H. tattersalli* sp. nov. is apparently the same species which W.M. Tattersall (in Dakin and Colefax, 1940) had recognised as a new species of *Gastrosaccus* from plankton samples collected at Broken Bay, New South Wales. However, no description was ever published and the location of the specimens remains unknown despite considerable efforts to locate them. Consequently, the presence of this species at many sites in Bass Strait, has provided an opportunity to describe it, and in doing so honour the late Dr W.M. Tattersall.

Dakin and Colefax (1940) placed this species in the genus *Gastrosaccus* Norman, however, it should now be placed in the closely related genus *Haplostylus* Kossmann, which was reinstated in 1973 by Băcescu. In view of the similarity between these two genera, the status of *Haplostylus* is discussed in detail here.

Haplostylus Kossmann

Haplostylus Kossmann, 1880: 95.—Băcescu, 1973: 321.—Hatzakis, 1977: 271–273.

Type species. Gastrosaccus normani G.O. Sars, 1877 (present designation).

Diagnosis. "Gastrosaccini with male pleopods well-developed, pairs I, II and V with unisegmented endopodite, exopodite of pleopod III with a minute endopodite and the four long segments reaching the end of the abdomen. Two or three articulation girdles divided the thick basal segment in 2–5 short segments. Without any supplemental segment on the dorsal portion of the junction between the last two pleonites." (Băcescu, 1973: 321).

Remarks. Kossmann (1880) established the genus *Haplostylus* to accept those species in the subfamily Gastrosaccinae which lacked lobes on the posterior margin of the carapace. This was later found to be a poor character to distinguish *Haplostylus* from its closely allied genus *Gastrosaccus* (Tattersall and Tattersall, 1951) and all species were placed in *Gastrosaccus*. *Haplostylus* was abandoned. *Gastrosaccus*, however, clearly held diverse species as evidenced by its major divisions, i.e. the so-called "*spinifer*" and "*normani*" groups, depending on whether the endopod of the third male pleopod was multi-articulate or uni-articulate respectively.

Băcescu (1973) reinstated the generic name *Haplostylus* to accept those species in which the endopod of the third male pleopod was uni-articulate and added a new species *H. estafricana* from eastern African waters. He also added *H. erythraeus*, *H. parerythraeus* and *G. pusillus*, to the genus *Haplostylus*. Hatzakis (1977) followed up what Băcescu had started by suggesting the transfer of the following *Gastrosaccus* species to the genus *Haplostylus*: *G. normani* G.O. Sars, 1877, *G. lobatus* Nouvel, 1951, *G. magnilobatus* Băcescu and Schiecke, 1974, *G. pacificus* Hansen, 1912, *G. indicus* Hansen, 1910 and *G. dakini* W.M. Tattersall, 1940, as well as describing a new species, *H. bacescui*. In addition, according to Hatzakis (1977), *G. vulgaris* Nakazawa, 1910, *G. philippinensis* W.M. Tattersall, 1951 (which had been synonymised with *G. bengalensis* by Ii in 1964) and *G. johnsoni* W.M. Tattersall, 1937 (which had been transferred to the genus *Bowmaniella* by Băcescu in 1968) would be transferred to the genus *Haplostylus*

Table 1. Comparison of species in the genus *Haplostylus*.

Species	Spine on pleonites	Endopod of male pleopod 2 multi-articulate	Exopod of male pleopod 4 multi-articulate	Exopod of male pleopod 5 multi-articulate
H. bacescui Hatzakis, 1977	–	["as in *H. normani*"]		
*H. bengalensis** (Hansen, 1910)	–	+	–	–
*H. brisbanensis** (Băcescu and Udrescu, 1982)	+	+	–	–
*H. dakini** (W.M. Tattersall, 1940)	–	+	+	+
H. erythraeus Kossmann, 1877	–	+	+	+
H. estafricana Băcescu, 1973	–	–	+	+
*H. indicus** (Hansen, 1910)	–	–	–	–
H. lobatus (Nouvel, 1951)	–	?	?	?
H. magnilobatus (Băcescu and Schiecke 1974)	–	?	?	?
H. normani (G.O. Sars, 1877)	–	+	+	+
*H. pacificus** (Hansen, 1912)	–	–	–	–
H. parerythraeus (Nouvel, 1944)	–	+	+	+
H. parvus (Hansen, 1910)	–	+	–	–
H. pusillus (Coifmann, 1937)	–	+	–	–
*H. queenslandensis** (Băcescu and Udrescu, 1982)	–	+	+	+
H. tattersalli sp. nov.	+	+	+	+

* = known from Australia; ? = details not given in original description; + = present; – = absent.

when more detailed descriptions became available. *G. bengalensis* and two species described by Băcescu and Udrescu (1982), *G. brisbanensis* and *G. queenslandensis*, should also be transferred to *Haplostylus* on the basis of the structure of the third male pleopod. The status of *G. vulgaris* Nakazawa, 1910 remains unclear due to an inadequate original description. Ii (1964) discussed the possibility that it may be synonymous with the relatively common Japanese species *Archaeomysis kokuboi* Ii, 1964 since he was unable to collect any specimens of *G. vulgaris* despite repeated attempts near the type locality.

Both the endopod and exopod of the male pleopod 2 are multi-articulate in most *Haplostylus* species (Table 1). Presumably this is true of *H. bacescui* also since Hatzakis (1977) refers to the pleopods "as in *H. normani*", in which pleo-

pod 2 has a multi-articulate endopod. It may be that Băcescu (1973) meant uni-articulate endopod on pleopods 1, 3, and 5 rather than 1, 2 and 5 as stated. The presence of an apophysis on the dorsal surface of pleonite 5 occurs in two species, *H. brisbanensis* and *H. tattersalli* sp. nov. This feature would, according to the generic diagnosis, remove these species from the genus *Haplostylus*; it is a feature that occurs in some but not all of the species in the genus *Gastrosaccus*. The only consistent feature of *Haplostylus* is the structure of the male pleopod 3. This feature alone was considered by Băcescu (1973: 321) as "a good feature for a generic taxon, the structure of this pleopod representing for the generic division of mysids, the same value as the genital armature does in insects."

The need for a complete revision of the two genera *Haplostylus* and *Gastrosaccus* is well recognised (Băcescu, pers. comm.), until this is done separation of the genera on the basis of the structure the third male pleopod will stand.

Haplostylus tattersalli sp. nov.

Figures 1–13

Type Material. Holotype. Western Bass Strait, 15 km SW of Point Reginald, Victoria (38°50.0′S, 143°07.5′E), 69 m, fine sand, Smith-McIntyre grab, R. Wilson on RV Tangaroa, 20 Nov 1981 (stn BSS-G 186), NMV J11044 (1 male).

Paratypes. Western Bass Strait, 25 km S of Cape Otway, Victoria (39°06.7′S, 143°28.7′E), 92 m, fine sand, WHOI epibenthic sled, M. Gomon et al. on FRV Hai Kung, 31 Jan 1981 (stn BSS-S 119), NMV J11045 (4 males, 2 females). Western Bass Strait, 15 km SW of Point Reginald, Victoria (38°50.0′S, 143°07.5′E), 69 m, fine sand, Smith-McIntyre grab, R. Wilson on RV Tangaroa, 20 Nov 1981 (stn BSS-G 186), NMV J5440 (1 male, 1 female, 1 juvenile).

Other material. Western Bass Strait, 10 km W of Cape Otway, Victoria (39°49.0′S, 143°24.0′E), 56 m, fine sand, Smith-McIntyre grab, R. Wilson on RV Tangaroa, 20 Nov 1981 (stn BSS-G 184), NMV J5437 (1); Western Bass Strait, 42 km NW of Cape Farewell, King Island, Tasmania (39°17′S, 143°39′E), 86 m, coarse sand, carbonate, Smith-McIntyre grab or pipe dredge, G.C.B. Poore on HMAS Kimbla, 10 Oct 1980 (stn BSS 75), NMV J9523 (1); Western Bass Strait, 32 km SSW of Cape Otway, Victoria (39°09′S, 143°26′E), 85 m, coarse carbonate sand, Smith-McIntyre grab or naturalist's dredge, G.C.B. Poore on HMAS Kimbla, 8 Oct 1980 (stn BSS 55), NMV J9521 (12); Western Bass Strait, 25 km S of Cape Otway, Victoria (39°06.0′S, 143°35.8′E), 95 m, fine sand, 95% carbonate, Smith-McIntyre grab, M. Gomon, et al. on FRV Hai Kung 31 Jan 1981 (stn BSS-G 118), NMV J5409 (1); Eastern Bass Strait, 19 km E of Lake Tyers Entrance, Victoria (37°50.5′S, 148°16.0′E), 26 m, coarse sand, WHOI epibenthic sled, M. Gomon and R. Wilson on FV Silver Gull, 30 Jul 1983 (stn BSS-S 206), NMV J9524 (1).

Description. (Male holotype with female characters given [where appropriate] from paratype material). Carapace produced in front into a rounded rostrum (Fig. 1); posterior margin deeply emarginate exposing last 2 pereonites, with small lobe present on each side close to mid-line (Fig. 2). Pleonite 5 with spinose process on posterodorsal surface (Fig. 3).

Eyes small extending one-third of first article of antennular peduncle; pigment black.

Antennular peduncle with first article approximately same length as combined length of articles 2 and 3. Antennal scale only slightly longer than first article of antennular peduncle: outer margin naked terminated by distal spine beyond which apical lobe extends slightly; apex and inner lateral margin setose.

Labrum with large spine (Fig. 4). Maxilla with 12 plumose setae on distal end of terminal article of endopod (Fig. 5).

Carpo-propodus of endopod of pereopods 3, 4, 5, 6, 7 and 8 sub-divided into 6, 6, 8, 8, 10 and 13 articles respectively.

Female pleopods: pleopod 1 with long slender sympod and uni-articulate endopod and exopod (Fig. 6); pleopods 2–5 uniramous.

Pleonite 1 with pleural plate, larger in female than male.

Male pleopods: endopods of pleopods 1, 3, 4 and 5 rudimentary; exopods of pleopods 1, 4 and 5 composed of 9, 6 and 5 articles respectively (Figs 7, 8, 9). Pleopod 2 biramous, endopod composed of 7 articles, exopod composed of 9 articles (Fig. 10). Exopod of pleopod 3 composed of 7 articles, terminating in 1 barbed seta and 2 simple curved setae (Fig. 11).

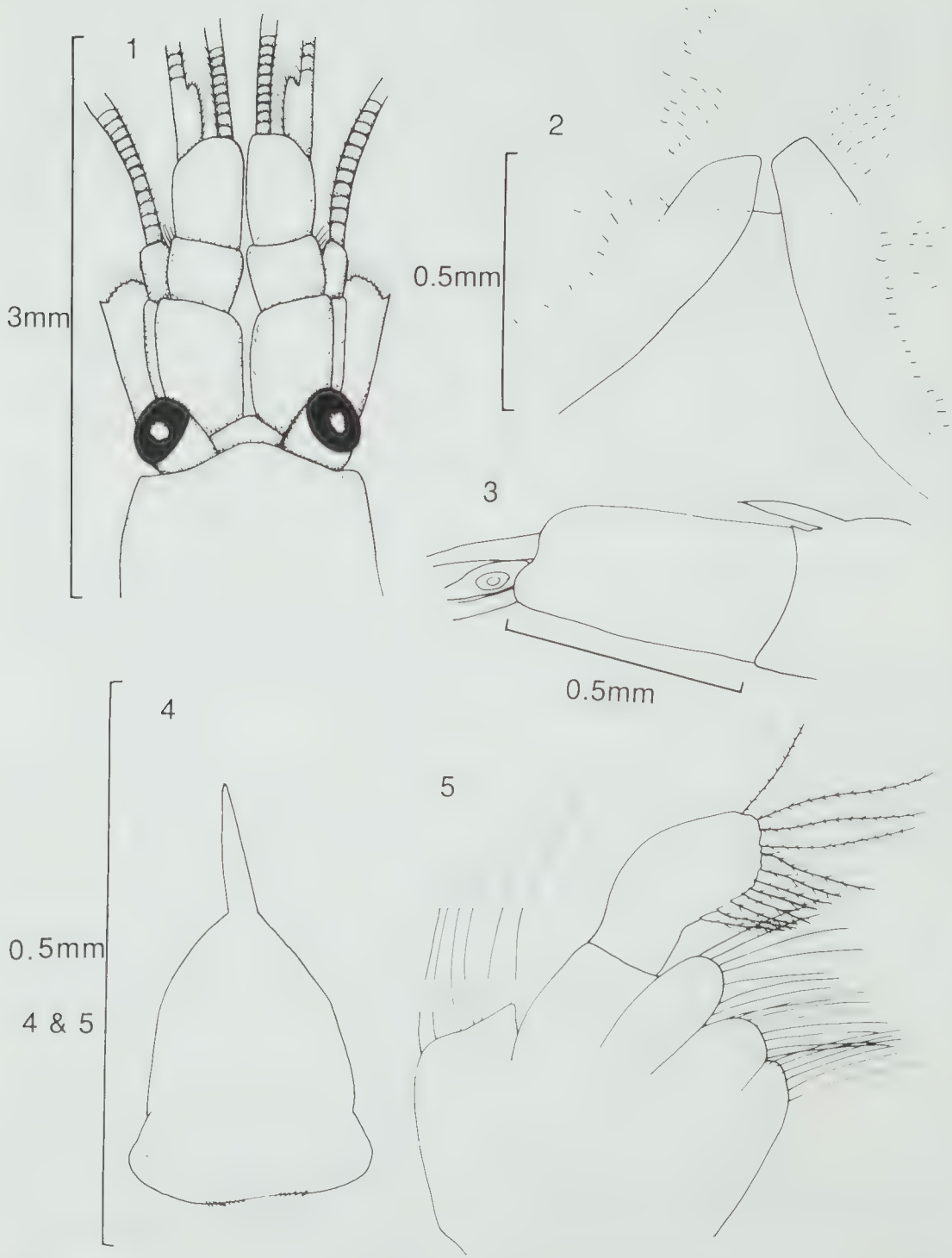
Telson cleft, armed with approximately 15 small spines; lateral edges armed with 5 spines, pair directly behind apical spines bend inwards reaching same level as small cleft spines (Fig. 12).

Uropods: Endopod slightly longer than exopod bearing a row of 8 spines on inner margin and 2 spines on statocyst. Exopod with 12 spines on outer border (Fig. 13).

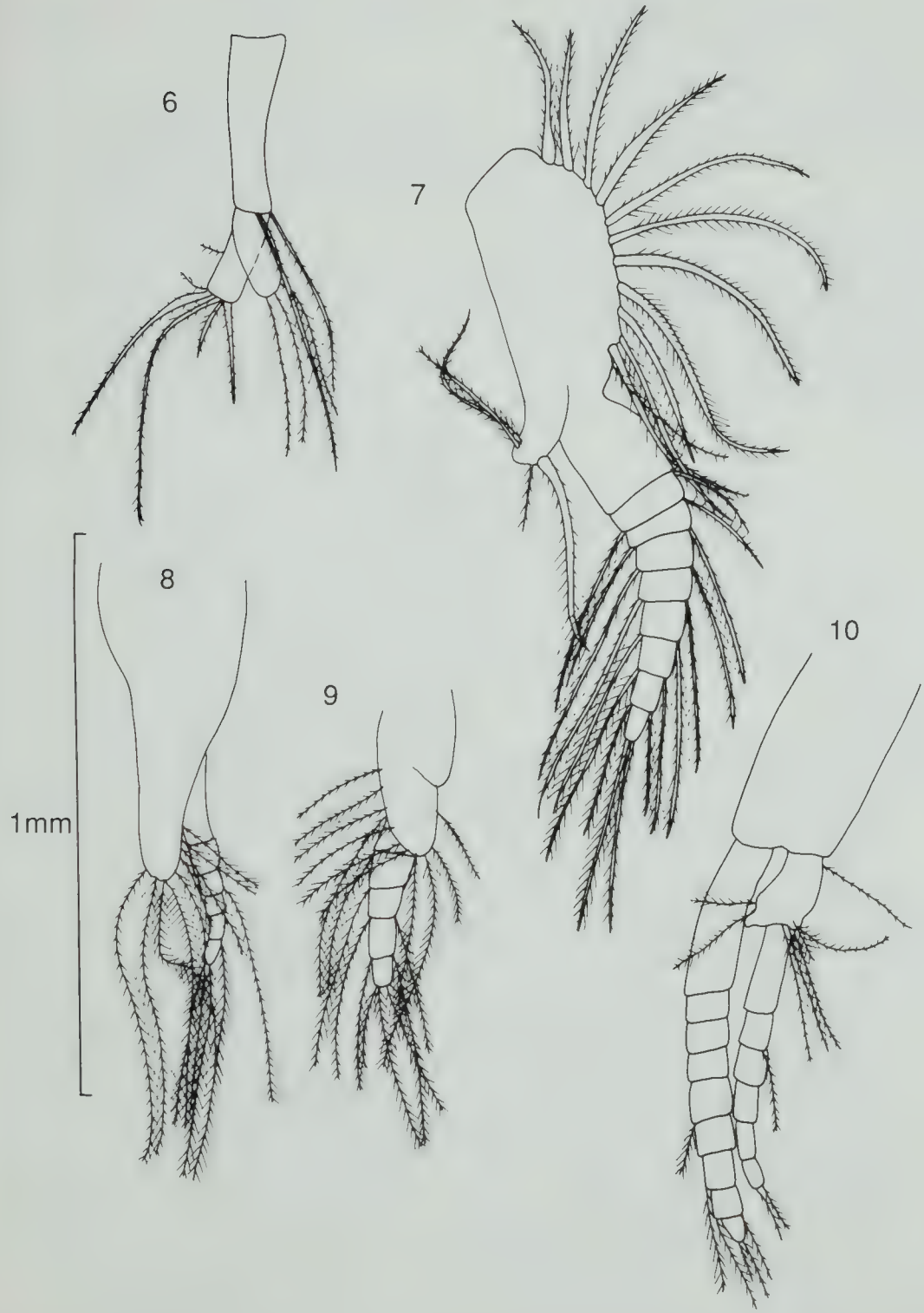
Adult length: 9–13.4mm (tip of rostrum to tip of exopod of uropod).

Etymology. This species is named in honour of the late Dr W.M. Tattersall.

Distribution. South-eastern Australia including Broken Bay, New South Wales (Dakin and Colefax, 1940), One Tree Point, southern Tasmania



Figures 1–10. *Haplostylus tattersalli* sp. nov. Holotype. 1, anterior of adult male. 2, posterior margin of carapace (dorsal view). 3, spinose process of pleonite 5. 4, labrum. 5, maxilla. 6, female pleopod 1 (paratype). 7, male pleopod 1. 8, male pleopod 4. 9, male pleopod 5. 10, male pleopod 2.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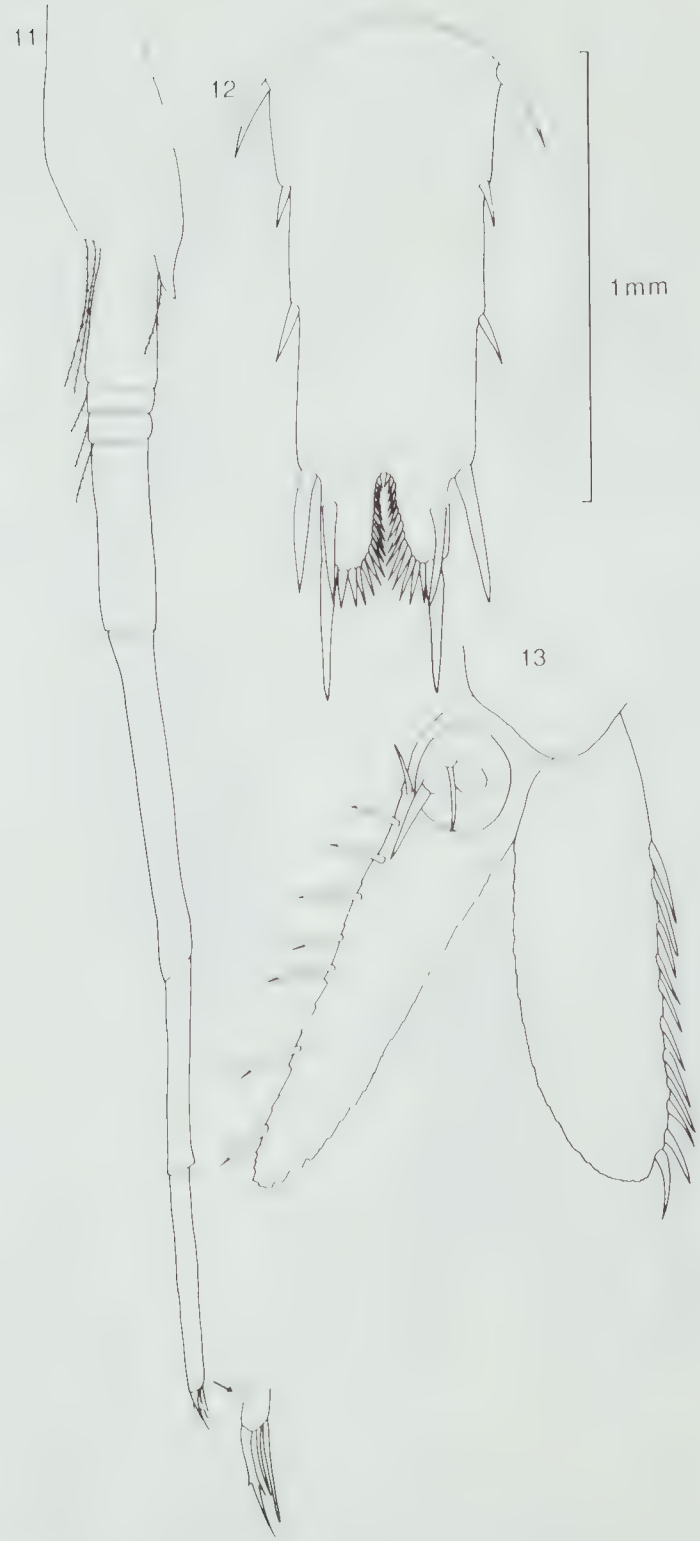

Figures 11–13. *Haplostylus tattersalli* sp. nov. Holotype. 11, male pleopod 3. 12, telson. 13, right uropods.

(Fenton, 1985) and in Bass Strait. It has been collected in water between 3 and 96 m deep.

Remarks. Haplostylus tattersalli sp. nov. is distinguished from all other members of the genus, except *H. brisbanensis* (Băcescu and Udrescu, 1982), by the presence of a spinous process on the dorsal surface of pleonite 5. However, *H. brisbanensis* is easily separated from *H. tattersalli* sp. nov. by:

(1) the uni-articulate exopod of male pleopods 4 and 5 (multi-articulate in *H. tattersalli* sp. nov.);

(2) the terminal setae of pleopod 3 is composed of 2 equal and opposed rami armed with 2–6 paired denticles (1 barbed seta and 2 simple curved setae in *H. tattersalli* sp. nov.);

(3) the carpo-propodus of pereopods of 10–16 articles (6–13 in *H. tattersalli* sp. nov.);

(4) the telson bears 8-9 lateral spines (5 in *H. tattersalli* sp. nov.); and

(5) 6 spines on the inner margin of the endopod and 13–18 spines on the outer margin of the exopod of the uropod (8 and 12 and *H. tattersalli* sp. nov. respectively).

The description of *H. tattersalli* sp. nov. takes the total number of *Haplostylus* species, recorded from Australian waters to seven, four of which are endemic. There are also two species of *Gastrosaccus* known from Australian waters, *G. daviei* Băcescu and Udrescu, 1982 and *G. sorrentoensis* Wooldridge and McLachlan, 1986, both endemic. A key for the identification of the species known from Australian waters is provided.

Key to the Australian Species of *Gastrosaccus* and *Haplostylus*

1. Endopod of male pleopod 3 multi-articulate ... *Gastrosaccus* 2
— Endopod of male pleopod 3 uni-articulate ... *Haplostylus* 3
2. Posterodorsal edge of carapace with fringe of spine-like filaments. Spinous process on posterodorsal edge of pleonite 5. Lateral margins of telson armed with 7–8 strong spines ..... *G. sorrentoensis*
— Posterodorsal edge of carapace without spine-like filaments. Spinous process on posterodorsal edge of pleonite 5. Lateral margins of telson armed with 12–15 spines ..... *G. daviei*
3. Spinous process on posterodorsal edge of pleonite 5 4
— Spinous process absent 5
4. Endopod of male pleopod 4 of 8 articles; exopod uni-articulate. Exopod and endopod of pleopod 5 uni-articulate. Lateral margins of telson with 8–9 spines. Endopod of uropod with 6 spines on inner margin, outer margin of exopod with 13-18 spines. Terminal setae of male pleopod 3 broad with denticles ..... *H. brisbanensis*
— Exopod of male pleopods 4 and 5 multi-articulate; endopod of both uni-articulate. Lateral margins of telson armed with 5 spines. Endopod of uropod with 8 spines on inner margin, outer margin of exopod with 12 spines. Male pleopod 3 with 1 barbed and 2 simple terminal setae ... . *H. tattersalli* sp. nov.
5. Exopod of male pleopods 4 and 5 short and uni-articulate 6
— Exopod of male pleopods 4 and 5 multi-articulate 7
6. Endopod of male pleopod 2 uni-articulate. Exopod of male pleopod 3 of 4 articles terminating in 2 small simple setae. Lateral margins of telson with 10 spines ..... *H. indicus*
— Endopod of male pleopod 2 composed of 2 articles. Exopod of male pleopod 3 of 3 articles terminating in 2 spines and a sinuous lash-like seta. Lateral margins of telson with 12 spines, penultimate spine much longer than apical ones ..... *H. pacificus*
7. Lateral margins of telson armed with 11–13 spines. Exopod of male pleopod 3 of 5 articles. Rami of male pleopod 2 modified with a process and strong seta ..... *H. bengalensis*
— Lateral margins of telson armed with 6–7 spines. Exopod of male pleopod 3 of 3 or 4 articles. Terminal setae of male pleopod 2 not as above 8

8. Exopod of male pleopod 3 of 3 articles. Endopod of male pleopod 2 of 6 articles; terminal setae simple and curved. Lateral edges of telson armed with 6 spines ..... *H. dakini*

— Exopod of male pleopod 3 of 4 articles. Endopod of male pleopod 2 of 7 articles; terminal setae modified. Lateral margins of telson with 7 spines ..... *H. queenslandensis*

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A NEW SPECIES OF *DONSIELLA* (COPEPODA: HARPACTICOIDA) ASSOCIATED WITH THE ISOPOD *LIMNORIA STEPHENSENI* MENZIES FROM MACQUARIE ISLAND

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Abstract

Hicks, G.R.F., 1990. A new species of *Donsiella* (Copepoda: Harpacticoida) associated with the isopod *Limnoria stephenseni* Menzies from Macquarie Island. *Memoirs of the Museum of Victoria* 50(2): 451–456.

A fifth species of *Donsiella* and the first from an algae-boring species of the genus *Limnoria* is described and illustrated. It differs from other donsiellines, inter alia, by the unique armature of the P1 endopod 2 claws. A key to the genus is presented and notes provided on aspects of the biology of this new species.

Introduction

The genus *Donsiella* Stephensen has recently been revised and its status, along with that of other new allied genera within the Donsiellinae, has been discussed in relation to the relocated position of the subfamily within the Thalestridae (Hicks, 1988a). Currently four species of *Donsiella* are known and all members of the subfamily are implicated either as direct associates of wood-boring species of the isopod genus *Limnoria* Leach, or of microhabitats occupied by them.

Some species of *Limnoria*, until now assigned to the genus *Phycolimnoria* Menzies (L.J. Cookson, pers. comm.), are active borers of marine algae, excavating tunnels particularly in the holdfasts and stipes of kelp (Laminariales and Durvillaeales). Examination of material collected from Macquarie Island by Mr Harold Hamilton as part of Mawson's Australasian Antarctic Expedition 1911–1914 (see Hale, 1937), has revealed four donsiellines that were found as commensals of *Limnoria stephenseni* Menzies. Further specimens have subsequently come to light and since aspects of its morphology are unique, it is described here as new; this is the first species to be described from a seaweed-boring limnoriid. A key separating the five species of *Donsiella* has also been constructed.

Terminology, abbreviations, methods of study and type rationale were detailed in Hicks (1988b). Scale bars on illustrations are 0.03 mm.

Donsiella phycolimnoriae sp. nov.

Figures 1–3

Material examined. Syntypes: 60 females (5 dissected); 12 males (2 dissected) taken from sternum of *Limnoria stephenseni* in holdfasts of *Durvillaea antarctica* (Cham.) Hariot, Handspike Pt, Macquarie Island, 21 Dec 1977. MA-135, coll. D.S. Horning and J.K. Lowry. Deposited in Museum of Victoria, Melbourne, Australia (J14492). The host is registered as J16320.

Supplementary material. 2 females; 2 males on sternum of juvenile *Limnoria stephenseni* taken from burrows in kelp (*Macrocystis pyrifera* (L).C.Ag.) holdfasts, North end Macquarie Is., 3 Sep 1912. coll. H. Hamilton, South Australian Museum, Adelaide (C4201). 4 females (ovigerous) removed from sternum at base of legs of one *L. stephenseni*, Macquarie Is., stn C1-14, 19 Oct 1983 (no other data) (J14496). 3 brooding female *L. stephenseni* (same data as syntypes, J14493) were examined and the following were respectively removed from each marsupium: 6 females (3 ovigerous), 9 males, 28 copepodites, 34 nauplii; 9 females (4 ovigerous), 47 males, 61 copepodites, 164 nauplii (24 pairs in copula); 4 females (3 ovigerous), 9 males, 14 copepodites, 28 nauplii.

Description. Female. Total length 0.56–0.60mm. Body pyriform (Fig. 1a), broad (length/width ratio 1.8:1), moderately dorsoventrally flattened. Rostrum (Fig.1g), distinct with 4 long sensilla. Genital field (Fig. 1b), similar to other species in genus. Genital double somite with chitinous stripe; abdominal ornamentation as 2 short dorsolateral rows of fine spinules midway down double somite and short ventrolateral clusters posteriorly on this and succeeding two somites; posteromedial edges of somites naked except for sensilla. Caudal rami (Fig. 1c) divergent, tapering posteriorly, with cuticular pore proximolaterally and glandular (?) opening at outer distal corner; outermost apical seta short, basally scaleiform, closely juxtaposed with principal seta; posteroventral margin of rami finely ciliate.

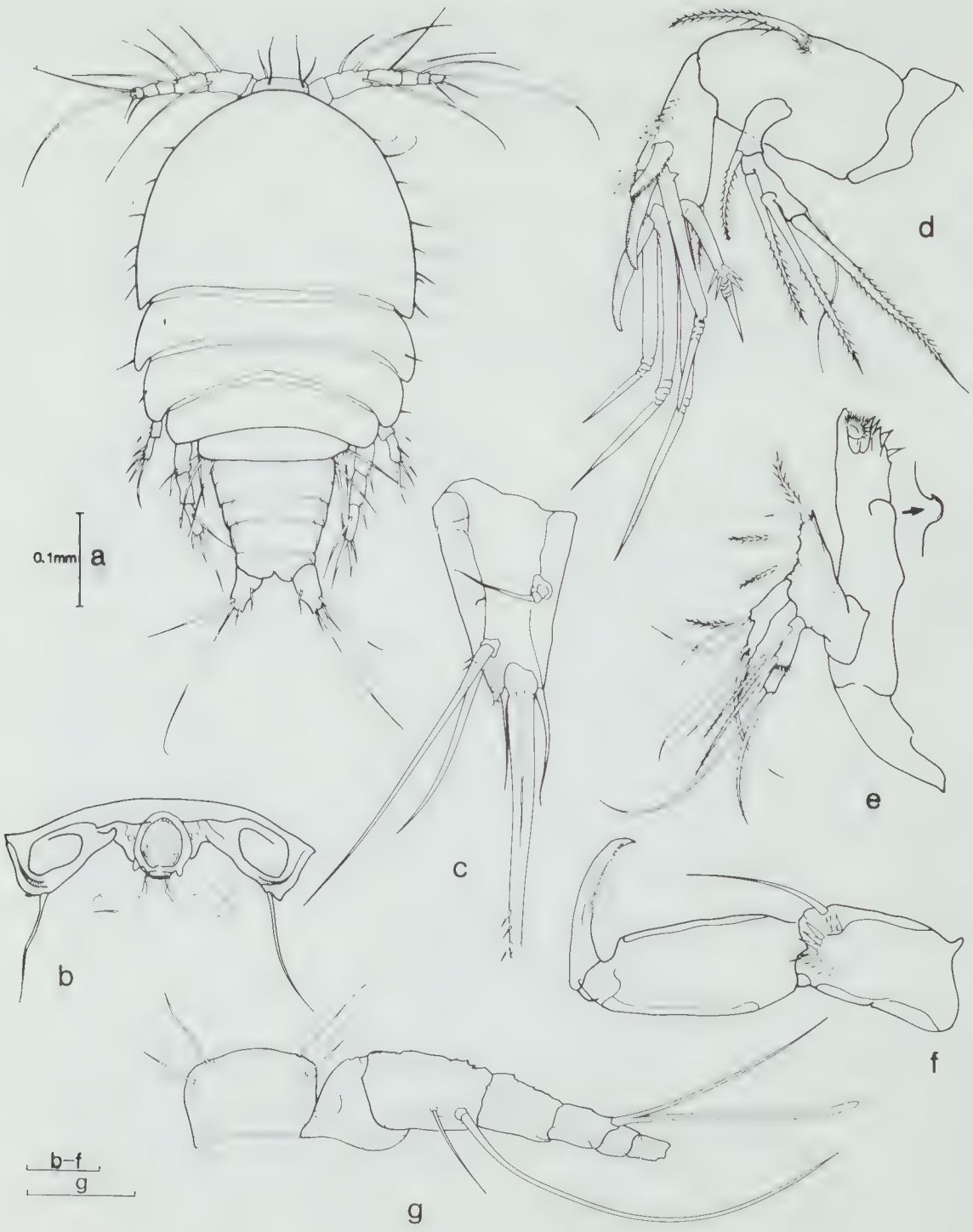

Figure 1. *Donsiella phycolimnoriae* sp. nov. Female. a, whole animal dorsal; b, genital field; c, caudal ramus; d, antenna; e, mandible; f, maxilliped; g, rostrum and antennule, most setae omitted.

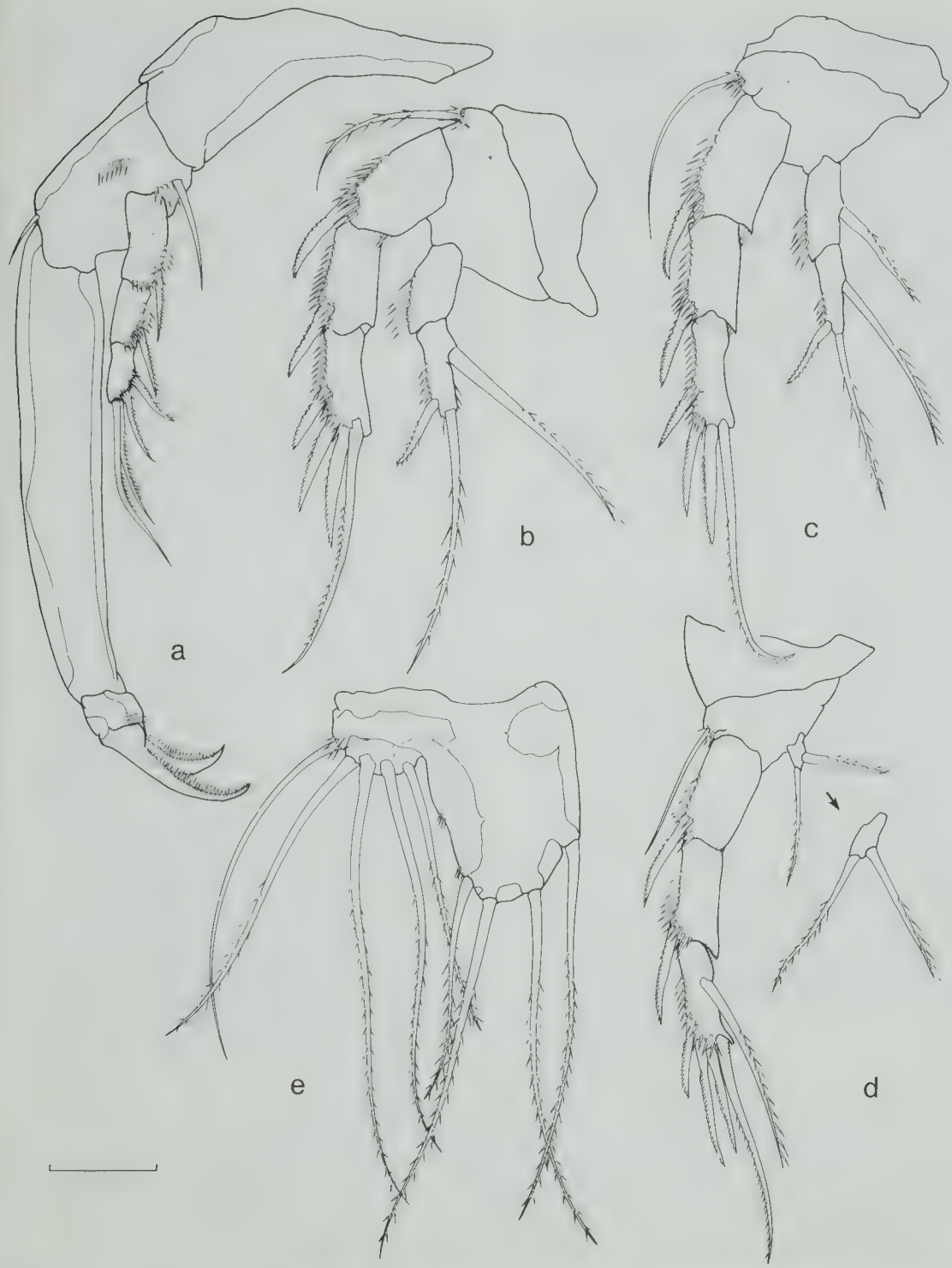

Figure 2. *Donsiella phycolimnoriae* sp. nov. Female. a, P1; b, P2; c, P3; d, P4 with endopod of larger specimen; e, P5.

Antennule (Fig. 1g) 6-segmented. Posterodorsal seta on distal part of second segment and apical seta of sixth segment particularly elongate; aesthetasc on fourth segment.

Antenna (Fig. 1d) allobasis stout. Coxa narrow. Endopod with 9 distal spines/setae, outermost geniculate with medial spinule cluster. Exopod second segment only slightly longer than first, setation of 1:22.

Mandible (Fig. 1e) cutting edge with large spines and a denticulate comb; pars molaris rounded. Coxa-basis with 4 setae, innermost arising at right angles to next outermost. Endopod one-, exopod two-segmented, suture weak on latter.

Maxillule and maxilla not significantly different from other species in the genus.

Maxilliped (Fig. 1f) prehensile. Palm stout, without setule; inner edge of claw finely serrate.

P1 (Fig. 2a) coxa narrow, elongate; basis with medial spinules; coxa-basis oriented longitudinally. First exopod segment longest, middle segment without inner seta, third segment with 4 distal spines/setae. Endopod without marginal setae; distal claws on second segment densely spinulose.

P2 (Fig. 2b), P3 (Fig. 2c), P4 (Fig. 2d) exopods 3-segmented with setal arrangement as in other species of *Donsiella*. Endopods of P2 and P3, two-segmented; setal formula of P2 is nominally 0:111, but a greatly reduced accessory seta (spine?) exists terminally; setal formula of P3 is 1:111; P4 bears two distal setae on the single reduced segment.

P5 (Fig. 2e) inner expansion of baseoendopod large with 4 elongate setae on posterior margin. Exopod reduced, distinct but with very weak suture and 4 elongate setae.

Male. Differs from female in following re-

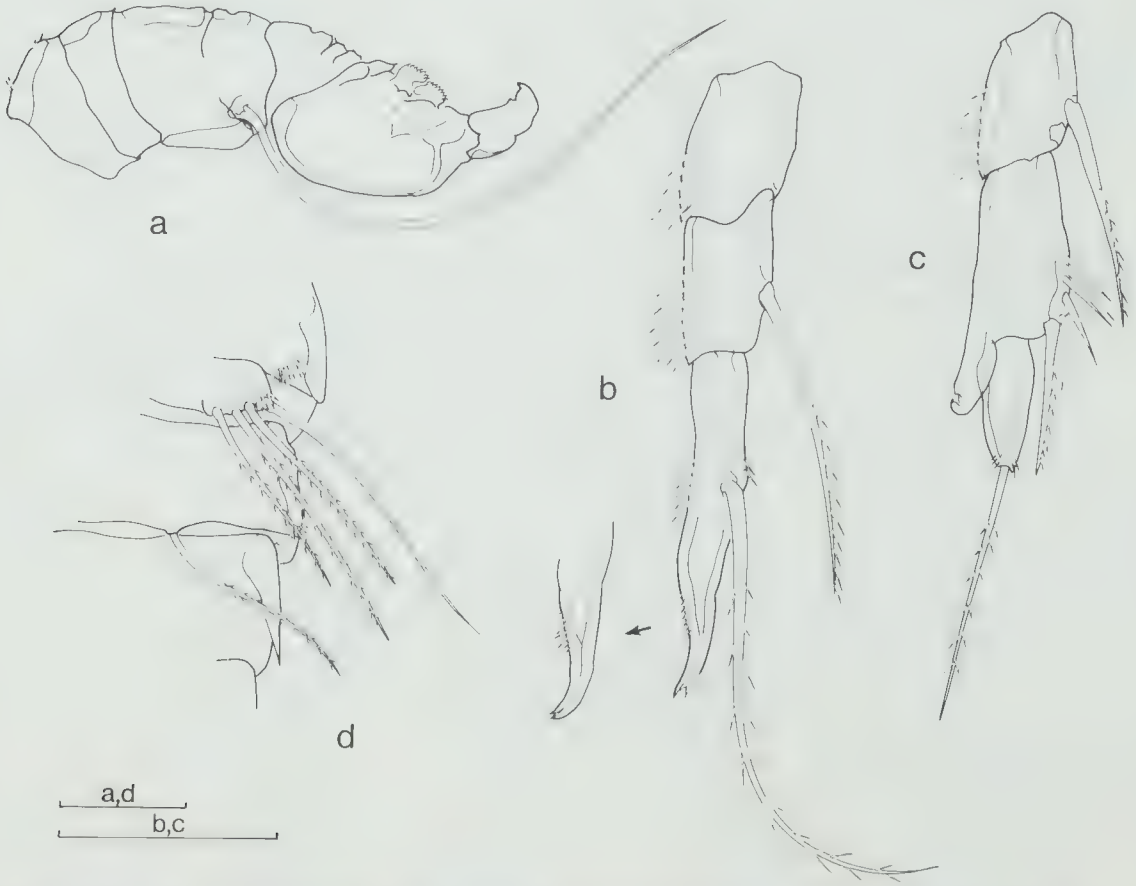

Figure 3. *Donsiella phycolimnoriae* sp. nov. Male. a, antennule, most setae omitted; b, P2 endopod with tip of another specimen; c, P3 endopod; d, P5 and P6.

spects. Body smaller (0.52-0.55 mm); first two abdominal somites distinct, each with 2 short dorsolateral spinule rows and posterolateral clusters on succeeding two somites.

Antennule (Fig. 3a) chirocerate, 6-segmented, incomplete incipient suture on article 3; fifth segment bears aesthetasc and two thorny pads on anterior margin.

P2–P4 exopods armed and built as in female. P2 endopod (Fig. 3b) distally curved with bi- or trifurcate tip, depending on orientation. Medial segment of P3 endopod (Fig. 3c) with thumb-shaped outer distal process; third segment ellipsoid with seta arising terminally. P4 endopod as in female but a little smaller.

P5 (Fig. 3d) baseoendopod and exopod fused with 4 setae and some outer spinules.

P6 (Fig. 3d) a single elongate spinulose seta.

Variability. There are variations in the relative size of the P4 endopod in both sexes, conspicuousness of the baseoendopod/exopod suture in the female P5, degree of presentation of pars molaris, shape of CR and extent of lateral spinule patches on abdomen of both sexes.

Remarks. Donsiella phycolimnoriae is clearly separable from other species in the genus by the unique spinule elaboration on the P1 endp. 2 claws in both sexes (see Key). Moreover, in the female, the setation of the P2 and P3 endopods is quite unlike other species, yet there is an affinity with *D. bisetosa* in the P4 endopod and CR. In the male, the terminal origin of the P3 endp.3 seta is shared only with *D. anglica*, from which it differs in the overall proportions of this limb. In all other species this seta arises mediolaterally.

At about 0.5 mm in length, the body of *D. phycolimnoriae* is the largest within the genus, other species measuring in the region of 0.3 mm. Such a body size probably reflects the relative proportions of the host; at about 8.0 mm in length, *Limnoria stephenseni* is the largest known limnoriid (Menzies, 1957), other species measuring on average 3.0–5.0 mm. It might be instructive in future studies on the phylogeny of the Limnoriidae to consider the coevolutionary consequences not only to body size, but also to appendage morphology of their donsielline commensals.

Biology. Laboratory experiments conducted on *Donsiella limnoriae* by Pinkster (1968), concluded that in the absence of live specimens of *Limnoria*, adult copepods failed to survive more than 3 days. The suggestion was that the association between adult copepods and the isopod host was obligatory.

Adult, including ovigerous female, and juvenile donsiellines are frequently taken from the ventral surface of limnoriids, yet apart from Pinkster's observations, no naupliar stages have hitherto been collected (Hicks, 1988a). Large numbers of nauplii along with older life cycle stages were removed from within the brood pouches of three *Limnoria stephenseni* specimens (see *Material*). Nauplii were distributed throughout the marsupium, closely applied to the surfaces of isopod embryos and prehatchlings. Moreover, one isopod contained a substantial number of adult males that were in precopulatory association with female copepodites, again the first time this behaviour has been recorded in donsiellines. The intriguing question is whether or not aspects of the reproductive repertoire (precopulatory clasping, copulation, egg laying, eclosion of nauplii), are actually timed to occur within the safety of the host marsupium. Should this be so then nauplii would be in an ideal situation to infect the young isopod manca stages as they emerge from the maternal brood pouch. Alternatively, Pinkster (1968) found that nauplii lived twice as long as adults in the absence of the host and concluded that they were free swimming and free living, implying that this might be the invasion pathway. By whatever process this commensal/host relationship is maintained, it is clearly a matter in need of fresh investigation.

Key to species of *Donsiella* (both sexes)

1. P1 endopod 2 claws naked 2
— P1 endopod 2 claws strongly spinulose ..... *D. phycolimnoriae*
2. CR only slightly longer than wide; P5 baseoendopod with 4 setae in female 3
— CR much longer than wide; P5 baseoendopod with 3 setae in female ..... *D. bisetosa*
3. P2 and P3 endopod 2 with 2 and 2 setae respectively in female; P3 endopod 1 with seta in male 4
— P2 and P3 endopod 2 with 4 and 3 setae respectively in female; P3 endopod 1 without seta in male ..... *D. limnoriae*

4. P4 endopod of both sexes with 1 long seta; P2 endopod 3 of male terminally digitiform ..... *D. anglica*
— P4 endopod with 1 long seta in female, 2 in male; P2 endopod 3 of male terminally bifurcate ..... *D. victoriae*

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THREE NEW SPECIES OF *OCTOPUS* (MOLLUSCA: CEPHALOPODA) FROM SOUTH-EASTERN AUSTRALIA

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Abstract

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Three new species of *Octopus* are described and illustrated from south-eastern Australian waters: *Octopus warringa*, *Octopus kaurna* and *Octopus bunurong*. *Octopus warringa* also occurs in New Zealand.

Introduction

There are about 30 species of octopus described from Australian waters (Lu and Phillips, 1985). As part of an ongoing study of the fauna, a systematic revision of the inshore benthic octopodids of south-eastern Australia was undertaken (Stranks, 1988), and three undescribed species of *Octopus* were identified. This paper describes the new species. More details will be included with the future publication of a larger monographic revision of the Octopodidae of south-eastern Australia.

The counts, measurements and indices listed are as defined by Roper and Voss (1983). Other abbreviations used are ML — mantle length and TL — total length. Material is lodged in the Australian Museum, Sydney (AM); Museum of Victoria, Melbourne (NMV); Otago Museum, Dunedin (OM); and South Australian Museum, Adelaide (SAM).

Octopodidae

Octopus Lamarck, 1798

Type species. Octopus vulgaris Lamarck, 1798.

Diagnosis. Benthic octopodids. Mantle saccular, without fins. Eight arms lacking cirri, arms with biserial suckers, third right arm of males hectocotylised with end of arm modified into ligula and calamus. Web well developed. Ink sac present. Mantle aperture wide. Internal shell cartilaginous and vestigial.

Octopus warringa sp. nov.

Figures 1a–f

Polypus duplex.—Berry, 1917: 11, text fig. 5 (non *Octopus duplex* Hoyle, 1885).

Robsonella australis.—Benham, 1942: 227, text fig. 3, pls 18, 19 (*partim*).—Dell, 1952: 32, pl. 4, figs 2–6, pl. 5, figs 1, 3, 4, pls 7, 8 (*partim*).—1959: 95 (non *Octopus australis* Hoyle, 1885).

Octopus Species A.—Stranks, 1988: 54, text figs 21–25.

Material examined. Holotype: Tasmania, Maria Island, west of Darlington (42°35′S, 148°03′E), 30 m, R. Wilson, 23 Apr 1985, NMV F57444 (mature male, 16.5 mm ML).

Paratypes: Tasmania, Off east coast of Tasmania (42°40′S, 148°28′E), 122 m, RV "Discovery", Station 113, BANZARE, 23 Mar 1931, SAM D15219 (submature female, 22.0 mm ML); Maria Island (42°44′S, 148°01′E), D. Clayton, 1985, NMV F53219 (submature female, 25.9 mm ML; 2 mature males, 16.0 mm ML and 18.0 mm ML).

Victoria, eastern Bass Strait (38°10′S, 147°49′E), 48 m, Station 262, East Gippsland Scallop Survey, 28 Feb 1971, NMV F31259 (mature male, 14.4 mm ML)

New Zealand, Portobello (45°51′S, 170°39′E), C. Hedley, 10 Dec 1918, AM C159292 (mature male, 20.5 mm ML).

Other material: Tasmania, Off east coast of Tasmania (42°40′S, 148°28′E), from fish stomach contents, RV "Discovery", stn 113, BANZARE, 23 Mar 1931, SAM D15220 (male, 18.9 mm ML); off Maria Island (42°38′S, 148°05′E), 119 m, RV "Aurora", Australasian Antarctic Expedition, 12 Dec 1912, AM C40887 (mature female, 29.6 mm ML).

Victoria, eastern Bass Strait (37°55′S, 148°21′E), 50 m, stn 412, East Gippsland Scallop Survey, 15 Feb 1971, NMV F53214 (immature male, 12.4 mm ML).

New Zealand. Foveaux Strait (46°32′S, 168°00′E), OM A.'15.34 (mature female, 26.5 mm ML, with eggs); same locality, OM A.'29.111 (mature male, 34.1 mm ML; 2 submature females, 12.9 mm ML and 22.5 mm ML); Portobello (45°51′S, 170°39′E), OM A.'28.24 (2 mature males, 19.1 mm ML and 20.6 mm ML; 2 submature females, 16.2 mm ML & 20.6 mm

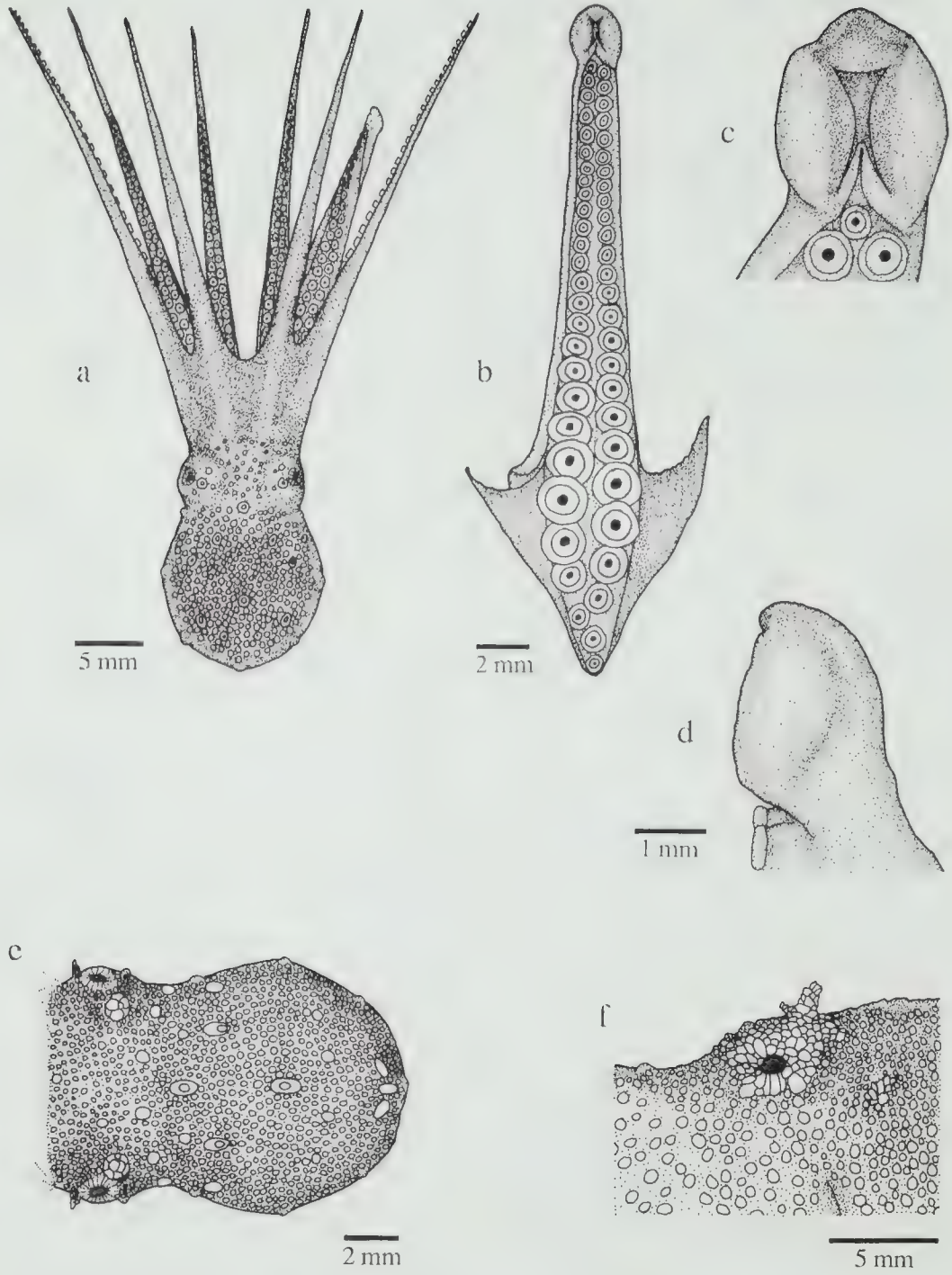

Figure 1. *Octopus warringa* sp. nov.: a, dorsal view of holotype, NMV F57444, male, 16.5 mm ML; b, hectocotylised arm, and c, dorsal, and d, lateral, detail of hectocotylus, of paratype, NMV F53219, 16.0 mm ML; e, tubercles, branched and unbranched papillae on head and mantle dorsum of NMV F53214, male, 12.4 mm ML; f, lateral view of arborescent ocular papillae of paratype, NMV F53219, male, 16.0 mm ML.

ML); between Nelson and Stephen Islands, Tasman Bay (41°42′S, 174°00′E), 18–55 m, G. Thomson, 1900, OM A.'0.97 (submature female, 24.8 mm ML).

Description. Small animals (ML to 35 mm; TL to 125 mm); mantle broadly ovoid (MWI 56.3–*80.5*–107.0); head wide, but narrower than mantle (HWI 40.9–*66.0*–82.2), demarked from mantle by moderate constriction; eyes large, projecting above surface of head. Funnel large, stout, bluntly tapered (FuLI 32.6–*41.7*–56.7); funnel organ W-shaped, limbs thick, outer limbs three-quarters as long as median limbs. Arms long (MAI 27.4–*36.4*–52.8) (1.9–3.7 times ML in mature animals), stout, tapering to narrow tips. Arm lengths subequal, arm order usually III.IV.II.I. Arm suckers biserial, raised from arm surface, moderately sized (ASIn 6.1–*10.3*–14.3), 6th to 10th suckers usually largest, enlarged on all arms of mature males and females. Third right arm of males hectocotylised, shorter than its opposite number (OAI 67.2–*77.6*–85.8; HcAI 149.2–*205.5*–273.3); ligula 6–10% of third right arm length in mature animals (LLI 6.3–*7.9*–10.2); ligula groove long, well marked and deep, without transverse ridges; calamus short, acutely pointed (CaLI 24.0–*35.7*–50.0); hectocotylised arm with 51–65 suckers. Web shallow (WDI 18.8–*24.7*–33.9), web formula usually CB=DA=E. Radula with B_{3-4} seriation of the rhachidian. Ink sac present. Gill lamellae 6–8. Mature female with small eggs (2–3 mm long; 1.0–1.5 mm wide), very long stalks, forming festoons. Male with very long penis (PLI 15.2–*29.3*–51.9), with a coiled diverticulum marked by three lobes; spermatophores very long (SpLI 71.7–*146.0*–184.4), slender (SpWI 2.5–*3.1*–3.6), with large, coiled sperm reservoir (SpRI 29.2–*32.2*–36.4).

Integumental sculpture consists of a pattern of fine, rounded and closely set epidermal tubercles; tubercles cover both dorsal and ventral surfaces; branched and unbranched papillae present on dorsum; pattern of papillae on mantle dorsum includes approximately seven subparallel rows of simple, usually unbranched papillae along the mantle length; each row has 3–4 papillae, a single larger papilla forms a posterior point on the mantle; a larger arborescent papilla is obvious in the supraocular region, surrounded by 3–4 smaller, usually unbranched papillae; lateral integumentary ridge or fold around mantle circumference absent. No information is available on colouring of live animals. Preserved specimens in ethyl alcohol uniformly light brown to purple dorsally, cream to light brown ventrally. Ocelli absent.

Distribution. South-eastern Australia, from the Great Australian Bight to eastern Victoria, including Bass Strait and Tasmania. Also in the temperate waters of New Zealand, including the North and South Islands, and Stewart Island. An inshore species, living on rocky bottom, and among sponges and polyzoans, at depths from 0–144 m (Stranks, 1988).

Etymology. The specific epithet *warringa* is derived from an Australian Aboriginal word meaning "the sea", and is to be treated as indeclinable.

Remarks. There has been discussion about the generic placement of this species. *Octopus warringa* has been previously incorrectly identified and described under the name *Robsonella australis* (Hoyle, 1885).

Pickford (1955) reviewed the generic characters of *Robsonella*, and concluded that the genus was not valid. Pickford (1955) considered that species which had been assigned to *Robsonella* should be returned to the genus *Octopus*, a view I agree with.

Tait (1982) revised *Octopus australis* Hoyle, 1885 from south-eastern Australia, and discussed the status of similar species described from New Zealand, including material described as *Robsonella australis*. *Octopus warringa* may be readily distinguished from *O. australis* by the characteristic skin patterning (particularly the absence of a ventro-lateral integumentary ridge), the enlarged suckers on all arms of mature males and females, the bulbous-shaped ligula, and the small eggs arranged in festoons.

Previous accounts, under various names, now referable in part or entirely to *O. warringa* include: *Polypus duplex* (Hoyle, 1885) (as used by Berry, 1917); and *Robsonella australis* (Hoyle, 1885) (as used by Benham, 1942; Dell, 1952; 1959; Brough, 1965). Two detailed descriptions exist for *Octopus warringa* (Benham, 1942; Dell, 1952).

Berry (1917) described a specimen collected by the "Aurora" off Maria Island, Tasmania, during the Australasian Antarctic Expedition (1911–1914). Berry (1917) tentatively identified the specimen as *Polypus duplex*, and included measurements and a figure. The specimen was a mature female (AM C40887), not an immature female as Berry (1917) reported.

Based upon the examination of 30 new specimens from New Zealand, Benham (1942) gave a comprehensive description of *Robsonella australis*, with detailed measurements and figures.

Of this series in the Otago Museum, nine specimens have been re-examined.

Dell (1952) also described new material of *R. australis* from New Zealand, and in 1959 listed two specimens collected by the "Discovery" off Tasmania during the British, Australian and New Zealand Antarctic Research Expedition (BANZARE) (1929–1931). One specimen, a submature female (SAM D15219), has been re-examined; a second specimen, a male (SAM D15220) collected from fish stomach contents, has been examined but was unsuitable for measurement.

The systematic status of several lots of material described from New Zealand waters cannot be identified with certainty. These include *Octopus campbelli* Smith, 1902 and *Polypus australis* Massy, 1916. These accounts differ from descriptions of both *Octopus australis* from south-eastern Australia, and *O. warringa* from south-eastern Australia and New Zealand. *O. campbelli* Smith, 1902, from Campbell Island, New Zealand, which was subsequently redescribed by Robson (1929), possesses enlarged suckers, an unusual ligula with a long calamus, and 10 gill lamellae. *Polypus australis*, described by Massy (1916) from Spirits Bay, New Zealand, and subsequently redescribed by Robson (1929), possesses a stout ligula, 6–7 gill lamellae, and a characteristic colour pattern of spots and bars on the arms. Definite conclusions regarding the species' identities and affinities await examination of the respective materials.

Specimens of *Octopus warringa* from south-eastern Australia and New Zealand are almost exactly the same; no geographical variation was detected. *O. warringa* is a distinctive species endemic to temperate waters of south-eastern Australia and New Zealand. It can be distinguished easily from other species of *Octopus* on the basis of a combination of characters: a broadly ovoid mantle; skin with a characteristic pattern of rounded tubercles and both branched and unbranched papillae on the dorsum, and enlarged papillae over each eye; large and prominent eyes; long, subequal arms (1.9–3.7 times ML in mature animals); moderately sized suckers, enlarged on all arms of mature males and females; a medium sized ligula (6–10% of third right arm length in mature animals); small eggs (2–3 mm long), arranged in festoons; and 6–8 gill lamellae.

Brough (1965) described the morphology and brooding of eggs, and the hatching and behaviour of juveniles of *Robsonella australis*, here re-identified as *Octopus warringa*. A female specimen in the Portobello Aquarium laid approximately 1000 eggs during January 1963, which she brooded for about 80 days, until hatching occurred (Brough, 1965). *O. warringa* has mature eggs with a small egg length index (7–13% of mantle length), and the newly hatched juveniles are small, with a total length of approximately 4 mm (Brough, 1965; and this study). Based upon the relative sizes of eggs and juveniles, it may be assumed that the juveniles of *O. warringa* adopt a planktonic existence initially. The duration of the planktonic phase is unknown.

Octopus kaurna sp. nov.

Figures 2a–f

Octopus flindersi.—Macpherson, 1966: 241, text-fig. 1, pl. 2, figs 1-3 (*partim*) (non *Octopus flindersi* Cotton, 1932).

Octopus Species B.—Stranks, 1988: 61, text figs 26–30.

Material examined. Holotype: Victoria, Hobsons Bay (37°52′S, 144°56′E), NMV F24494 (mature male, 34.0 mm ML).

Paratypes: Victoria. Port Phillip Bay, Rosebud (38°22′S, 144°54′E), shallows, J.H. Black, 5 Feb 1969, NMV F53228 (mature female, 42.3 mm ML); Port Phillip Bay, Carrum (38°05′S, 145°07′E), beached, Port Phillip Authority, Feb 1981, NMV F52317 (mature female, 51.0 mm ML).

South Australia. Brighton (35°01′S, 138°31′E), Sept 1937, SAM D13283 (immature male, 31.3 mm ML); Glenelg (34°58′S, 138°32′E), A. Robb, 29 Mar 1949, SAM D16195 (mature female, 60.9 mm ML); Great Australian Bight (32°24′S, 133°30′E), 49 m, FRV "Explorer", P. Symonds, 23 Aug 1973, NMV F53226 (mature male, 38.6 mm ML).

Other material: Victoria. Port Phillip Bay, Mordialloc (38°01′S, 145°05′E), W. Kershaw, Nov 1888, NMV F24488 (immature female, 22.7 mm ML); Port Phillip Bay, Mentone (38°00′S, 145°04′E), L. Kershaw, 28 May 1928, NMV F24505 (mature male, 57.2 mm ML).

Description. Medium-sized animals (ML to 85 mm; TL to 420 mm); mantle elongate ovoid (MWI 40.0–*69.9*–106.8); head wide, slightly narrower than mantle (HWI 36.7–*58.1*–88.8), demarked from mantle by minor constriction; eyes small, not projecting far above surface of head. Funnel large, slender, bluntly tapered (FuLI 43.9–*61.4*–88.8); funnel organ VV-shaped, limbs thick, outer limbs three-quarters as long as median limbs. Arms very long (MAI 14.5–*23.1*–33.3) (3.1–6.2 times ML in mature animals), slender, tapering to narrow tips. Arm lengths unequal, arm order I.II.III.IV. Arm suckers biserial, deeply set in arms, small sized

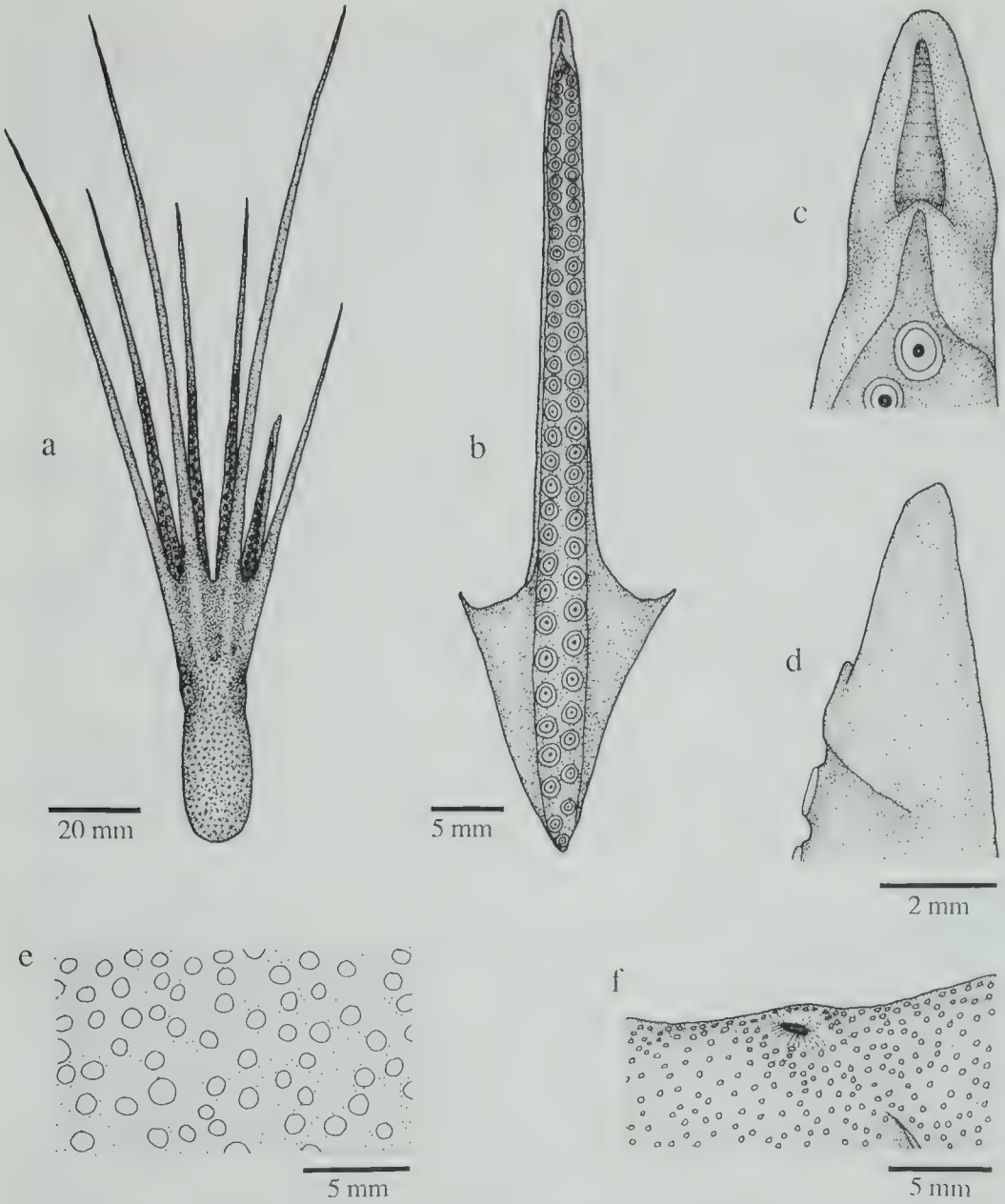

Figure 2. *Octopus kaurna* sp. nov.: a, dorsal view, and b, hectocotylised arm, of holotype, NMV F24494, 34.0 mm ML; c, dorsal, and d, lateral, detail of hectocotylus of NMV F24505, 57.2 mm ML; e, rounded tubercles on mantle dorsum of paratype, NMV F52317, female, 51.0 mm ML; f, lateral view of ocular region of NMV F24488, female, 22.7 mm ML.

(ASIn 3.0–*5.3*–8.7), all suckers similarly sized, without sucker enlargement. Third right arm of males hectocotylised, shorter than its opposite number (OAI 53.5–*61.2*–69.3; HcAI 143.5–*248.9*–325.5); ligula 4–8% of third right arm length in mature animals (LLI 4.7–*6.0*–8.0); ligula groove long, well marked and moderately deep, with incomplete transverse ridges; calamus short, pointed (CaLI 32.7–*41.7*–48.0); hectocotylised arm with 66–129 suckers. Web very

shallow (WDI 10.5–*14.1*–18.7), web formula usually ABCDE. Radula with B_{4-5} seriation of the rhachidian. Ink sac present. Gill lamellae 9–11. Mature female with large eggs (9–11 mm long; 2–3 mm wide); method of egg attachment to substrate unknown. Male with long penis (PLI 17.7–*23.9*–35.5), with a large, single coiled diverticulum; spermatophores relatively short (SpLI 51.7–*82.4*–103.1), slender (SpWI 2.6–*3.6*–5.3), with large, coiled sperm reservoir (SpRI 20.5–*28.7*–39.3).

Integumental sculpture consists of a pattern of fine, rounded and widely set epidermal tubercles; tubercles reach the largest size on the dorsum, and those on the ventral surface are smaller and less prominent; some tubercles on ventro-lateral surface are more elongate, but no more prominent, than those on dorsal and ventral surfaces; no larger papillae in ocular region; lateral integumentary ridge or fold around mantle circumference absent. No information is available on colouring of live animals. Preserved animals in ethyl alcohol uniformly light brown to dark purple dorsally, creamy red to light brown ventrally. Ocelli absent.

Distribution. South-eastern Australia, from the Great Australian Bight to eastern Victoria, including Bass Strait and northern Tasmania. An inshore species, living on sand bottom, and among seagrass, at depths from 0–49 m (Stranks, 1988).

Etymology. The specific epithet *kaurna* is derived from the name of an Australian Aboriginal clan which originally inhabited the Adelaide region of South Australia, and is to be treated as indeclinable.

Remarks. Undescribed medium-sized octopuses, with elongate ovoid mantles and very long arms, from south-eastern Australia, were noted in museum collections. Macpherson (1966) had identified two (NMV F24488 and NMV F24505; an immature female and a mature male respectively) from Port Phillip Bay, Victoria, as *Octopus flindersi* Cotton, 1932. They are now re-identified as a new species, *O. kaurna*.

O. kaurna is a distinctive species endemic to temperate waters of south-eastern Australia. It can be distinguished easily from other species of *Octopus* on the basis of a combination of characters: an elongate ovoid mantle; skin with a characteristic pattern of rounded tubercles on the dorsum, without large papillae over the eyes; small, not prominent eyes; very long, unequal arms (3.1–6.2 times ML in mature animals); small suckers, without enlargement; a small sized ligula (4–8% of third right arm length in mature animals); large eggs (9–11 mm long), with unknown method of attachment to substrate; and 9–11 gill lamellae.

The biology of the species is unknown.

Octopus bunurong sp. nov.

Figures 3a–f

Octopus flindersi.—Macpherson, 1966: 241, text fig. 1, pl. 2, figs 1–3 (*partim*) (non *Octopus flindersi* Cotton, 1932).

Octopus Species C.—Stranks, 1988: 65, text figs 31–35.

Material examined. Holotype: Victoria, Wilsons Promontory, Townsend Point (38°49′S, 140°16′E), beached, National Museum of Victoria, 13 Dec 1977, NMV F53223 (mature male, 55.0 mm ML).

Paratypes: Victoria. Western Port, Crib Point (38°21′S, 145°13′E), University of Melbourne, Department of Zoology, 25 Mar 1974, NMV F57445 (immature male, 37.5 mm ML); Corner Inlet, Yanakie, Red Bluff (38°49′S, 146°13′E), Marine Study Group, 24 Mar 1974, NMV F53221 (mature female, 45.5 mm ML).

South Australia. Marino Rocks (35°03′S, 138°31′E), R. Browne, 28 Jan 1982, SAM D17986 (mature male, 93.2 mm ML); Sir Joseph Banks Group, west of Partney Island, Partney Shoal (34°31′S, 136°15′E), 6 m, W. Zeidler and N. Holmes, 21 Jan 1986, SAM D17983 (mature male, 40.3 mm ML).

Other material: Victoria. Corio Bay, Geelong (38°10′S, 144°21′E), C. Burton, Feb 1903, NMV F5101 (immature male, 25.0 mm ML); Port Phillip Bay, Newport Power House (37°51′S, 144°54′E), H. Morrison, 25 Feb 1947, NMV F1516 (mature male, 49.2 mm ML); Western Port, French Island (38°20′S, 145°21′E), 1974, NMV F53222 (mature male, 37.5 mm ML); Western Port, Corinella (38°25′S, 145°26′E), Marine Study Group, 9 Feb 1969, NMV F53220 (mature male, 39.3 mm ML).

Description. Medium-sized animals (ML to 95 mm; TL to 475 mm); mantle elongate ovoid (MWI 42.3–*59.0*–83.2); head slightly narrower than mantle (HWI 27.7–*49.0*–65.3), demarked from mantle by moderate constriction; eyes large, projecting above surface of head. Funnel large, slender, bluntly tapered (FuLI 46.7–*55.3*–74.7); funnel organ VV-shaped, limbs thick, outer limbs three-quarters as long as median limbs. Arms very long (MAI 14.1–*20.8*–28.2) (4.1–7.3 times ML in mature animals), stout, tapering to narrow tips. Arm lengths unequal, arm order I.II.III.IV. Arm suckers biserial, raised from arm surface, moderately sized (ASIn 3.4–*6.9*–11.9), 15th to 25th suckers usually

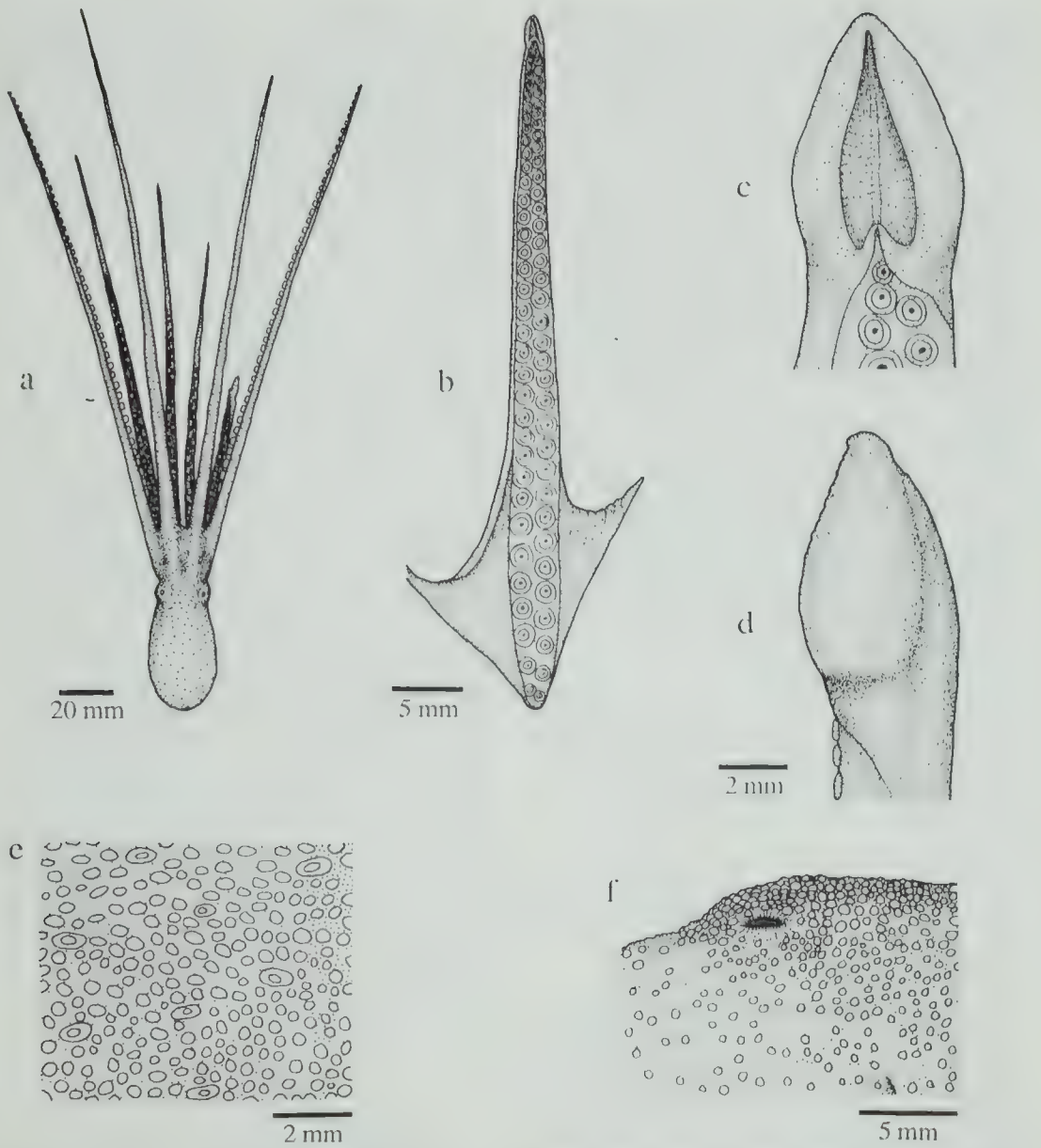

Figure 3. *Octopus bunurong* sp. nov.: a, dorsal view of holotype, NMV F53223, male, 55.0 mm ML; b, hectocotylised arm of NMV F5101, 25.0 mm ML; c, dorsal, and d, lateral, detail of hectocotylus of NMV F53220, 39.3 mm ML; e, rounded and elongate tubercles on mantle dorsum of NMV F53222, male, 37.5 mm ML; f, lateral view of ocular region of NMV F53220, male, 39.3 mm ML.

largest, without sucker enlargement. Third right arm of males hectocotylised, shorter than its opposite number (OAI 45.9–*61.6*–81.8; HcAI 166.9–*208.6*–278.9); ligula 9–12% of third right arm length in mature animals (LLI 9.0–*9.8*–11.8); ligula groove long, well marked and deep, with incomplete transverse ridges; calamus very short, acutely pointed (CaLI 12.8–*17.5*–22.1); hectocotylised arm with 70–96 suckers. Web very shallow (WDI 9.4–*12.4*–14.8), web formula usually ABCDE. Radula with A_{3-4} seriation of the rhachidian. Ink sac present. Gill lamellae

9–10. Mature female with large eggs (8–10 mm long; 2–3 mm wide); method of egg attachment to substrate unknown. Male with long penis (PLI 4.5–*20.7*–39.2), with a single coiled diverticulum; spermatophores relatively short (SpLI 41.2–*65.1*–102.9), slender (SpWI 3.1–*4.4*–5.1), with large, coiled sperm reservoir (SpRI 40.6–*49.7*–55.9).

Integumental sculpture consists of a pattern of fine, rounded and closely set epidermal tubercles; some irregularly spaced tubercles are larger and more elongate than the former type; tubercles reach the largest size on the dorsum, and those on the ventral surface are smaller and less prominent; no larger papillae in ocular region; lateral integumentary ridge or fold around mantle circumference absent. No information is available on colouring of live animals. Preserved specimens in ethyl alcohol light brown to red brown dorsally, creamy red to light brown ventrally. Some regions on the dorsum have a mottled appearance. Surface of the raised tubercles usually darker than the background, coloured brick red to dark brown, giving a speckled appearance. Ocelli absent.

Distribution. South-eastern Australia, from the Great Australian Bight to southern New South Wales, including Bass Strait and northern Tasmania. An inshore species, living on reefs, or rocky areas of sand, and among seagrass, at depths from 1–130 m (Stranks, 1988).

Etymology. The specific name *bunurong* is derived from the name of the Australian Aboriginal clan which once inhabited the south-eastern region of Melbourne, Victoria, and is to be treated as indeclinable.

Remarks. Octopus bunurong is a new species of medium sized octopus with an elongate ovoid mantle and very long arms, from south-eastern Australia. Macpherson (1966) had identified two (NMV F5101 and NMV F1516; a juvenile male and a mature male respectively) from Port Phillip Bay, Victoria, as *O. flindersi*. The specimens are now re-identified as *O. bunurong*.

Octopus bunurong appears closely related to *O. kaurna*, but may be readily distinguished from the latter by the characteristic skin patterning, the larger and more prominent eyes, the larger suckers on all arms, and the longer ligula.

O. bunurong is a distinctive species endemic to temperate waters of south-eastern Australia. It can be distinguished easily from other species of *Octopus* on the basis of a combination of characters: an elongate ovoid mantle; skin with a characteristic pattern of rounded and elongate tubercles on the dorsum, without large papillae over the eyes; large and prominent eyes; very long, unequal arms (4.1–7.3 times ML in mature animals); moderately large suckers, without enlargement; a medium sized ligula (9–12% of third right arm length in mature animals); large eggs (8–10 mm long), with unknown method of attachment to substrate; and 9–10 gill lamellae.

The biology of the species is unknown.

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Memoirs of the Museum of Victoria 50(2): 467–472 (1990) ISSN 0814-1827

THE TERTIARY BRYOZOAN FAMILY PROSTOMARIIDAE – MORPHOLOGY AND RELATIONSHIPS

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Abstract

Gordon, D.P., 1990. The Tertiary bryozoan family Prostomariidae – morphology and relationships. *Memoirs of the Museum of Victoria* 50(2): 467–472.

The relationships of the Tertiary Victorian bryozoan genus *Prostomaria* and family Prostomariidae are considered based on SEM examination of well-preserved material. It is concluded that the family is monotypic, the sole included species being *Prostomaria gibbericollis*. Recent species attributed to *Prostomaria* are not related and a new genus and family of Schizoporelloidea (*Mawatarius*, Mawatariidae) are established for a New Zealand species previously attributed to *Prostomaria*. The most likely affinities of the Prostomariidae are with the recent family Urceoliporidae and a new superfamily, Urceoliporoidea, is erected to accommodate these two families.

Introduction

The monotypic bryozoan genus *Prostomaria* and family Prostomariidae were established simultaneously by MacGillivray (1895) on the basis of fossil specimens from Victoria. The possible affinities of the genus are intriguing, but the refining of taxonomic relationships has been hampered by a lack, in *Prostomaria*, of such helpful characters as avicularia and ovicells. These have never been seen in the many specimens available for examination (P.E. Bock, pers. comm). Until recently, the family has remained monotypic and is still poorly understood.

Examination of internal and external skeletal structures by scanning electron microscopy of both well-preserved *Prostomaria gibbericollis* and other possibly related genera has provided a better basis for a statement on the taxonomic affinities of the Prostomariidae. The purpose of this paper is to redescribe *Prostomaria gibbericollis*, comment on its likely relationships with other genera, and introduce new supraspecific taxa based on these relationships.

Prostomaria MacGillivray

Prostomaria MacGillivray, 1895: 105.

Type species. Prostomaria gibbericollis MacGillivray.

Prostomaria gibbericollis MacGillivray

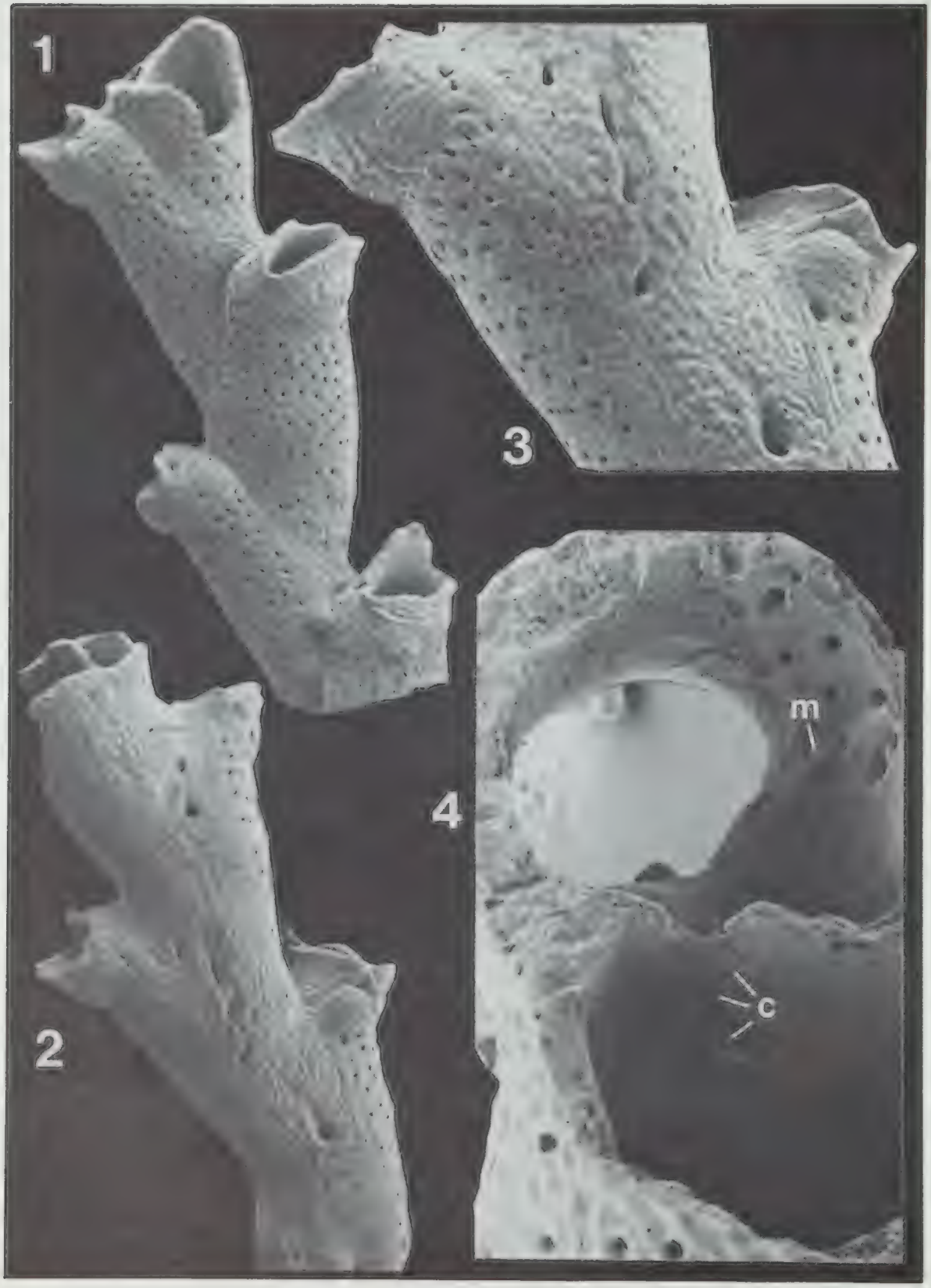
Prostomaria gibbericollis MacGillivray, 1895: 105, pl. 3, fig. 28.

Material examined. Several colony fragments, from "Schnapper Point, Fossil Beach", Victoria, Balcombian (Lower Miocene), sent courtesy of P.E. Bock, Museum of Victoria, N.Z. Oceanographic Institute No. Z6720.

Distribution. Balcombian (Lower Miocene), Victoria, Australia. Schnapper Point is the type locality of the Balcombian (Brown, 1958: 30).

Description. Colony erect, probably of articulated segments since there is no evidence of bifurcation, each segment attaining at least 6–7 mm in length and comprising up to about 8 zooids. Zooids about 1.32–1.60 × 0.53–0.64 mm, back to back and alternating, but facing more towards one side (Figs 1, 2). Frontal wall granular-tubercular, and regularly and evenly perforated with numerous small pores, except for an abfrontal area which is marked off by a line in the calcification; roughly down the middle of the abfrontal face are larger, scattered, areolar pores (Figs 2, 3). Primary orifice (Fig. 4) sunken, transversely elliptical, lacking a sinus or condyles, surrounded by a high, transversely set peristome of which both the proximal and distal rims project from the branch. Avicularia and ovicells absent.

Discussion. When MacGillivray (1895) established the monotypic genus *Prostomaria*, he underscored its uniqueness by placing it in its own family, Prostomariidae, commenting "its nearest allies [are] the Tubucellariidae". Harmer (1957) compared *Prostomaria gibbericollis* to a new species that he was describing – *Lagenipora cylindrica* (Lageniporidae) [sic]. Gordon (1985), commenting on MacGillivray's opinion, compared *Prostomaria* (not having seen specimens,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however) with *Margaretta* Gray (formerly *Tubucellaria* d'Orbigny) and *Porina* d'Orbigny (Porinidae). Thus three separate families have been suggested as being related to *Prostomaria*.

Each of these supposed relationships can be ruled out. *Margaretta* (a jointed genus of Margarettidae) has an erect colony and a primary orifice similar to that of *Prostomaria*. It differs substantially in having internodes with as many as ten longitudinal series of zooids (depending on the species), an ascopore, and peristomial brood chambers; internodes lack frontal and abfrontal surfaces.

Harmer's (1957) *Lagenipora cylindrica* is not a *Lagenipora* Hincks (Celleporidae) but appears rather to belong to *Lagenicella* Cheetham and Sandberg, 1964 (Teuchoporidae). It has little in common with *Prostomaria*, being entirely encrusting and possessing ovicells.

Similarly, the Porinidae are quite unrelated, with: bilamellar branches (in the type species of *Porina*), or cylindrical branches (in *Haswellina* Livingstone) in which zooids open on both (or all) sides, a peristomial spiramen (superficially resembling an ascopore), and peristomial ovicells.

A recent study by Gordon (1988) of the families Bifaxariidae and Urceoliporidae suggests additional, more likely, candidates for close relationship with *Prostomaria*, especially the genera *Aberrodomus* Gordon and *Urceolipora* MacGillivray. *Aberrodomus* looks, superficially, quite like *Prostomaria*. In both genera the zooids alternate back to back, are regularly and evenly perforated, and have similar orifices and peristomes. There are significant differences, however. *Aberrodomus* is non-articulated (assuming *Prostomaria* was articulated in life) and produces lateral branches. The species of *Aberrodomus* also produce avicularia and ovicells. Importantly, the well-preserved specimens of *P. gibbericollis* that I have examined clearly lack the separate internal zooidal chamber seen in *Aberrodomus candidus* Gordon for example.

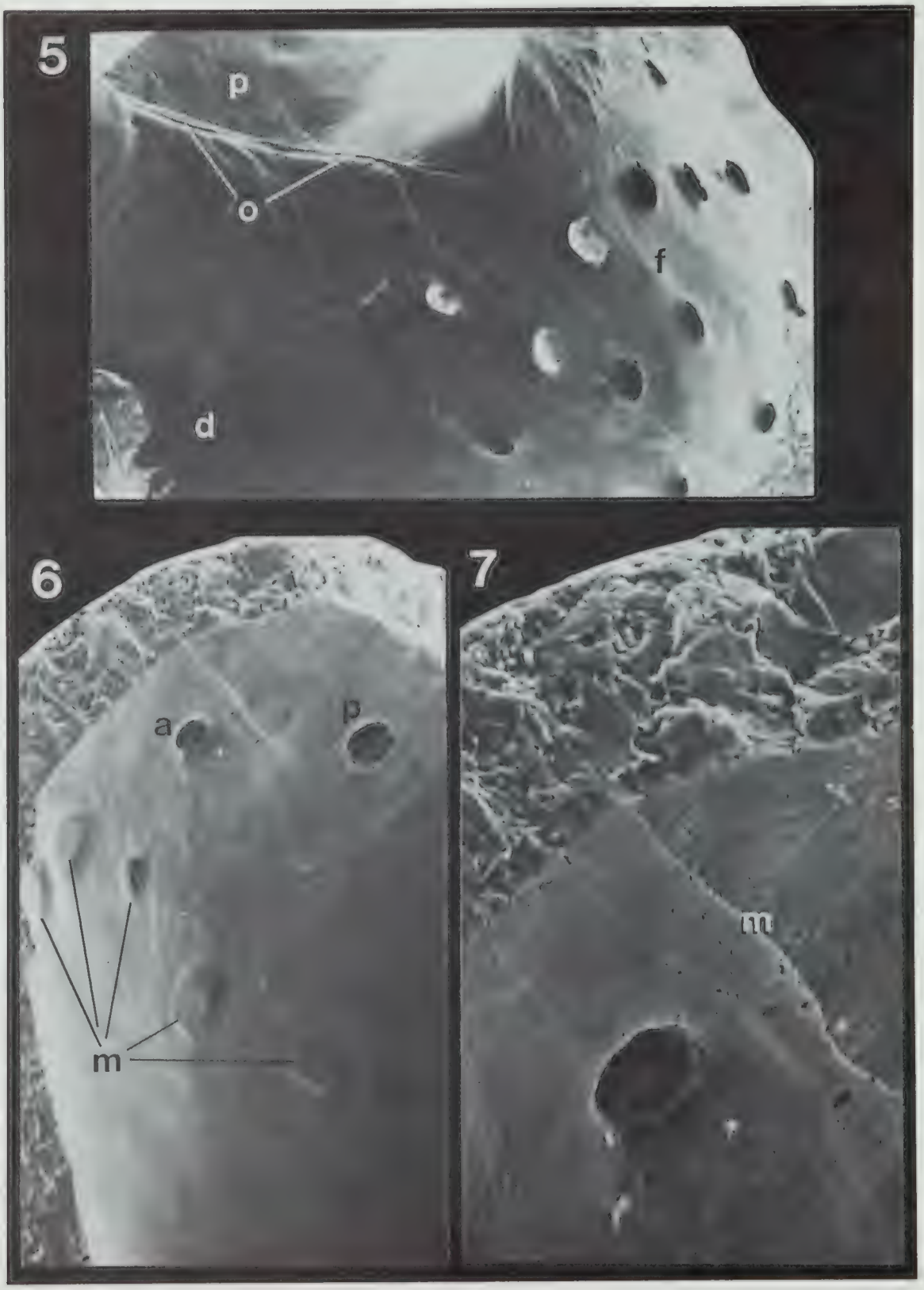
I believe the relationships of *Prostomaria* and the Prostomariidae are with the Urceoliporidae. The Urceoliporidae (comprising *Urceolipora* and *Reciprocus* Gordon) have the following important features in common with *Prostomaria* – biserial segments of back-to-back zooids which incline to one side so that each segment has an oral face and an aboral face; no oral spines or avicularia, and no internal ultrastructure (e.g., planar spherulitic) (Figs 5–7) indicating an umbonuloid frontal wall (see Gordon, 1988). *Urceolipora*, particularly, is reminiscent of *Prostomaria* because its two species (*U. nana* MacGillivray and *U. lucida* Busk) have a longitudinal ridge on one side of the frontal wall dividing the cryptocyst into two fields – a large one which includes most of the frontal wall and a lateral one which includes some of the areolar pores by which the zooidal body cavity communicates with the outer hypostegal coelom. This is exactly the case in *Prostomaria* (except that a line replaces the ridge), which argues for a close relationship between the two genera.

I conclude that the Prostomariidae and Urceoliporidae are related, but separate, families. *Prostomaria* has a frontal wall which is evenly perforated all over (except in the lateral field) whereas the pseudopores of *Urceolipora* (lacking in *Reciprocus*) are confined to a cluster adjacent to the orifice (see Gordon, 1988, figs 76, 77). Further, the orifice of *Prostomaria* lacks a sinus, there is a peristome, and ovicells have not been seen. [Ovicells are lacking in *Reciprocus* also but there are recognisable fertile orifices.]

I have earlier suggested (Gordon, 1988) that the Urceoliporidae might be accommodated in the cryptocystidean superfamily Schizoporelloidea, although "somewhat on the fringe". With the association of the Prostomariidae with the Urceoliporidae it now seems appropriate to unite these two families into a new superfamily Urceoliporoidea. The outstanding and distinctive features of this superfamily are summarised below in a formal diagnosis.

Prostomaria and the Prostomariidae are presently strictly monotypic and known only from the Tertiary of Victoria. Two Recent species have been described but it is now clear that they are unrelated to *Prostomaria*. D'Hondt and Schopf (1984) described *Prostomaria cyclostomata* from about 4800 m depth north-west of Bermuda. Like *Prostomaria gibbericollis*, it is erect and biserial with zooids alternating back to back. However the frontal wall is imperforate

Figures 1–4. *Prostomaria gibbericollis*, Schnapper Point, Victoria. Figs 1 and 2, frontal and abfrontal sides, respectively, of parts of branch segments (× 40). Fig. 3, part of fig. 2 enlarged, showing a series of areolar pores in the imperforate field of zooidal walls on the abfrontal side of a branch segment (× 72). Fig. 4, internal view of parts of two zooids showing a primary orifice, connections between adjacent dorsal walls (c), and a line marking the attachment of the ascus membrane (m) in life (× 175).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(apart from the marginal areolae), and there is no division of the cryptocyst into fields nor are there frontal or abfrontal faces. Ovicells were not seen but d'Hondt and Schopf reported a "scar" on the proximal border of the zooidal orifice indicating a possible suboral avicularium. D'Hondt and Schopf's (1984) *P. cyclostomata* certainly represents a new genus, possibly a new family, and, judging from the external morphology, the possibility exists that it could be umbonuloid. The ultrastructure of the inner surface of the frontal wall needs to be examined.

A second Recent species, *Prostomaria inexpectabilis*, was described by Gordon (1985) from about 1170 m on pumice gravel north of Raoul Island, Kermadec Ridge. It resembles *Prostomaria* in being erect, with perforated walls and sunken orifices, but differs significantly in being uniserial, with a somewhat sinusoid orifice and peristomial ovicells. The colony is also non-segmented and branching. The affinities of this species are obscure. It is reminiscent of *Vix* (Vicidae) (Gordon, 1988) but that genus is quadriserial, has avicularia, and is non-ovicellate. *Prostomaria inexpectabilis* clearly represents a new, presently monotypic, genus. I name this genus *Mawatarius* in recognition of the contribution, over many decades, of Dr Shizuo Mawatari to knowledge of the Bryozoa. A new family of Schizoporelloidea, Mawatariidae, is established to accommodate it. [The species name, *inexpectabilis*, was coined as a hybrid, connoting "unexpected and spectacular".]

Ureoliporoidea Bassler, 1936 n. superfam.

Diagnosis. Colony erect, biserial, segmented, basally rooted. Zooids cryptocystidean, arranged back to back, each connecting with three others dorsally; orientated such that segments tend to have an oral face and an aboral face. Orifice variable, with or without a sinus. Frontal wall with scattered pseudopores or these limited in distribution or lacking. No oral spines. No avicularia. Ovicells present or lacking.

Included families. Urceoliporidae Bassler, 1936; Prostomariidae MacGillivray, 1895.

Urceoliporidae Bassler, 1936

Diagnosis. Zooids frontally imperforate or with only a cluster of pores near the orifice; orifice with a shallow or distinct sinus and oral processes; no peristome. Ovicells prominent and recumbent, or absent and zooids with dimorphic orifices.

Included genera. Urceolipora MacGillivray, 1881; *Reciprocus* Gordon, 1988.

Prostomariidae MacGillivray, 1895

Diagnosis. Zooids with an evenly perforated frontal wall; orifice lacking a sinus; peristome well developed. Ovicells lacking, orifices monomorphic.

Included genus. Prostomaria MacGillivray, 1895

Schizoporelloidea Jullien, 1883

Diagnosis. See Gordon (1984).

Mawatariidae n. fam.

Diagnosis. Colony erect, uniserial, branching, non-segmented, the zooids facing mainly on one aspect. Frontal wall cryptocystidean, with scattered pores. Primary orifice sunken, with shallow sinus; secondary (peristomial) orifice with pseudosinus. No oral spines. No avicularia. Ovicell peristomial. Ancestrula resembling later zooids, anchored by a chitinous portion.

Included genus. Mawatarius n. gen.

Mawatarius n. gen.

Type species. Prostomaria inexpectabilis Gordon, 1985.

Diagnosis. With characters of the family.

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Figures 5–7. *Prostomaria gibbericollis*, Schnapper Point, Victoria. Fig. 5, enlargement of part of fig. 4, showing an interior view of parts of the peristome (p), distal rim of primary orifice (o), frontal wall (f) and dorsal wall (d) (× 374). Fig. 6, interior of zooidal wall, showing a pseudopore (p), areolar pore (a), and attachment scars of parietal muscles (m) (× 380). Fig. 7, enlargement of part of fig. 6, showing the areolar pore, and the attachment scar of the ascus membrane (m) with no difference in skeletal ultrastructure either side (× 902).

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