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- KOHN, A. J. 1960a. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Annals and Magazine of Natural History* (13) **2** (17): 309-320.
- KOHN, A. J. 1960b. Spawning behaviour, egg masses and larval development in *Conus* from the Indian Ocean. *Bulletin of the Bingham Oceanographic Collection, Yale University* **17** (4): 1-51.
- THIELE, J. 1910. Mollusca. B. Polyplacophora, Gastropoda marina, Bivalvia. In: SCHULTZE, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika ausgeführt in den Jahren 1903-1905* **4** (15). *Denkschriften der medizinisch-naturwissenschaftlichen Gesellschaft zu Jena* **16**: 269-270.

(continued inside back cover)

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REVISION OF THE FAMILY PARAMELITIDAE  
(CRUSTACEA, AMPHIPODA)  
FROM SOUTH AFRICAN FRESH WATERS

By

BARBARA A. STEWART  
&  
CHARLES L. GRIFFITHS

Cape Town

Kaapstad

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FROM SOUTH AFRICAN FRESH WATERS

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(With 29 figures and 2 tables)

[MS accepted 6 February 1995]

ABSTRACT

Twenty-five species of freshwater amphipod, including one new species, are recognized within the family Paramelitidae. These are allocated to three genera, *Paramelita*, *Aquadulcaris* gen. nov. and *Mathamelita* gen. nov. Each genus and species is diagnosed and all species are illustrated. Distribution records are updated, and new keys for the identification of the species are provided. Morphological similarities between the species are discussed.

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INTRODUCTION

South African freshwater amphipods first received attention from Barnard (1916) who described four species from Table Mountain, Cape Peninsula, placing them in the genus *Gammarus*. Schellenberg (1926) erected the genus *Paramelita* to accommodate the new species *P. ctenodactyla*, collected from the Cape Peninsula, but a year later, Barnard (1927) listed this species as a synonym for '*G. capensis*'. Thus, although it is clear that Barnard (1927) had seen Schellenberg's (1926) paper, he did not recognize, nor discuss, the validity of Schellenberg's proposed new genus *Paramelita*. Instead, he extended the known ranges of two of his existing '*Gammarus*' species and added six further new species and one variety. Schellenberg (1937) again argued that South African freshwater species assigned to *Gammarus* were sufficiently different from those

of the Palaearctic and Nearctic regions to warrant separate generic status under the name *Paramelita*. Thus, when Thurston (1973) described a new cave-dwelling amphipod from the Cape Peninsula, he placed it in this genus, recognizing the transfer of South African freshwater '*Gammarus*' species to *Paramelita*. A further new species of *Paramelita* was added to the fauna by Griffiths (1981), bringing the total to 12 species and one variety.

Present collections by the authors in 1989 and 1990 have doubled this number of species. Four of the most distinctive species were described by Stewart & Griffiths (1992a) and, after further morphological and isozyme analysis, eight other new taxa were added by Stewart (1992), Stewart & Griffiths (1992b, 1992c) and Stewart *et al.* (1994). Thus, since Griffiths (1981) last revised the genus, 12 new species have been added, bringing the total to 24.

Despite the fact that a number of species of *Paramelita* did not fit his original generic diagnosis, Schellenberg (1937) did not extend this; neither did Griffiths (1981) comment on or rediagnose the genus in his revision. Barnard & Barnard (1983) provided a rediagnosis of the genus in their study of freshwater amphipods of the world, but this contains some inaccuracies and also does not adequately accommodate all of the species described to date. Thus, a relatively large assemblage of morphologically variable paramelitid species from the south-western regions of South Africa is currently assigned to the single, poorly diagnosed genus. Phylogenetic relationships between these species are unknown.

The closest relatives to the South African genus *Paramelita* are 21 species of Australian crangonyctoids, which are placed in seven genera in the family Paramelitidae, all rediagnosed or described in a recent detailed account of the Australian crangonyctoids by Williams & Barnard (1988). Although a cladistic analysis of the family Paramelitidae has yet to be undertaken, Williams & Barnard (1988) did comment on relationships between the genera in their revision of the Australian crangonyctoid amphipods. Thus, they regarded *Austrogammarus* as the most primitive of Australian paramelitids, *Antipodeus* as being 'much closer to *Austrocrangonyx* than to *Austrogammarus*' (p. 54), *Hurleya* as having 'more affinities with paramelitid genera than with neoni-phargid and perthiid genera' (p. 86), and *Uroctena* as having 'strong affinities with *Paramelita*' (p. 91).

The only other freshwater gammarid amphipods from the south-western Cape are five species assigned to the genus *Sternophysinx* (Holsinger 1992). There is some dispute as to how closely related *Sternophysinx* is to *Paramelita*. Bousfield (1983) placed this genus in the Paramelitidae, but Williams & Barnard (1988) did not recognize its inclusion in the family in their revision of Australian crangonyctoids. Holsinger (1992) also concluded that sternophysingids are sufficiently different from the other paramelitids to warrant recognition as a separate family, the Sternophysingidae.

The aim of this paper is to provide a revision of the taxonomic status of southern African species falling within the family Paramelitidae. Relationships between the South African paramelitid species are investigated by means of a cladistic analysis of morphological data. The polarity of the characters used was determined by outgroup comparison (Watrous & Wheeler 1981), and the computer program HENNIG86 (Farris 1988) used to generate most parsimonious

trees. The genus *Paramelita* is redefined and new genera are created to accommodate species falling outside this definition. Keys are provided to adult males, and all species, some of which have not been adequately depicted in earlier papers, are illustrated. Full distribution records are provided for all forms, many of which extend the ranges previously recorded. Finally, the opportunity is taken to describe a newly discovered and remarkable new species, which is allocated separate generic status under the name *Mathamelita* gen. nov.

## MATERIALS AND METHODS

This analysis is based both on an extensive series of samples gathered by the authors between 1989 and 1993 and deposited in the South African Museum (SAM), and on existing collections of the South African Museum. Specimens of both sexes were examined from all populations collected to assess the level of morphological variability. When necessary, specimens were partially dissected to facilitate measurement and illustration of the limbs. Drawings were made with the aid of a camera lucida attached either to Wild dissecting or compound microscopes.

A total of 24 characters, referring to the external morphology of the amphipods, could be successfully polarized. Quantitative characters were gap-coded by plotting histograms of all quantitative characters, and coding the character states according to 'identifiable' gaps (Conlan 1988; Notenboom 1988). Homologous characters were recognized by similarity in positions and connection with other body parts. Character states were polarized using outgroup comparison, where character state distributions in other paramelitid genera were determined largely by a survey of the literature (e.g. Williams & Barnard 1988). In the case of quantitative characters not supplied in the descriptions, these were scored from illustrations (see also Conlan 1988). Unknown polarities were coded in the data matrix with a question mark. Unique character states found only in one species were considered to be autapomorphies, and were excluded from the numerical analysis.

The data matrix was analysed by means of the HENNIG86 package (Farris 1988). Most parsimonious trees, which minimize the number of changes in character states needed to explain the pattern of character state distribution among the taxa, were derived from the character state matrix by means of the 'mh\*' and 'bb' commands. Although the 'ie\*' command is certain to find all trees of minimal length, this command proved to be prohibitively time-consuming for the analysis of *Paramelita*. The 'mh\*' command was therefore selected as the next-best choice, as recommended by Farris (1988) in the documentation accompanying the program. A consensus tree was constructed by means of the 'nelsen' command.

Morphological similarity between species was also investigated phenetically by calculating a matrix of Simple Matching Coefficients based on 29 variables. A cluster analysis based on this matrix was performed by means of the UPGMA algorithm. This analysis was performed with the aid of the NTSYS-pc computer program (Rohlf 1989).

## CLADISTIC ANALYSIS

*Selection of outgroups*

It is commonly held (e.g. Ridley 1986) that the most suitable outgroup to choose is that of a closely related species or genus. Obvious candidates would therefore be other genera within the Paramelitidae. Unfortunately, the choice of suitable outgroups is complicated by the fact that the composition of Paramelitidae is still under question (e.g. Bousfield 1983; Williams & Barnard 1988). Notenboom (1988: 160) encountered a similar situation in his study of the phylogeny of *Pseudoniphargus*, and commented that 'An important obstacle in phylogenetic studies of amphipods at lower taxonomic levels is the highly debated classification into families and superfamilies'. For the phylogenetic analysis of *Paramelita*, *Austrogammarus* and *Austrocrangonyx* were chosen as outgroups. Like *Paramelita*, these two genera possess sternal gills, a coxal gill on pereopod 7, a short second segment on the outer ramus of uropod 3 and a cleft telson. Williams & Barnard (1988) regard *Austrogammarus* as the most plesiomorphic genus of Australian paramelitids. Although these authors have suggested that *Uroctena* has strong affinities with *Paramelita*, a *Uroctena* type ancestor for *Paramelita* would have involved losing and regaining the coxal gill on pereopod 7, which is a plesiomorphic crangonyctoid 'marker'. Similarly, *Hurleya*, *Protocrangonyx* or *Giniphargus* type ancestors would also involve the loss and regaining of a coxal gill on pereopod 7, and an *Antipodeus* type ancestor, the loss and regaining of sternal gills. Thus, it seems more probable that *Austrogammarus* and *Austrocrangonyx* are closest to the hypothetical ancestor of *Paramelita*.

*Selection and polarity of characters*

The characters that differentiated species of *Paramelita* and that were used in the numerical analysis are listed in Table 1, and the distributions of character states over the species are given in Table 2. Characters were either 'qualitative', such as presence or absence or differences in shape, 'quantitative' and 'discontinuous', such as counts of spinules, or 'quantitative' and 'continuous', such as the relative lengths of limbs. As in Notenboom's (1988) and Conlan's (1988) cladistic studies on amphipods, ratios and counts were included in the present analysis, despite reservations by some authors (e.g. Pimental & Riggins 1987) about quantitative data. These characters avoided the use of subjective character state definitions, and were needed because of the shortage of usable characters. Care was taken to identify clear gaps when coding these data.

The structure of antenna 2 in adult males showed interesting differences between the paramelitid species. In eight species, the 'pediformity' alluded to by Williams & Barnard (1988) in the Australian genus *Uroctena*, was clearly evident, with articles 3, and particularly 4, strongly swollen in adult males (e.g. Figs 3C, 8C). Based on outgroup analysis, this condition was considered apomorphic in southern African paramelitid species. The presence of teeth (Figs 6C, 20C, 26C), lobes (Figs 3C, 4C, 8C, 14C) and ridges (Fig. 23C) on antenna 2 in eight *Paramelita* species was also apomorphic, as was the elongation of the peduncle of this antenna in six *Paramelita* species (Figs 17C, 18C, 20C, 23C, 24C, 28C).



TABLE 1

Descriptions of the 24 characters used for cladistic analysis of paramelitid species from South Africa. Characters apply to adult males, and have been polarized using *Austrogammarus* and *Austrocrangonyx* as outgroups.

No.	Character	States
<i>Antenna 1</i>		
0	Ratio of lengths of antenna 1 : antenna 2	(0) > 1.2; (1) 0.7-1.0
1	Ratio of length : width of article 1	(0) 1.8-2.3; (1) 2.6-4.3
<i>Antenna 2</i>		
2	Number of articles in flagellum	(0) 12-30+; (1) < 12
3	Ratio of length : width of article 3	(0) 0.7-0.9; (1) 1.1-1.9
4	Lobe on article 3	(0) absent; (1) present
5	Shape of article 4	(0) normal; (1) elongate and stout; (2) strongly laterally swollen
<i>Gnathopod 1</i>		
6	Medial spines on article 2	(0) absent; (1) present
<i>Gnathopod 2</i>		
7	Angle of palm	(0) transverse to slightly oblique; (1) moderately to strongly oblique
8	Medial spines on article 2	(0) absent; (1) present
<i>Pereopod 3</i>		
9	Medial spines on article 2	(0) absent; (1) present
10	Width of article 4	(0) normal; (1) widening distally
11	Projection on article 4	(0) absent; (1) present
12	Tooth-like spines on article 5	(0) absent; (1) present
13	Shape of article 6	(0) normal; (1) arched
14	Spinules on dactyl of article 7	(0) 1; (1) 2-6; (2) 7-8
<i>Pereopod 4</i>		
15	Posterior margin of coxa 4	(0) distinctly excavate; (1) slightly emarginate
16	Spinules on dactyl of article 7	(0) 1; (1) 2-6
<i>Pereopods 5-7</i>		
17	Spinules on dactyl of article 7	(0) 1; (1) 2-10; (2) > 10
<i>Uropod 1</i>		
18	Setation of outer ramus	(0) absent; (1) present
<i>Uropod 2</i>		
19	Setation of inner ramus	(0) absent; (1) present
20	Setation of outer ramus	(0) absent; (1) present
<i>Uropod 3</i>		
21	Ratio of length of inner : outer ramus	(0) 0.6-0.7; (1) 0.1-0.4; (2) 1.0
22	Article 2 on outer ramus	(0) 7-20% of article 1; (1) < 7%; (2) rudimentary or absent
<i>Telson</i>		
23	Spination	(0) 0-1 spines per lobe; (1) > 1 per lobe

TABLE 2  
Distribution of character states in paramelitid species from South Africa. (See Table 1 for description of characters and character states.)

Taxa	Characters																									
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
<i>Austrogammarus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<i>Austrocrangonyx</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<i>Paramelita andronyx</i>	0	1	0	1	2	1	0	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	2	0	
<i>Paramelita aurantia</i>	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	1	2	0		
<i>Paramelita auricularia</i>	0	1	1	1	2	0	0	0	1	0	1	0	1	1	0	1	0	0	0	0	0	1	2	0		
<i>Paramelita barnardi</i>	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1		
<i>Paramelita capensis</i>	0	1	0	1	0	0	1	1	1	0	0	0	0	0	1	0	1	2	1	1	1	1	1	0		
<i>Paramelita crassicornis</i>	0	1	1	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	2	0		
<i>Paramelita dentata</i>	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	0		
<i>Paramelita flexa</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0		
<i>Paramelita granulicornis</i>	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	0	0	0	1	2	0		
<i>Paramelita kogelensis</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0		
<i>Paramelita magna</i>	1	1	0	1	0	1	1	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1		
<i>Paramelita magnicornis</i>	1	1	0	1	0	1	1	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	1		
<i>Paramelita marunguis</i>	0	1	0	1	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	2	0		
<i>Paramelita nigroculus</i>	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0		
<i>Paramelita odontophora</i>	1	1	0	1	0	1	0	0	1	0	0	0	0	0	0	2	0	1	2	0	1	0	1	0		
<i>Paramelita parva</i>	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1		
<i>Paramelita pheronyx</i>	0	1	1	0	1	2	1	0	1	1	1	1	0	0	0	1	0	0	1	0	1	0	1	2	0	
<i>Paramelita pillicornis</i>	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	0		
<i>Paramelita pinnicornis</i>	1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	2	0	1	2	0	1	1	1	0		
<i>Paramelita platypus</i>	1	1	0	1	0	1	?	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	0		
<i>Paramelita seticornis</i>	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	1	1	0		
<i>Paramelita spinicornis</i>	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0		
<i>Paramelita tubaghensis</i>	0	1	1	1	0	2	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	2	0
<i>Paramelita validicornis</i>	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	1	

Gnathopod 2 differed amongst *Paramelita* species in terms of spination of article 2 and the nature of the palm in article 6. Like *Austrogammarus* and *Austrocrangonyx*, 15 species of *Paramelita* had transverse to slightly oblique palms (e.g. Fig. 4D), whereas nine *Paramelita* species had moderately to strongly oblique palms (e.g. Fig. 12D). The presence of spines on article 2 of gnathopod 2 was common amongst South African paramelitids, with 11 *Paramelita* species sharing this condition (e.g. Fig. 8D). A survey of the literature (e.g. Williams & Barnard 1988) revealed that none of the six *Austrogammarus* or two *Austrocrangonyx* species have spines of this type. Their presence was thus considered as apomorphic in *Paramelita*.

None of the eight species examined in the two Australian genera possessed a claw-like pereopod 3 of the type found in adult males of five *Paramelita* species (Figs 3E, 4E, 7E, 8E, 23E). Closer examination of this condition revealed that the 'claw' is achieved in several different ways through various modifications of either articles 4 or 5, and 6. This condition has obviously arisen in some of these species as a result of convergent evolution, so that the possession of a claw-like pereopod 3 is not necessarily evidence of close affinity between them.

Coxa 4 varies from being quadrate (e.g. Fig. 24F) to having its posterior margin strongly excavate (e.g. Fig. 13F) in *Paramelita* species. In *Austrogammarus* and *Austrocrangonyx*, this coxal plate is excavate. When Barnard (1916, 1927) first described *Paramelita* species, he was unable to decide which condition was plesiomorphic. However, outgroup analysis suggests that a strongly excavate coxa 4 is plesiomorphic in *Paramelita*.

Eighteen *Paramelita* species were characterized by a multispinose dactyl in pereopods 3–7 (e.g. Fig. 16F) and, in at least two species, as many as 14 spinules were counted on the dactyl of pereopod 6! This multispinose condition is apomorphic, as all *Austrogammarus* and *Austrocrangonyx* species have at most one spinule on the margin of the dactyl of each pereopod.

Uropods 1 and 2 differed mainly in the degree of setation of the rami. In *Austrogammarus* and *Austrocrangonyx*, the outer rami of these uropods are never setose, but in six *Paramelita* species, setae were present on one or both of these rami (e.g. Fig. 17H–I). It is likely, however, that this setose condition has evolved more than once, so that the sharing of this condition could represent an example of convergent evolution.

The relative length of the inner ramus of uropod 3 differed markedly between the outgroups. In *Austrogammarus*, this appendage is usually about 60–70 per cent of the length of the outer ramus, but in *Austrocrangonyx*, the inner ramus is only about 10 per cent the length of the outer ramus. This figure varied from 10–40 per cent in *Paramelita*. Ten of the *Paramelita* species were characterized by the virtual absence of a second segment on the outer ramus of uropod 3 (e.g. Figs 3I, 4J), whereas the remaining species had a small, but distinct, article 2 on the outer ramus of uropod 3 (e.g. Fig. 13J).

On the whole, relatively few characters could be polarized, and thus only these were usable. Many characters, such as eye colour, setation of the antennae and limbs, and the relative lengths of the peduncle and flagellum in the antennae, had variable character states within the outgroups. Notenboom (1988) also complained of a shortage of usable characters in his study of the amphipod

genus *Pseudoniphargus*, and pointed out that this was a general problem when working at a low taxonomic level.

### *Phylogeny of Paramelita*

In the initial analysis, use of the 'mh\*' and 'bb' commands resulted in 116 most parsimonious trees with consistency indices of 0.40. A consensus tree was constructed using the 'nelsen' command (Fig. 1). Six of the species formed a monophyletic group (group A) defined by the possession of a strongly laterally swollen article 4 in antenna 2. Relationships within this group of six species were fully resolved. The monophyletic subgroup comprising *P. pheronyx*, *P. andronyx* and *P. auricularia* was defined by two synapomorphies—the possession of a posterior lobe on article 3 of antenna 2, and a characteristic distal widening of article 4 of pereopod 3. Two of these species are known from adjacent streams, but *P. andronyx* is known only from an isolated mountain massif over 75 km north of the *P. auricularia* and *P. pheronyx* localities. This clade, thus, has a rather disjunct distribution.

The remaining species in group A—*P. crassicornis*, *P. dentata* and *P. marginus*—have been found in streams on the Cape Peninsula that are at most 15 km apart. The geographical distribution of these species, therefore, supports the proposed existence of this clade.

It is proposed that species falling into group A be recognized as belonging to a new, monophyletic genus, *Aquadulcaris* gen. nov., the description of which follows in the systematic section. Species in this proposed genus do not fit the original diagnosis of the genus *Paramelita* Schellenberg, 1926. Schellenberg (1926: 367) described dactyls with a row of spinules, and also alluded to the second segment on the outer ramus of uropod 3 as being well formed in species of *Paramelita*. All of the six species falling in group A usually have only a single spinule on the dactyl of pereopods 3–7, and the second segment on the outer ramus of uropod 3 is rudimentary or absent.

The only other species that have article 4 of antenna 2 markedly laterally swollen are *P. tulbaghensis* and *P. spinicornis*. The former species is in fact very similar to the group A species, and shares features such as a moderately emarginate (rather than distinctly excavate) coxa 4 and the absence of an outer segment on the outer ramus of uropod 3. It differs, however, in the possession of more than one spinule (2–4) on the dactyl of each pereopod. Preliminary analysis of electrophoretic data (Stewart in prep.) also suggests the inclusion of *P. tulbaghensis* in *Aquadulcaris* gen. nov. However, *P. tulbaghensis* has been left in the genus *Paramelita* in this review, pending further investigations regarding the phylogenetic relationships of this species.

The 'pediformity' of antenna 2 in *P. spinicornis* is more likely to represent an example of convergent evolution. This species has an excavate rather than poorly emarginate coxa 4, 3–4 spinules on the dactyl of pereopods 3–4 and 5–8 spinules on pereopods 5–7, and a distinct but small second article on the outer ramus of uropod 3. It is, therefore, more likely that lateral swelling of article 4 of the peduncle of antenna 2 has occurred more than once in different lineages, and does not suggest that *P. spinicornis* and the species of *Aquadulcaris* are related.

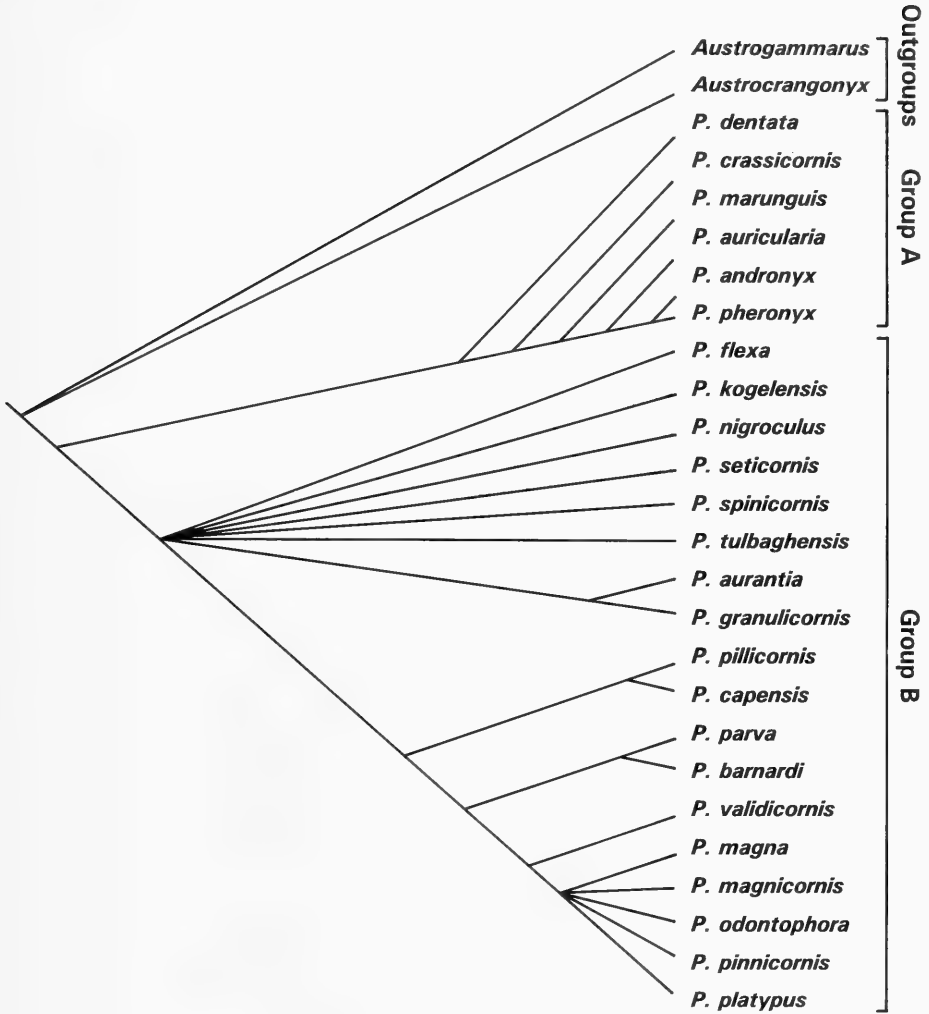


Fig. 1. Cladistic analysis of southern African paramelitids.

*Aquadulcaris* gen. nov. is almost certainly most closely allied to the Australian genus *Uroctena*, which also includes members with 'pediform' second antennae and poorly emarginate fourth coxal plates (Williams & Barnard 1988).

The unresolved nature of group B can be attributed to a combination of the relative shortage of 'good' apomorphies and the possibility that the genus, as currently composed, is not monophyletic. For example, it is possible that 'weak' synapomorphies are shared due to parallel evolution rather than due to common descent. A good example of this is the possession of medial spines on article 2 of pereopod 3, a condition shared by *Paramelita granulicornis* and *P. capensis*. Myers (1988) also expressed concern about the effect of parallel evolution on the development of a synapomorphic scheme and concluded, from his study of

amphipods in the family Aoridae, that parallel evolution was a far more common phenomenon than previously believed. He suggested that in amphipods, in general, complex character states are rare and variation morphoclinial, thus making it difficult to detect cases of parallel evolution in these animals (Myers 1988). In addition, Notenboom (1988) has pointed out that at low taxonomic levels, species share similar gene pools, thus increasing the chances of the occurrence of parallelisms.

Within group B, the cladogram shows that the species *P. aurantia* and *P. granulicornis* are closely related. The fact that *P. aurantia* and *P. granulicornis* are geographically close provides additional evidence for the validity of this clade. *Paramelita aurantia* and *P. granulicornis* share many apomorphic conditions, such as an almost quadrate coxa 4, medial spines on article 2 of gnathopod 2, and the absence of a second article on the outer ramus of uropod 3. Griffiths (1981: 82) has suggested that these 'Hottentots Holland Mountain' species, along with *P. kogelensis* and *P. seticornis*, form a 'closely related group'. When Barnard (1927) first described *P. kogelensis*, he considered it to be 'closely allied' (p. 172) to *P. seticornis*. It is highly probable that the present analysis does not include all the extant species of this group, so that a fully resolved cladogram is not possible at this stage.

The group consisting of *P. magna*, *P. magnicornis*, *P. odontophora*, *P. pinnicornis* and *P. platypus* is characterized mainly by the possession of elongate and stout second antennae. *Paramelita magna* and *P. magnicornis* occur, often in sympatry, in streams in the southern part of the Cape Peninsula. *Paramelita odontophora* and *P. pinnicornis* are also relatively close geographically to each other, with the most easterly known population of *P. pinnicornis* only about 15 km away from the nearest population of *P. odontophora*. *Paramelita pinnicornis* is also known from two localities on the Cape Peninsula.

The most unlikely monophyletic group is that of *P. parva* and *P. barnardi*, as these species occur over 400 km apart, with the latter species known only from a single cave on the Cape Peninsula.

Although the assumption has been made that all existing species have been included in the cladistic analysis, it is possible that a more thorough search of streams in the mountainous areas of the south-western Cape could reveal more as yet undescribed forms.

#### PHENETIC ANALYSIS

A phenetic analysis of the 25 known paramelitid species, including the new species described in this paper, confirmed the existence of morphologically distinct groups within the species (Fig. 2). Six of the species fell into a relatively 'tight' and distinct cluster (cluster A), and were easily distinguished from the remaining species by a combination of characteristic features. These included the possession of a sparsely setose urosome and a poorly emarginate coxa 4; the presence of only a single spinule on the dactyl of pereopods 3 and 4, and (with the exception of one population of *Paramelita auricularia*) on the dactyl of pereopods 5-7; a strongly swollen article 4 in antenna 2, and the absence of a second segment on the outer ramus of uropod 3. This cluster represents the six species belonging to *Aquadulcaris* gen. nov.

Seventeen species grouped together to form 'cluster B'. This cluster was clearly divisible into smaller distinct 'subclusters'. Like the *Aquadulcaris* species (cluster A), *Paramelita aurantia* and *P. granulicornis* are characterized by the possession of a poorly emarginate coxa 4, and the absence of a second article on the outer ramus of uropod 3. However, these species have a multi-spinose dactyl on each pereopod, and the peduncle of antenna 2 is never markedly swollen laterally. With the exception of *P. seticornis* and *P. tulbaghensis*, all of the remaining 'cluster B' species have an excavate coxa 4 and a distinct second segment on the outer ramus of uropod 3. Although it is possible that these 16 species should be considered as belonging to more than one genus, it is proposed that, until further detailed cladistic analysis is undertaken, they remain in the genus *Paramelita*.

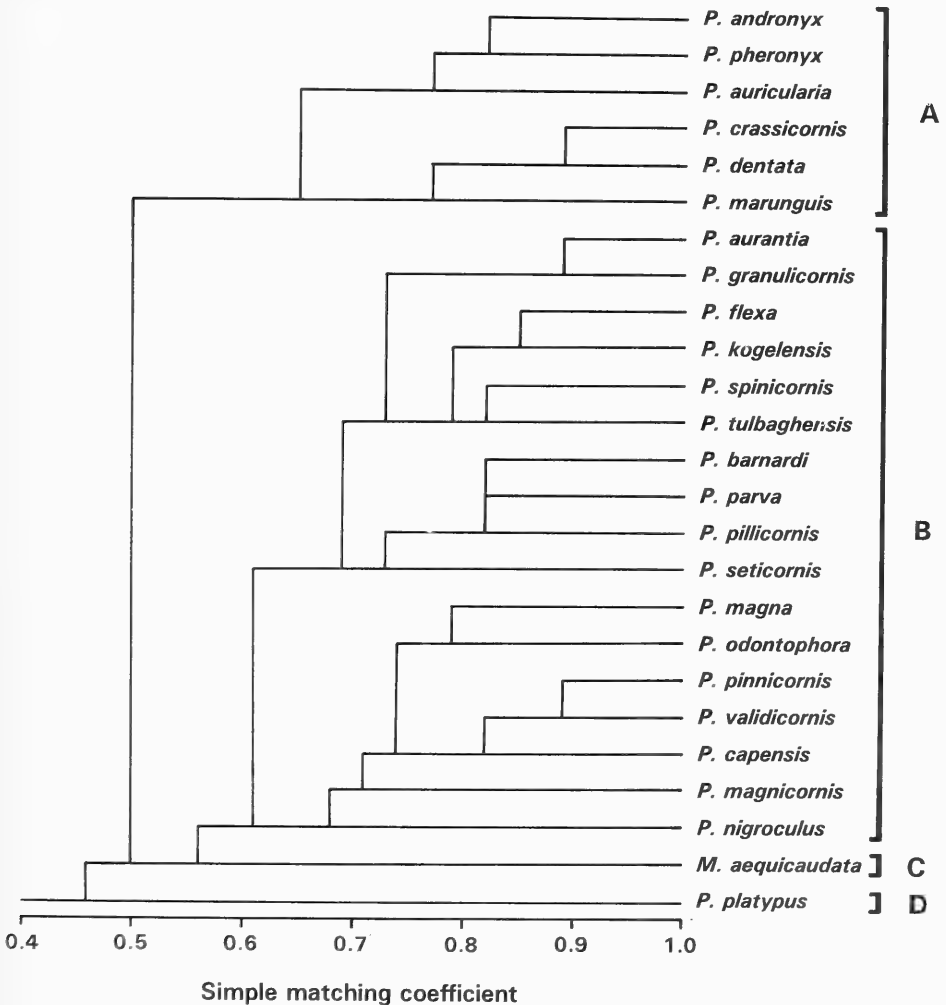


Fig. 2. Phenetic analysis of southern African paramelitids.

In January 1992, a collection of unusual paramelitid specimens was made from the Outeniqua Mountains near Knysna by CLG. This population is represented by cluster C in the phenogram. In these specimens, there is no coxal gill on pereopod 7, and the inner and outer rami of uropod 3 are of equal length in adult males. All other South African paramelitids have a coxal gill on pereopod 7, as do species of the Australian paramelitid genera *Austrogammarus*, *Austrocrangonyx* and *Antipodeus*. The inner ramus of uropod 3 is either absent or shorter than the outer ramus in all known species of paramelitids both in South Africa and Australia. The occurrence of rami of equal length in uropod 3 in these specimens is thus a highly diagnostic feature, and this, together with the absence of a coxal gill on pereopod 7, supports the recognition of a new, monospecific genus, *Mathamelita* gen. nov., which is described below.

A unique combination of character states in *Paramelita platypus* is reflected in the position of this species in a separate cluster D in the phenogram. This species is characterized by the possession of an almost quadrate coxa 4, a strongly convex palm with a palmar tooth in gnathopod 2, lateral expansion of article 4 in both pereopods 3 and 4, and a small but distinct second segment on the outer ramus of uropod 3. The combination of a distinctly quadrate coxa 4 and a palmar tooth in gnathopod 2 is shared with *P. granulicornis* and, although article 4 of pereopod 4 in this species is not as markedly posterodistally protruded as in *P. platypus*, Barnard (1927: 176), in his description of *P. granulicornis*, remarked that this article was 'rather strongly expanded distally' in this species. These two species also occur in close proximity geographically.

## SYSTEMATICS

Superfamily CRANGONYCTOIDEA Bousfield, 1973

Family **Paramelitidae** Bousfield, 1973

### KEY TO THE SOUTH AFRICAN PARAMELITID GENERA

- 1A. Pereopod 7, coxal gill absent ..... *Mathamelita* gen. nov.  
 1B. Pereopod 7, coxal gill present ..... 2
- 2A. Antenna 2, article 4 always laterally swollen (e.g. Figs 3C, 4C, 5C);  
 pereopods 3 and 4, dactyl with a single spinule; pereopods 5–7, dactyl  
 usually with one spinule, rarely two ..... *Aquadulcaris* gen. nov.  
 2B. Antenna 2, article 4 sometimes elongate and stout (e.g. Figs 17C, 18C),  
 but rarely laterally swollen; pereopods 3 and 4, dactyl usually with  
 2–8 spinules, rarely one; pereopods 5–7, dactyl usually with 2–14 spinules,  
 rarely one ..... *Paramelita*

*Aquadulcaris* gen. nov.

### Diagnosis

Eyes white. Antenna 1 longer than 2, peduncle sparsely setose, article 1 1.2–1.5 length of article 2, 3.0–3.8 longer than wide, flagellum sparsely to



densely setose, 16- to 30-articulate, accessory flagellum 3- to 5-articulate. Antenna 2 sparsely setose, peduncle either shorter or longer than flagellum, article 4 laterally swollen, 1.9–2.7 longer than wide, semicircular lobe on article 3 present or not, flagellum 8- to 20-articulate. Gnathopod 2, article 2 medially spinose or not, palms slightly to markedly convex, transverse to slightly oblique. Pereopod 3 modified or not, article 4 either posterodistally protruded or not, article 5 lobed or not, often bearing 1–4 tooth-like spines. Coxa 4, posterior margin transverse to slightly emarginate. Pereopods 3 and 4, dactyl usually with a single spinule, pereopods 5–7, usually with one, but occasionally with two spinules. Segments 2–7 with 1–4 sausage-shaped sternal gills, coxal gill present on pereopod 7. Uropod 3, second segment of outer ramus rudimentary to absent.

*Etymology*

From the Latin *aqua dulcis*, meaning fresh water, and *caris*, meaning shrimp. The gender is feminine.

*Type species. Gammarus crassicornis* Barnard, 1916: 207–209, pl. 27 (figs 24–25).

KEY TO SPECIES OF *AQUADULCARIS*

- 1A. Pereopod 3 unmodified (Fig. 6E) ..... *A. dentata*
- 1B. Pereopod 3 modified, either article 4 posterodistally protruded to form a lobe or spur (Figs 3E, 8E), or article 5 posteriorly lobed (Fig. 4E), or with 1–4 tooth-like spines (Figs 5E, 7E) ..... 2
- 2A. Antenna 2, article 3 bearing a semicircular lobe (Figs 3C, 4C, 8C) ..... 3
- 2B. Antenna 2, article 3 lacking a lobe ..... 5
- 3A. Pereopod 3, article 4 not posterodistally protruded, article 5 usually posteriorly lobed, always bearing a tooth-like spine (Fig. 4E) .....  
..... *A. auricularia*
- 3B. Pereopod 3, article 4 posterodistally protruded (Figs 3E, 8E) ..... 4
- 4A. Pereopod 3, article 4 short, posterodistally protruded into a long, narrow ‘spur’; antenna 2, article 3 strongly swollen and enlarged (Fig. 8A, C, E) .....  
..... *A. pheronyx*
- 4B. Pereopod 3, article 4 long, posterodistally protruded into a triangular-shaped lobe; antenna 2, article 3 moderately swollen (Fig. 3A, C, E) .....  
..... *A. andronyx*
- 5A. Pereopod 3, article 5 attached normally to article 6 (Fig. 5E) .....  
..... *A. crassicornis*
- 5B. Pereopod 3, article 5 attached at right angles to article 6 to form a ‘claw’ (Fig. 7E) ..... *A. marunguis*

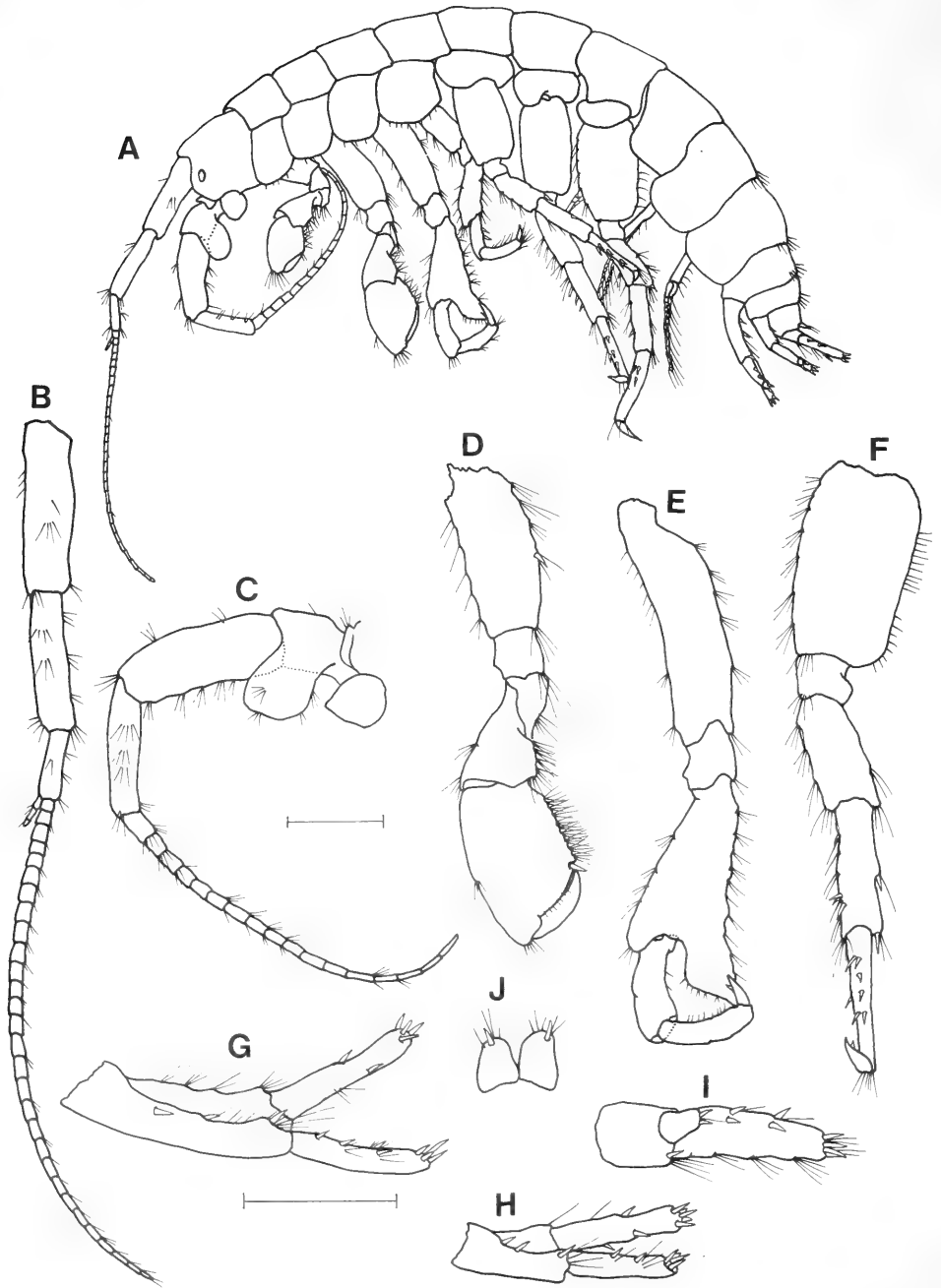


Fig. 3. *Aquadulcaris andronyx*, SAM-A40017, holotype, male, 16.1 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Pereopod 6. G. Uropod 1. H. Uropod 2. I. Uropod 3. J. Telson. Scale lines represent 1 mm.

*Aquadulcaris andronyx* (Stewart & Griffiths, 1992)

## Fig. 3

*Paramelita andronyx* Stewart & Griffiths, 1992a: 148–153, figs 5–6.

*Material examined*

*Types.* Holotype, SAM–A40017; paratypes, SAM–A40018, from a tributary of the Riebeek's River, above the farm Waterval, Kasteelberg.

*Other material.* SAM–A40019, from a stream above the farm Wynkeldersberg, draining the slopes of Kasteelberg.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum about 20- to 30-articulate, accessory flagellum 3- to 5-articulate. Antenna 2 shorter than 1, moderately setose, article 3 of peduncle bearing a semicircular lobe posteriorly and article 4 laterally swollen in males, flagellum 13- to 20-articulate. Coxa 4 slightly emarginate posteriorly. Gnathopod 2, article 2 strongly spinose medially, palm slightly oblique, with 3–5 defining spines. Pereopod 3 moderately setose, modified in males, article 2 strongly spinose medially, article 4 posterodistally projected into a large lobe, article 5 short and stout, article 6 bent at right angles to article 5, dactyl with a single spinule. Pereopods 4–7 sparsely to moderately setose, unmodified, dactyl with a single spinule. Uropods 1 and 2, peduncle spinose and setose, rami usually with marginal spines and setae and apical spines. Uropod 3, inner ramus 0.3 length of outer, apically spinose, sometimes with a seta, outer ramus with marginal and apical spines, sparsely to moderately setose, second segment rudimentary or absent. Telson deeply cleft, each lobe with one spine and 4–5 setae.

*Remarks*

One of three species with article 3 of antenna 2 lobed and pereopod 3 modified to form a 'claw', *Aquadulcaris andronyx* is easily distinguished by the manner in which the claw-like structure is achieved.

*Distribution*

From streams draining the slopes of Kasteelberg, north of Malmesbury (Fig. 29).

*Aquadulcaris auricularia* (Barnard, 1916)

## Fig. 4

*Gammarus auricularius* Barnard, 1916: 209–210, pl. 27 (figs 26–28); 1927: 169–170.

*Paramelita auricularis* (Barnard) Thurston, 1973: 166. Griffiths, 1981: 82–85, fig. 3A–C.

*Paramelita auricularius* (Barnard) Stewart & Griffiths, 1992b: 166–179, figs 1–3.

*Material examined*

*Types.* Syntypes, SAM–A2599, top of Table Mountain, Cape Peninsula.

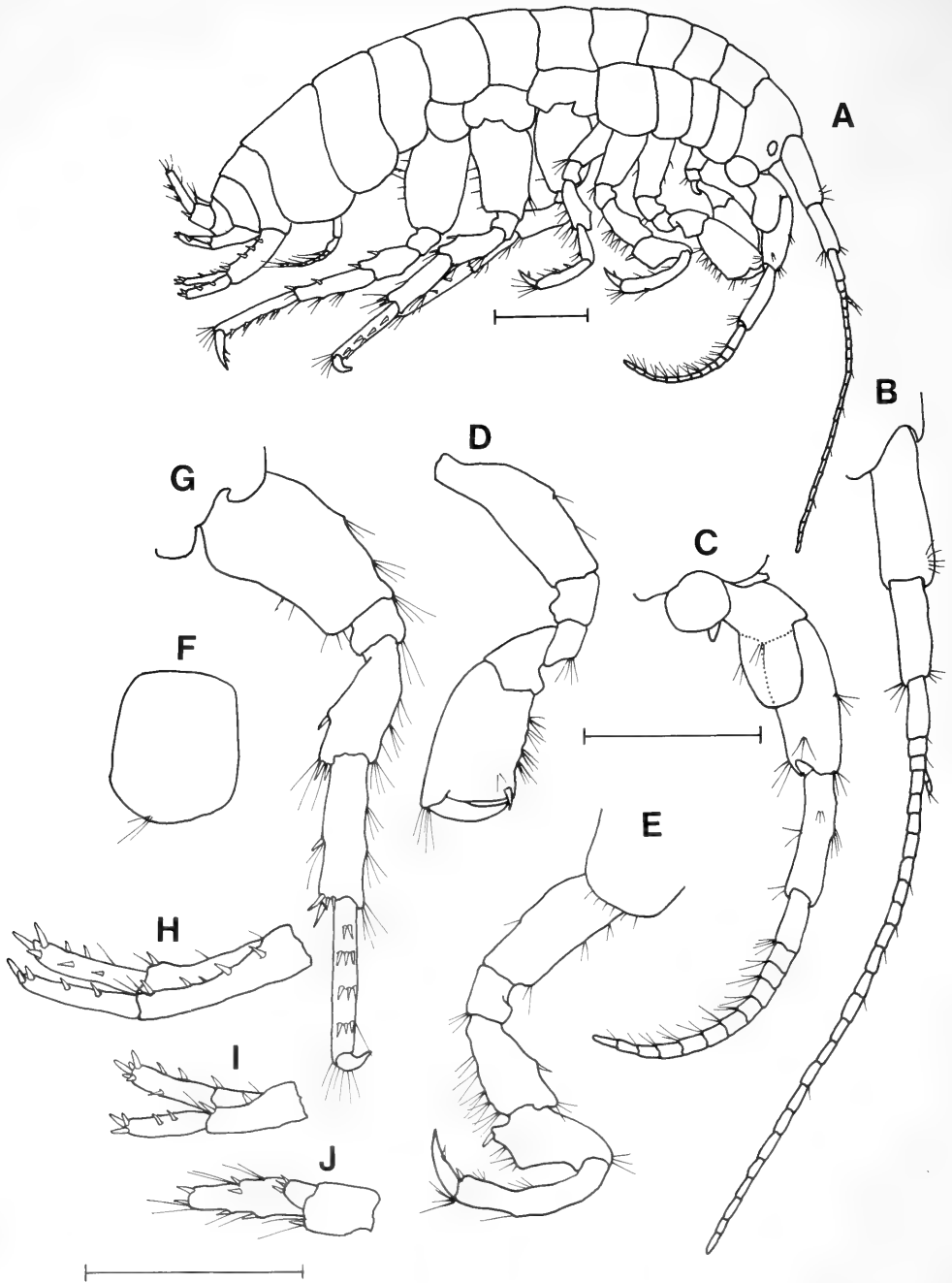


Fig. 4. *Aquadulcaris auricularia*, SAM-A2599, syntype, male, 6.7 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Other material.* SAM-A2634, A2962, A3882, A4559, A5907, A40251 and A40800, all from various localities on the top of Table Mountain. SAM-A40252, from a stream draining Constantiaberg, Cape Peninsula.

### *Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 20- to 25-articulate, accessory flagellum 3- to 4-articulate. Antenna 2 moderately setose, shorter than 1, article 3 with a posterodistal lobe extending forward to middle of swollen article 4 in males, flagellum 8- to 13-articulate. Coxa 4, posterior margin transverse to very slightly emarginate. Gnathopod 2, palm transverse, with 1-3 defining spines. Pereopod 3 sparsely to moderately setose, modified in males, article 4 widened distally, article 5 with a rectangular lobe and a single tooth-like spine posteriorly, article 6 elongate and arched and folded back against the lobed posterior margin of 4, dactyl with a single spinule. Pereopod 4 sparsely to moderately setose, unmodified, dactyl with one spinule. Pereopods 5-7 sparsely to moderately setose, dactyl with 1-2 spinules. Uropod 1, peduncle spinose, sometimes with 1-2 setae, rami subequal, with marginal and apical spines, inner ramus sometimes with a single seta. Uropod 2, peduncle spinose and setose, inner ramus slightly longer than outer, both rami with marginal and apical spines, lacking setae. Uropod 3, inner ramus about 0.3 length of outer, apically spines, outer ramus with marginal and apical spines, sparsely setose, second segment rudimentary to absent. Telson deeply cleft, each lobe with about 6-8 apical setae, lacking spines.

### *Remarks*

This species most closely resembles *Aquadulcaris andronyx* and *A. pheronyx*, but can be distinguished from these species by the manner in which the claw-like structure of pereopod 3 is achieved. Article 5 of this pereopod can vary from having a small projection, to having a large, rounded to rectangular-shaped lobe posteriorly.

### *Distribution*

Cape Peninsula, in streams draining the upper slopes of Table Mountain in the north to Constantiaberg in the south (Fig. 29).

### *Aquadulcaris crassicornis* (Barnard, 1916)

Fig. 5

*Gammarus crassicornis* Barnard, 1916: 207-209, pl. 27 (figs 24-25).

*Paramelita crassicornis* (Barnard) Thurston, 1973: 166. Griffiths, 1981: 85-86, fig. 3E-G. Stewart & Griffiths, 1992b: 166-179, figs 1, 4-5.

### *Material examined*

*Types.* Syntypes, SAM-A3031, from Table Mountain.

*Other material.* SAM-A3865 and A40220, Grotto Ravine, Table Mountain. SAM-A3864, Platteklip Gorge, Table Mountain. SAM-A3881, Slangolie, Table Mountain. SAM-A4367 and A4368, unknown localities on Table

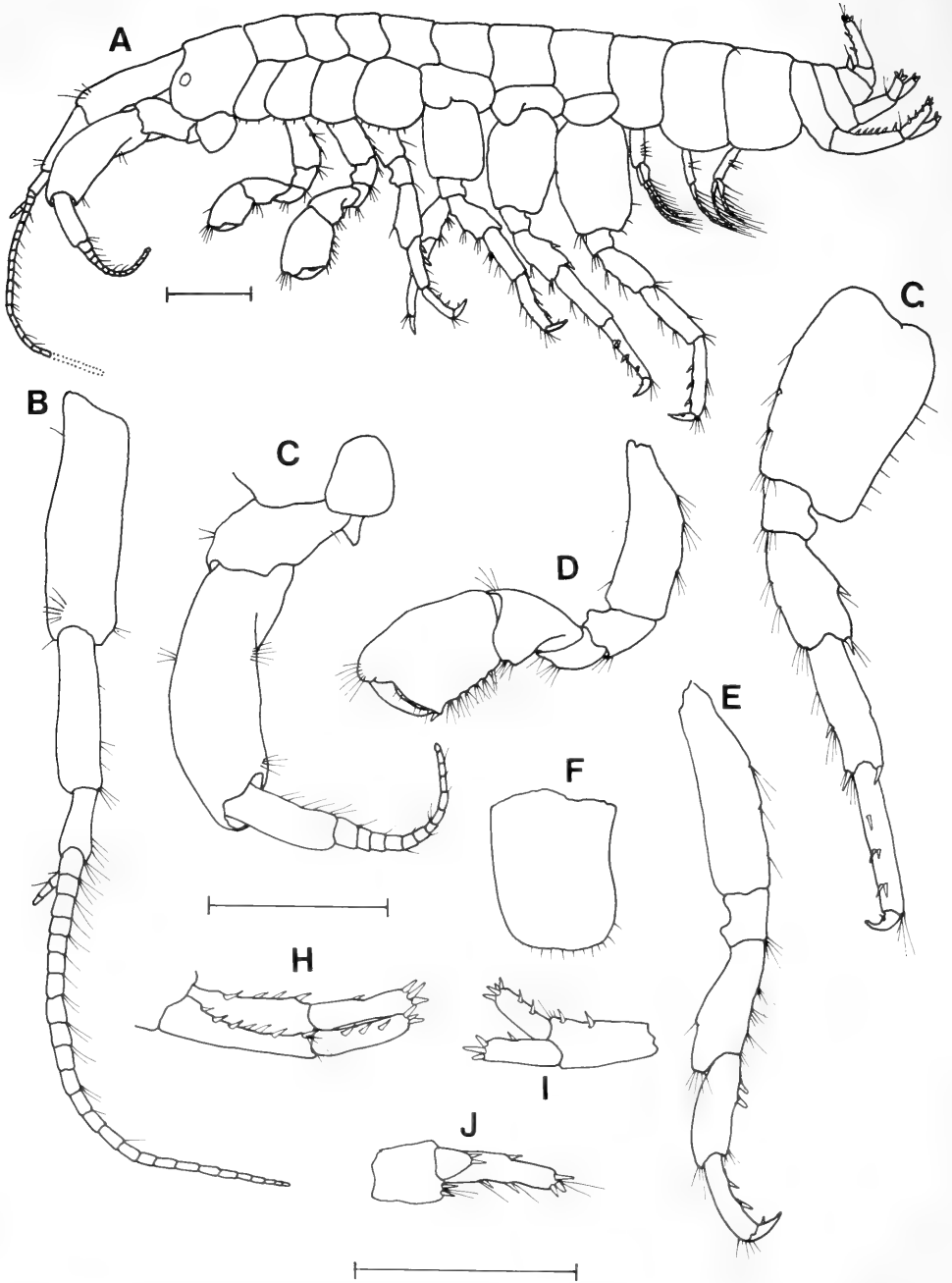


Fig. 5. *Aquadulcaris crassicornis*, SAM-A40223, male, 6.9 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

Mountain. SAM-A4868, Stinkwater, Table Mountain. SAM-A40222, Blinkwater, Table Mountain. SAM-A40223, Echo Valley, Table Mountain. SAM-A40225, Rhodes Memorial, Table Mountain. SAM-A40991, Table Mountain, above Camps Bay. SAM-A41220, Woodhead Reservoir, Table Mountain.

### *Diagnosis*

Eyes white. Antenna 1 sparsely to moderately setose, flagellum 19- to 25-articulate, accessory flagellum with 3–5 articles. Antenna 2 moderately setose, peduncle articles 3 and, to a greater extent, 4, strongly swollen in males, normal in females, flagellum 10- to 13-articulate. Coxa 4, posterior margin slightly emarginate. Gnathopod 2, palm transverse to slightly oblique, with 2–4 defining spines. Pereopod 3, article 5 in males usually with 1–4 stout, tooth-like spines, dactyl with one spinule. Pereopods 4–7 sparsely to moderately setose, unmodified, dactyl with a single spinule. Uropod 1, peduncle spinose and setose, rami subequal, with marginal and apical spines, inner ramus usually with a few setae. Uropod 2, peduncle spinose and setose, inner ramus longer than outer, both with marginal and apical spines, lacking setae. Uropod 3, inner ramus 0.3 length of outer, apically spinose, outer ramus with marginal and apical spines, sparsely setose, second segment rudimentary to absent. Telson deeply cleft, each lobe with a few setae but no spines.

### *Remarks*

The swollen peduncle in antenna 2, poorly emarginate coxa 4, absence of a second segment on the outer ramus of uropod 3, and the presence of only a single spinule on the dactyl of each pereopod suggests a strong link between this species and *Aquadulcaris marunguis*, *A. dentata*, *A. auricularia*, *A. andronyx* and possibly *Paramelita tulbaghensis*.

### *Distribution*

Endemic to streams draining the upper slopes of Table Mountain (Fig. 29).

*Aquadulcaris dentata* (Stewart & Griffiths, 1992)

Fig. 6

*Paramelita dentata* Stewart & Griffiths, 1992b: 179–183, figs 7–8.

### *Material examined*

*Types.* Holotype, SAM-A40244; paratypes, SAM-A40245, from a tributary of the Sandvlei River on Ou Kaapse Weg, Cape Peninsula.

*Other material.* SAM-A40249, from a tributary of the Silvermine River, Cape Peninsula. SAM-A40794, Noordhoek lookout, Silvermine Nature Reserve.

### *Diagnosis*

Eyes white. Antenna 1, peduncle sparsely setose, flagellum moderately to densely setose posteriorly, 18- to 21-articulate, accessory flagellum 3- to 5-articulate. Antenna 2 shorter than 1, sparsely setose, articles 3 and 4 of

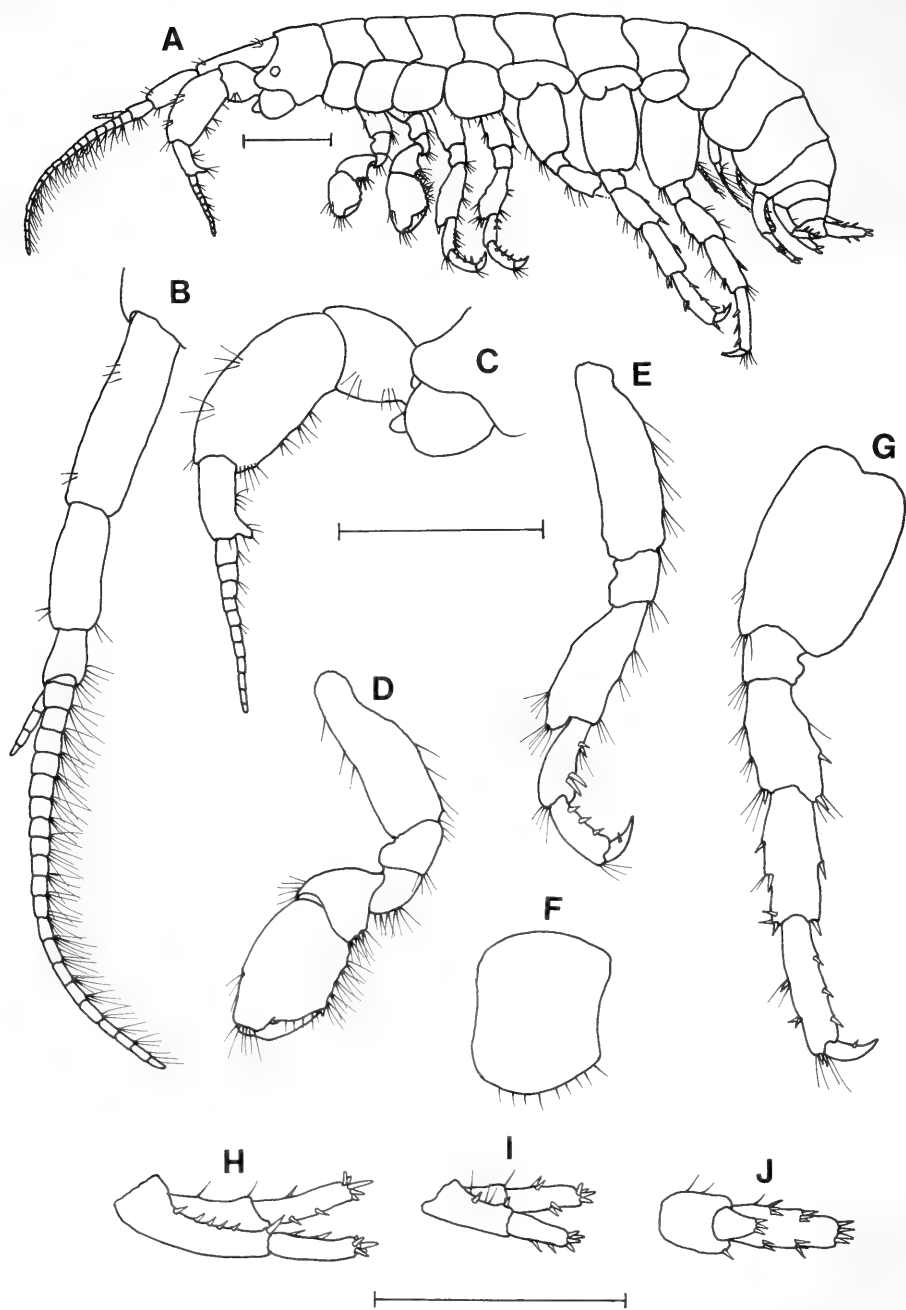


Fig. 6. *Aquadulcaris dentata*, SAM-A40244, holotype, male, 6.9 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.



peduncle strongly laterally swollen and enlarged and article 5 with a posterodistal tooth in adult males, flagellum 9- to 11-articulate. Coxa 4 slightly emarginate posteriorly. Gnathopod 2, palm transverse to slightly oblique, with 3–4 defining spines. Pereopods 3–7 sparsely setose, unmodified, dactyl with a single spinule. Uropods 1 and 2, peduncles spinose and setose, rami with marginal and apical spines, lacking setae. Uropod 3, inner ramus 0.3–0.4 length of outer, apically spinose, lacking setae, outer ramus with marginal and apical spines, poorly setose, second segment rudimentary to absent. Telson deeply cleft, each lobe with 1–2 spines and 1–3 setae.

#### Remarks

Although obviously related to *Aquadulcaris crassicornis*, *A. dentata* is distinguished from it by the presence of a posterodistal tooth on article 5 of the peduncle of antenna 2. *Paramelita spinicornis*, with its swollen article 4 of antenna 2 and occasional tooth on article 5 is also superficially similar, but this species can be distinguished by the possession of multispinose dactyls, an excavate coxa 4, and the presence of a small, but distinct second article on the outer ramus of uropod 3.

#### Distribution

Known from small streams draining the Kalk Bay Mountains, as well as Chapman's Peak Mountains above Noordhoek, Cape Peninsula (Fig. 29).

#### *Aquadulcaris marunguis* (Stewart & Griffiths, 1992)

Fig. 7

*Paramelita marunguis* Stewart & Griffiths, 1992b: 183–187, figs 9–10.

#### Material examined

*Types.* Holotype, SAM–A40224; paratypes, SAM–A40246, from a tributary of the Burgersbos River, Cape Peninsula.

*Other material.* SAM–A40221, from a tributary of the Disa River, Cape Peninsula.

#### Diagnosis

Eyes white. Antenna 1 sparsely to moderately setose, flagellum 24- to 26-articulate, accessory flagellum 4-articulate. Antenna 2 shorter than 1, sparsely to moderately setose, articles 3 and 4 laterally swollen and enlarged in adult males, flagellum with 12–15 articles. Coxa 4, posterior margin weakly emarginate posteriorly. Gnathopod 2, palm transverse and markedly convex, with 3–5 spines. Pereopod 3 moderately to densely setose posteriorly, articles 5 and 6 modified in males, article 5 with two large teeth on posterior margin, article 6 bent backwards against toothed, posterior margin of 5, with two spines, dactyl with one spinule. Pereopods 4–7 unmodified, moderately setose, dactyl with a single spinule. Uropods 1 and 2, peduncle spinose and setose, inner rami with marginal spines and setae and apical spines, outer rami with marginal and apical

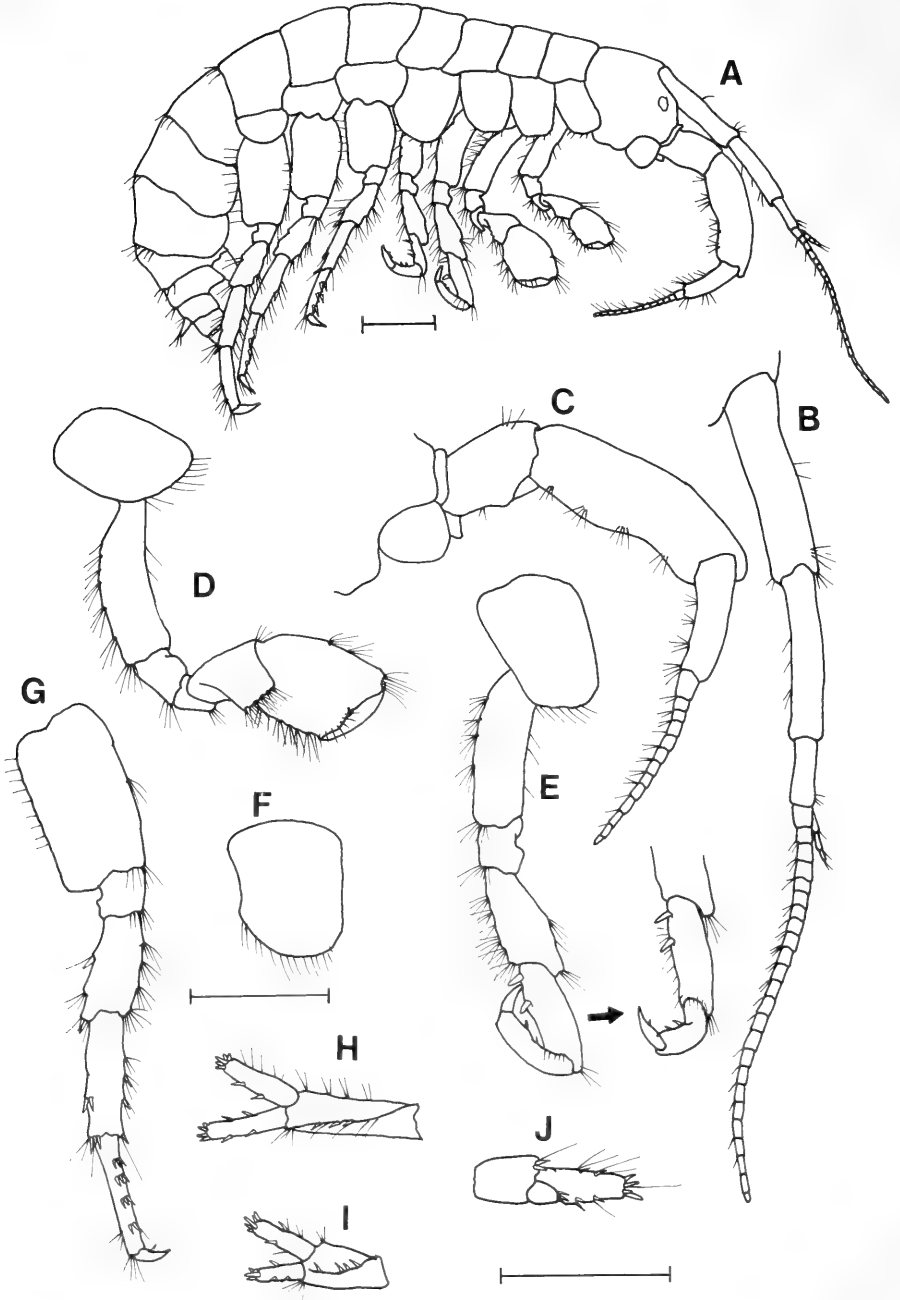


Fig. 7. *Aquadulcaris marunguis*, SAM-A40224, holotype, male, 10.8 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

spines, lacking setae. Uropod 3, inner ramus 0.3 length of outer, apically spinose, outer ramus with marginal and apical spines, sparsely setose, second segment rudimentary. Telson deeply cleft, each lobe with 8–10 setae.

#### Remarks

This species is very similar to *Aquadulcaris crassicornis*, from which it is distinguished by the 'claw-like' nature of pereopod 3. In *A. marunguis*, article 6 of this limb is attached 'at right angles' to article 5, whereas in *A. crassicornis*, these articles are attached normally.

#### Distribution

This species has so far been collected from two streams draining the southernmost parts of Table Mountain, Cape Peninsula (Fig. 29).

### *Aquadulcaris pheronyx* (Stewart & Griffiths, 1992)

#### Fig. 8

*Paramelita pheronyx* Stewart & Griffiths, 1992b: 187–191, figs 11–12.

#### Material examined

*Types.* Holotype, SAM-A40247; paratypes, SAM-A40248, from a stream draining the slopes of Constantiaberg, Cape Peninsula.

#### Diagnosis

Eyes white. Antenna 1 sparsely setose, flagellum 16- to 21-articulate, accessory flagellum 3- to 4-articulate. Antenna 2 sparsely setose, shorter than 1, articles 3 and 4 of peduncle strongly swollen and enlarged in males, article 3 with a large lobe posteriorly, flagellum with 10–14 articles. Coxa 4, posterior margin slightly emarginate. Gnathopod 2, article 2 strongly spinose medially, palm transverse, with 3–4 defining spines. Pereopod 3 sparsely setose, article 2 medially setose, articles 4 and 5 modified in males, article 4 short, widening distally, with a long, narrow posterodistal projection, article 5 elongate and enlarged, curved, bearing a stout spine at point of attachment with 4, dactyl with one spinule. Pereopods 4–7 sparsely setose, unmodified, dactyl with a single spinule. Uropods 1 and 2, peduncle spinose and setose, inner rami with marginal spines and setae, outer rami with marginal spines, lacking setae, all rami with apical spines. Uropod 3, inner ramus 0.3–0.4 length of outer, apically spinose, outer rami with marginal and apical spines, sparsely setose, second segment rudimentary to absent. Telson deeply cleft, each lobe with 4–5 setae, lacking spines.

#### Remarks

The 'spur-like' projection on article 4 of pereopod 3 makes *A. pheronyx* unmistakable. *Aquadulcaris andronyx* also has a projection on this article but, in this species, the projection is wide and triangular-shaped. Both species have a lobe on article 3 of the peduncle of antenna 2.

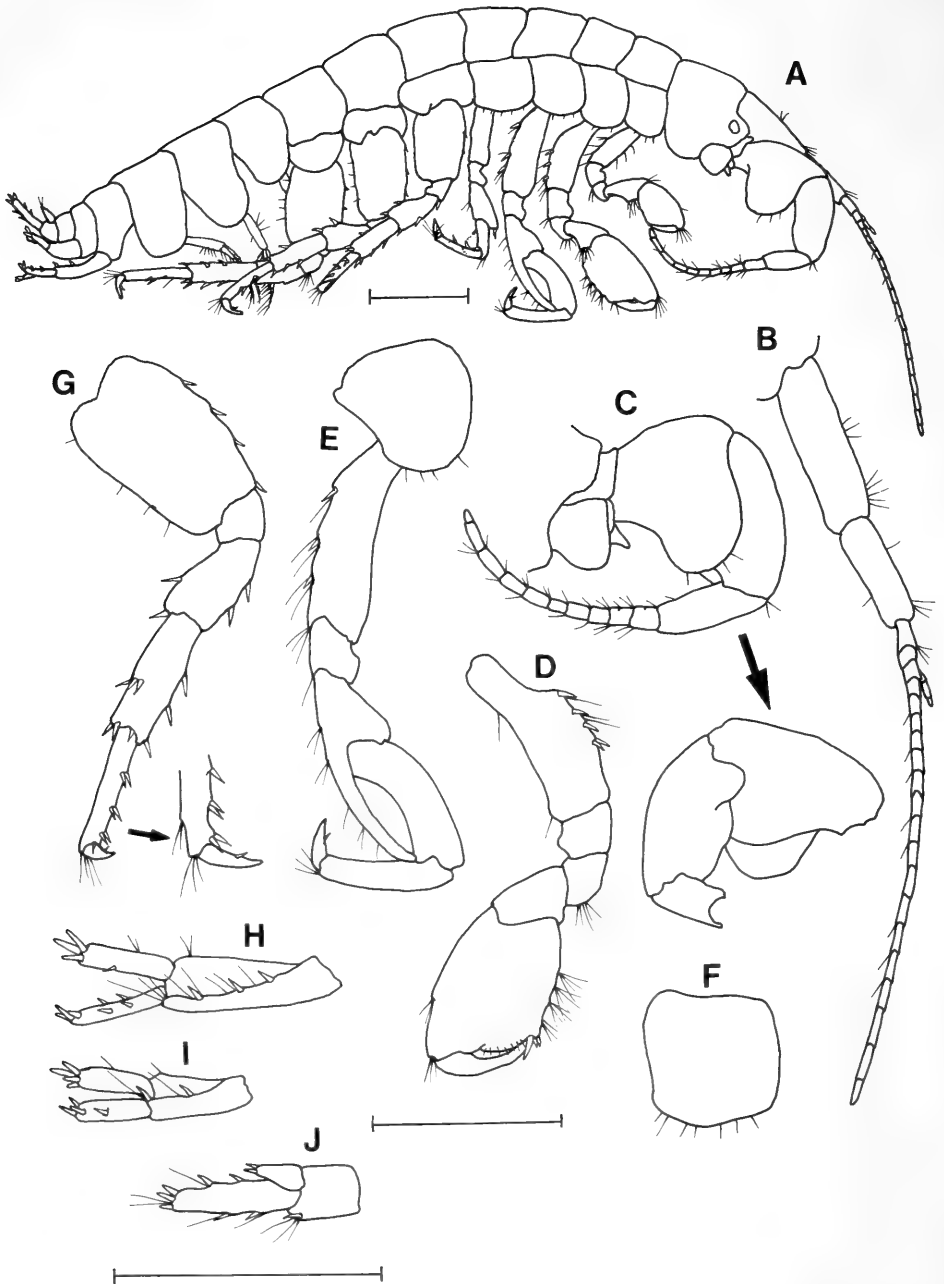


Fig. 8. *Aquadulcaris pheronyx*, SAM-A40247, holotype, male, 7.2 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2, lateral and medial views. D. Gnathopod 2, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Distribution*

This species is known only from the type locality, a stream draining the southern slopes of the Constantiaberg, above the Hout Bay Hotel (Fig. 29).

*Mathamelita* gen. nov.*Diagnosis*

Eyes white. Antenna 1 shorter than 2, sparsely setose, accessory flagellum with about four articles. Antenna 2 peduncle not toothed or lobed. Gnathopod 2 palm oblique, excavate. Coxa 4 not excavate posteriorly. Pereopod 3 unmodified, not subchelate. Pereopods 3–7, dactyls with a single spinule. Pereon 2 with a single sternal gill, pereon segments 3–7 each with a pair of sternal gills. Pereopod 7, coxal gill absent. Uropod 3, second segment of outer ramus present, inner ramus as long as outer in adult males, reduced in juveniles.

*Etymology*

This genus is named after the author's (CLG) young son Matthew. His request for a comfort stop during a scenic drive in the Outeniqua Mountains provided his father with the opportunity to explore a roadside stream, leading to the discovery of the type species.

*Type species. Mathamelita aequicaudata* sp. nov.

*Mathamelita aequicaudata* sp. nov.

Figs 9, 10

*Etymology*

The specific name refers to the equal rami of the third uropod, which is the most unusual feature of this species.

*Material examined*

*Types.* Holotype, SAM-A40990; paratypes, SAM-A41189, from stream situated between Kruisvallei and Knysna (Fig. 29).

*Description of holotype* (male, 8 mm)

Body off-white in colour. Head 1.5 length of pereon segment 1, eyes white, invisible in preserved specimens.

Antenna 1 about one-third body length, peduncle short, segment 1 50 per cent longer and broader than 2, 2 twice length of 3, flagellum twice length of peduncle, 18-articulate, accessory flagellum 4-articulate. Antenna 2 considerably longer and more robust than 1, 60 per cent body length, articles 4 and 5 of peduncle elongate, not bent or toothed, flagellum 20 per cent longer than peduncle, consisting of 16 broadened segments.

Left mandible with strongly tritirative molar and 3-articulate palp, second article of palp more than three times length of first and slightly longer than third, which ends in eight long setae. Cutting edge of five strong teeth, lacinia

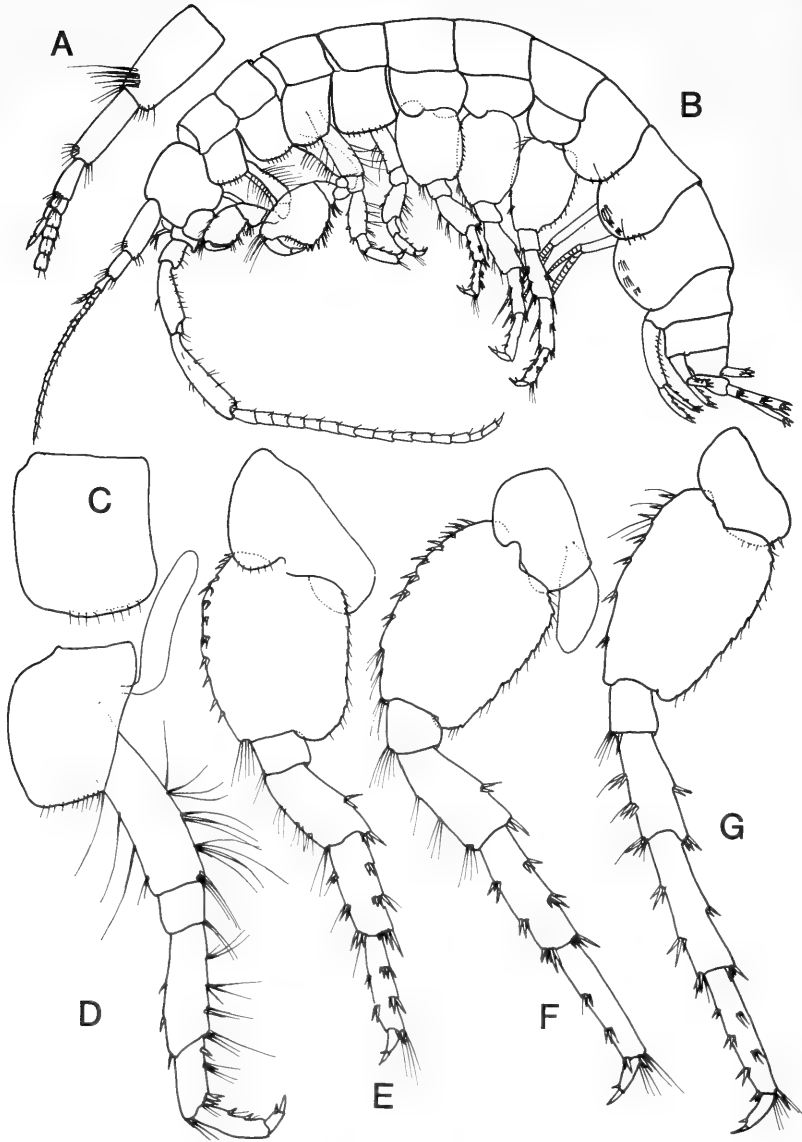


Fig. 9. *Mathamelita aequicaudata* sp. nov., SAM-A40990, holotype, male, 6.0 mm. A. Antenna 1, peduncle. B. Lateral aspect. C. Coxa 4. D. Pereopod 3. E. Pereopod 5. F. Pereopod 6. G. Pereopod 7.

mobilis large and 4-toothed, spine row of one simple and four spine-setae. Right mandible, cutting edge of five teeth, lacinia mobilis slender and bifurcate, spine row of two thick and two slender spine-setae.

Maxilla 1, inner plate with four terminal setae, outer plate with 10 strong serrate spines, palp bi-articulate, reaching beyond outer plate, ending in seven short spines.

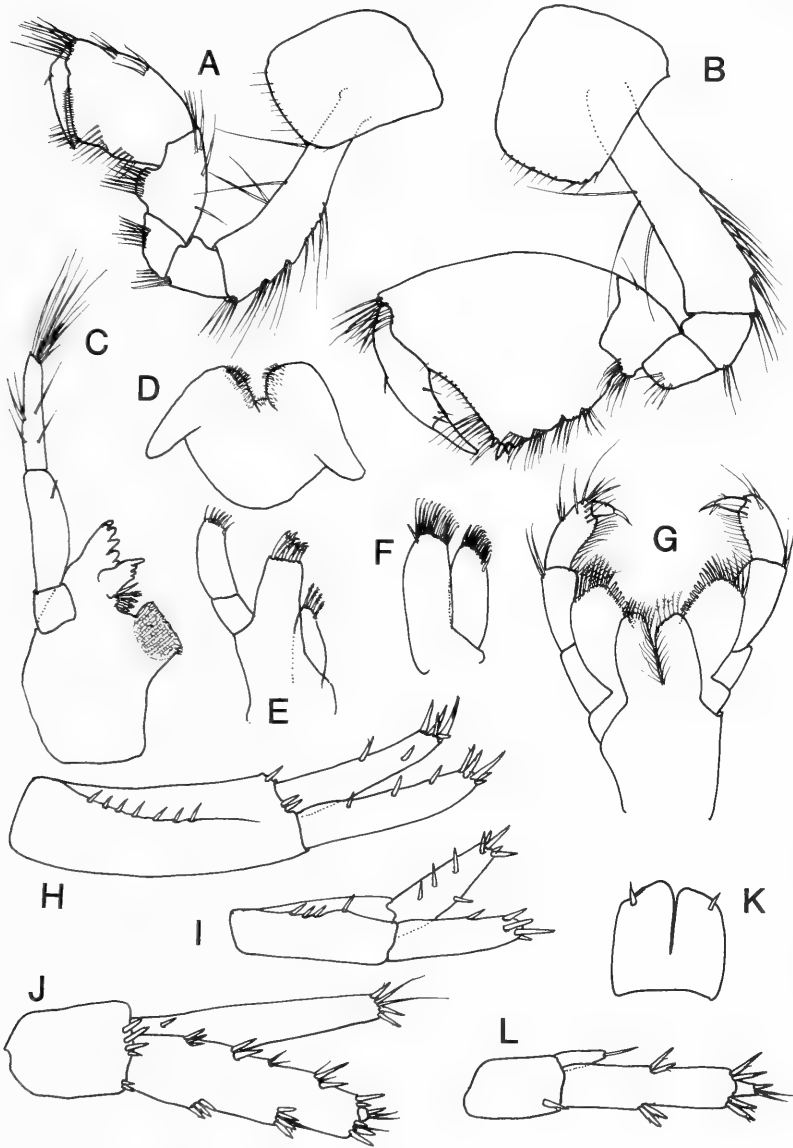


Fig. 10. *Mathamelita aequicaudata* sp. nov., SAM-A40990, holotype, male, 6.0 mm. A. Gnathopod 1. B. Gnathopod 2. C. Left mandible. D. Lower lip. E. Maxilla 1. F. Maxilla 2. G. Maxillipeds. H. Uropod 1. I. Uropod 2. J. Uropod 3. K. Telson. L. Uropod 3 of juvenile, 2.7 mm.

Maxilla 2 with about 23 hooked setae on inner plate, 21 on outer plate.

Maxilliped, inner plate with about 14 pectinate setae along margin, outer plate medially lined by 19–20 close-set spine-setae that increase in length distally, palp 4-articulate.

Pereon segments dorsally smooth, coxae 1–3 quadrate, setose ventrally, coxa 4 quadrate, not excised posteriorly, coxae 5 and 6 bilobed, 7 semicircular. A single sausage-shaped sternal gill occurs centrally on pereon segment 2 and a lateral pair on each of pereon segments 3–7. Coxal gills on pereopods 2–6 only, absent from pereopod 7.

Gnathopod 1 subchelate, article 2 with long setae posteriorly, article 5 two-thirds length of 6, 6 rectangular, palm oblique, fairly straight, lined by minute close-set setae, defined by a slender spine. Gnathopod 2 much larger and more robust than 1, article 5 much smaller than the broad quadrate 6, palm slightly concave, defined by three strong spines.

Pereopods 3 and 4 not modified, 5 and 6 about equal, dactyl with a single spinule. Pereopod 5 short, only about 25 per cent body length, article 2 moderately expanded posteriorly, spinose anteriorly, dactyl with a single spinule. Pereopods 6 and 7 each progressively longer, article 2 only slightly lobed posteriorly, spinose anteriorly, not strongly tapering, distal articles strongly spinose, but with few setae, dactyl with a single spinule.

Pleon segments sparsely setose dorsally, pleonal epimera rounded, with groups of spines along ventral and posterior margins. Uropod 1 reaching to tip of 2, peduncle with a row of seven spines on dorsal margin, rami equal, two-thirds length of peduncle, strongly spinose terminally. Uropod 2 two-thirds length of 1, rami equal. Uropod 3 reaching beyond 2 by full length of its rami, length about 11 per cent of body, peduncle quadrate, outer ramus twice length of peduncle, rectangular, with three clusters of spines on lower edge, five on upper, minute second article ends in one spine and two setae. Inner ramus equal in length to outer but more slender, tapering and without lateral spines, five spines at apex.

Telson 60 per cent cleft, apex rounded, each lobe with a single, short apical spine.

### *Variation*

The inner ramus of uropod 3 appears to start life small and tapering, and increases in size relative to the outer ramus later in life. In a juvenile of 2.7 mm (Fig. 10L), the inner ramus is triangular and only one-third the length of the outer—not dissimilar to that of *Paramelita* species but, by 4 mm, males had the inner ramus 85 per cent as long as the outer.

In females, antenna 2 is much shorter than that of males, reaching only about 90 per cent of the length of antenna 1. Gnathopod 2 is also much smaller than that of males, being similar in shape and structure to gnathopod 1. Uropod 3 of females has unequal rami, the inner ramus being tapering and about 50 per cent of the length of the outer.

*Paramelita* Schellenberg, 1926

### *Diagnosis*

Eyes white or black. Antenna 1 0.7–1.8 length of 2, peduncle sparsely setose, article 1 1.1–1.6 length of 2, 2.6–3.7 longer than wide, flagellum sparsely setose, 18- to 80-articulate, accessory flagellum 3- to 8-articulate.



Antenna 2, sparsely to densely setose, rarely toothed or lobed, peduncle either shorter or longer than flagellum, often stout in males, article 4 2.1–4.5 longer than wide, flagellum 11- to 35-articulate. Gnathopod 2, article 2 medially spinose or not, palm slightly to strongly oblique. Pereopod 3 usually unmodified, rarely subchelate. Coxa 4, posterior margin slightly emarginate to strongly excavate. Pereopods 3 and 4, dactyl usually with 2–8 spinules. Pereopods 5–7, dactyl usually with 3–14 spinules. Pereon segments 2–7 with 1–4 sausage-shaped sternal gills, coxal gill present on pereopod 7. Uropod 3, inner ramus 0.1–0.4 length of outer, second segment on outer ramus present or absent.

*Type species.* *Paramelita ctenodactyla* Schellenberg, 1926: 367–370, fig. 57 (= *Paramelita capensis* (Barnard, 1916)).

KEY TO SPECIES OF *PARAMELITA*

- 1A. Eyes black ..... 2  
 1B. Eyes white ..... 3
- 2A. Antenna 2, posterior margins and pereopods 3–7 densely setose posteriorly ..... *P. nigroculus* var. *persetosa*  
 2B. Antenna 2, posterior margins and pereopods 3–7 sparsely to moderately setose posteriorly, lacking setal brushes ..... *P. nigroculus*
- 3A. Antenna 2, peduncle either toothed, lobed or ridged (Figs 14C, 20C, 23C, 26C) ..... 4  
 3B. Antenna 2, peduncle lacking teeth, lobes or ridges (e.g. Fig. 11C) ..... 7
- 4A. Antenna 2, articles 4 or 5 of peduncle toothed (Figs 20C, 26C) ..... 5  
 4B. Antenna 2, article 3 posteriorly lobed (Fig. 14C) or article 5 with lateral ridges (Fig. 23C) ..... 6
- 5A. Antenna 2 shorter than 1, article 4 of peduncle strongly laterally swollen, with a posterodistal, terminal tooth and a proximal, medial lobe (Fig. 26A) ..... *P. spinicornis*  
 5B. Antenna 2 extremely elongate, exceeding 1 in length, article 4 of peduncle with a posterodistal, subterminal tooth (Fig. 20A) . *P. odontophora*
- 6A. Antenna 2, article 3 of peduncle posteriorly lobed, pereopod 3 normal (Fig. 14A) ..... *P. flexa*  
 6B. Antenna 2, article 5 of peduncle with lateral ridges, pereopod 3 subchelate (Fig. 23A) ..... *P. pinnicornis*
- 7A. Antenna 2 densely setose (Figs 22C, 25C) ..... 8  
 7B. Antenna 2 sparsely to moderately setose (e.g. Fig. 11C) ..... 9
- 8A. Antenna 2, peduncle stout, flagellum shorter than peduncle, with 8–12 articles; pereopods 5–7, article 2 moderately expanded; uropod 1, outer ramus lacking setae; uropod 2, inner ramus usually with some setae (Fig. 25A) ..... *P. seticornis*

- 8B. Antenna 2, peduncle elongate and slender, flagellum as long as peduncle, with 13–16 articles; pereopods 5–7, article 2 markedly poorly expanded; uropod 1, outer ramus with some setae; uropod 2, inner ramus lacking setae (Fig. 22A) ..... *P. pillicornis*
- 9A. Coxa 4, posterior margin poorly emarginate (Figs 11F, 15A, 24F, 27F) .  
..... 10
- 9B. Coxa 4, posterior margin moderately to strongly excavate (e.g. Figs 12F, 13F) ..... 13
- 10A. Gnathopod 2, palm moderately convex, lacking tooth at defining angle; pereopod 3, article 4 only moderately longer and wider than 5 (Figs 11A, 27A) ..... 11
- 10B. Gnathopod 2, palm strongly convex, defining angle forming a small projecting rounded tooth; pereopod 3, article 4 often considerably longer and wider than 5 (Fig. 24E) ..... 12
- 11A. Antenna 2, peduncle laterally swollen, flagellum 9- to 12-articulate (Fig. 27C) ..... *P. tulbaghensis*
- 11B. Antenna 2, peduncle not markedly laterally swollen, flagellum 12- to 13-articulate (Fig. 11C) ..... *P. aurantia*
- 12A. Pereopod 3, article 4 greatly expanded laterally; uropod 3, inner ramus about 0.2 length of outer ramus (Fig. 24A) ..... *P. platypus*
- 12B. Pereopod 3, article 4 not markedly expanded laterally; uropod 3, inner ramus about 0.4 length of outer ramus (Fig. 15A) ..... *P. granulicornis*
- 13A. Antenna 2 as long as, or exceeding 1 in length, peduncle markedly stout (Figs 17C, 18C, 28C) ..... 14
- 13B. Antenna 2, distinctly shorter than 1, peduncle slender to moderately stout (e.g. Figs 12C, 13C) ..... 16
- 14A. Uropod 3, outer ramus 3.0 length of peduncle; uropods 1 and 2, inner rami always with a few setae, outer rami lacking setae (Fig. 28A) .....  
..... *P. validicornis*
- 14B. Uropod 3, outer ramus 2.0–2.6 length of peduncle; uropods 1 and 2, inner rami with or without setae, outer rami sometimes with setae (Figs 17H–J, 18G–I) ..... 15
- 15A. Pereopod 3, article 4 unmodified; urosome densely setose dorsally; uropods 1 and 2, inner and outer rami with setae; body colour brown (Fig. 17A) ..... *P. magna*
- 15B. Pereopod 3, article 4 posterodistally protruded to form a ‘tooth’; urosome moderately setose dorsally; uropod 1, inner ramus with a few setae, outer ramus without; uropod 2, rami lacking setae; body colour white (Fig. 18A) ..... *P. magnicornis*
- 16A. Antenna 1, flagellum with 22–27 articles; antenna 2, flagellum 11- to 18-articulate (Figs 16B–C, 21B–C) ..... 17

- 16B. Antenna 1, flagellum with 33–80 articles; antenna 2, flagellum 15- to 35-articulate (Figs 12B–C, 13B–C) ..... 18
- 17A. Pereopods 3 and 4, dactyl with 2–3 spinules; uropod 2, inner ramus lacking marginal setae; uropod 3, outer ramus moderately to densely setose (Fig. 21A) ..... *P. parva*
- 17B. Pereopods 3 and 4, dactyl with four spinules; uropod 2, inner ramus with a few marginal setae; uropod 3, outer ramus, poorly setose (Fig. 16A) ...  
..... *P. kogelensis*
- 18A. Antenna 2, flagellum with 15–17 articles; pereopods 3 and 4, dactyl with 2–3 spinules; pereopods 5–7, dactyl with 5–7 spinules; coxa 4 distinctly, but moderately excavate posteriorly; uropods 1 and 2, rami lacking setae; uropod 3, outer ramus poorly setose (Fig. 12A) ..... *P. barnardi*
- 18B. Antenna 2, flagellum usually with more than 17 articles; pereopods 3 and 4, dactyl with 3–6 spinules; pereopods 5–7, dactyl with 8–13 spinules; uropods 1 and 2, inner rami with marginal setae; uropod 3, outer ramus, strongly setose (Fig. 13A) ..... *P. capensis*

*Paramelita aurantia* (Barnard, 1927)

Fig. 11

*Gammarus aurantius* Barnard, 1927: 173–174, pl. 10 (figs 6, 16).

*Paramelita aurantius* (Barnard) Thurston, 1973: 167. Griffiths, 1981: 82, fig. 2J.

*Material examined*

*Types.* Syntypes, SAM-A3997, from Landdrost Kloof, Hottentots Holland Mountains.

*Other material.* SAM-A4005, from valley at foot of Vallei Berg, Hottentots Holland Mountains. SAM-A4014, from Moordenaars Kop, Hottentots Holland Mountains. SAM-A4869, from Caledon side of Landdrost Kloof, Hottentots Holland Mountains. SAM-A40234, from a tributary of the Du Toit's River on Franchhoek Pass, Villiersdorp side. SAM-A40235, from a stream flowing through the Nuweberg State Forest on Viljoen's Pass.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum about 20- to 32-articulate, accessory flagellum 3- to 4-articulate. Antenna 2 sparsely to moderately setose, shorter than 1, only slightly stouter than 1 in males, flagellum with about 12–13 articles. Coxa 4, posterior margin with a slight emargination. Gnathopod 2, article 2 sometimes weakly spinose medially, palm transverse to slightly oblique, with 2–5 defining spines. Pereopods 3–7 unmodified, dactyl with 2–10 spinules. Uropod 1, peduncle spinose, sometimes with a few setae, rami subequal, with marginal and apical spines, lacking setae. Uropod 2, peduncle spinose, sometimes bearing at least one seta, inner ramus slightly longer than outer ramus, both with marginal and apical spines, lacking setae. Uropod 3, inner ramus about 0.3 length of outer, apically spinose, outer ramus with

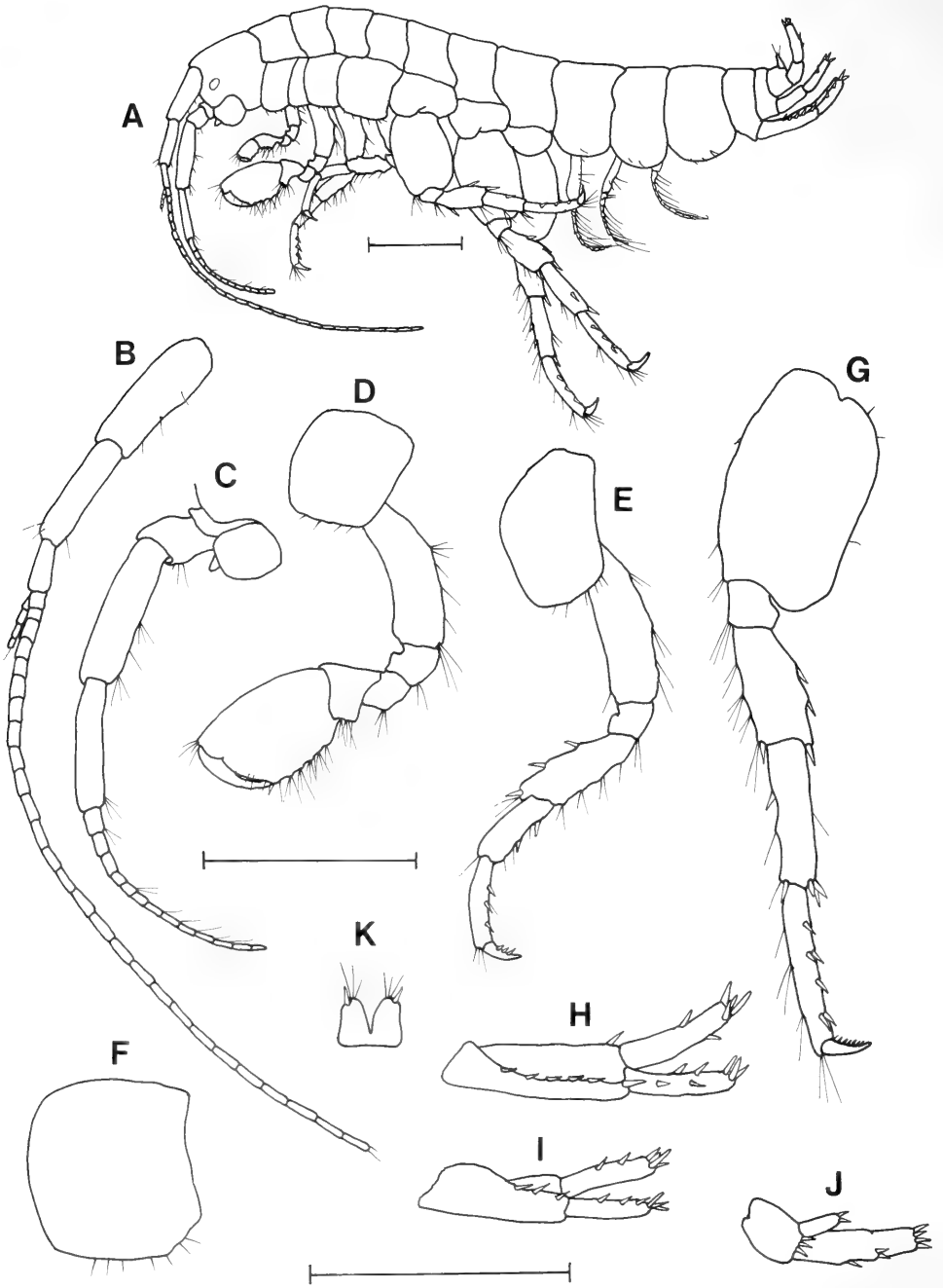


Fig. 11. *Paramelita aurantia*, SAM-A3997, syntype, male, 6.8 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. K. Telson. Scale lines represent 1 mm.

marginal and apical spines, sparsely setose, second segment rudimentary. Telson deeply cleft, each lobe bearing one spine and a few setae.

#### Remarks

This species is identified by the possession of an unmodified, sparsely to moderately setose, and relatively short antenna 2 in males, an almost quadrate coxa 4, the relative lack of setae on uropods 1 and 2, and its orange colour when alive. It most closely resembles *Paramelita granulicornis*, but can be distinguished from this species by the lack of a tooth on the palm of gnathopod 2, and the absence of spines on the medial surface of article 2 of pereopods 3 and 4.

#### Distribution

From streams draining the slopes of Hottentots Holland and Franchhoek mountains (Fig. 29).

#### *Paramelita barnardi* Thurston, 1973

Fig. 12

*Paramelita barnardi* Thurston, 1973: 159–168, figs 1–3. Griffiths, 1981: 85, fig. 2A–C.

#### Material examined

*Types.* Allotype, SAM–A16808, from Boomslang Cave, Kalk Bay Mountains.

*Other material.* SAM–A40239, from Boomslang Cave, Kalk Bay Mountains. SAM–A40796, Avernus Crack, Cave Peak, Kalk Bay.

#### Diagnosis

Eyes white. Antenna 1 sparsely setose, flagellum 33- to 36-articulate, accessory flagellum with 4–5 articles. Antenna 2 shorter than 1, moderately setose, flagellum with 15–17 articles. Coxa 4 distinctly but shallowly excavate posteriorly. Gnathopod 2, palm oblique, with 4–5 defining spines. Pereopods 3 and 4 moderately setose, unmodified, dactyl with 2–3 spinules. Pereopods 5–7 moderately setose, dactyl with 5–7 spinules. Uropod 1, peduncle spinose, sometimes with a single seta, rami subequal, with marginal and apical spines, lacking setae. Uropod 2, peduncle spinose, inner ramus slightly longer than outer, both rami with marginal and apical spines, lacking setae. Uropod 3, inner ramus about 0.4 length of outer, apically spinose, outer ramus very poorly setose, with several groups of marginal and apical spines, second segment short, about 4 per cent length of first. Telson deeply cleft, left lobe bearing a single spine and some setae, right lobe with 1–2 spines and some setae.

#### Remarks

This species is morphologically similar to *Paramelita capensis*, *P. kogelensis* and *P. parva*, but can be separated from these species based on its relatively weakly excavate coxa 4, its poorly setose uropod 3, and the number of articles in the flagellum of antenna 2.

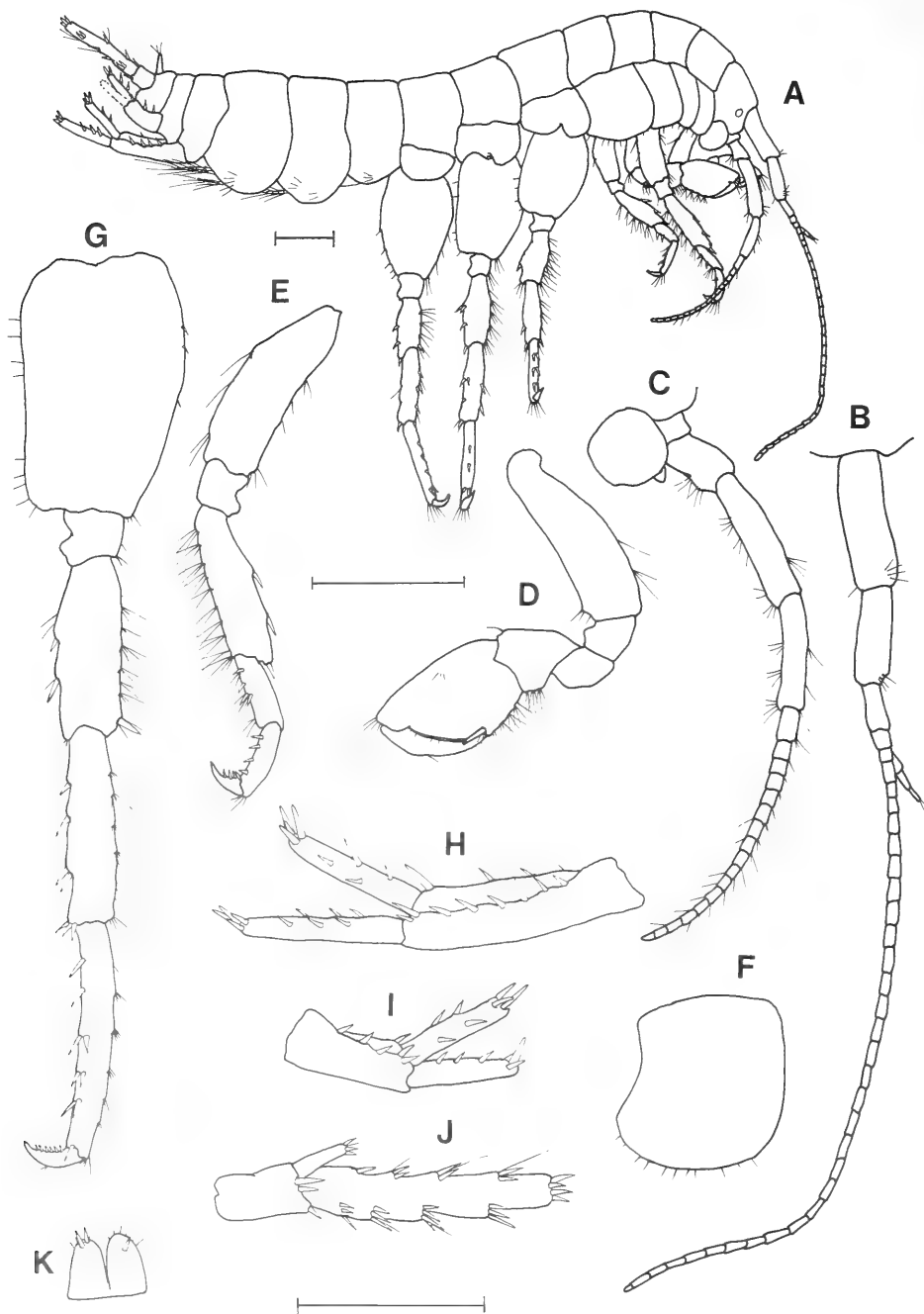


Fig. 12. *Paramelita barnardi*, SAM-A40239, male, 9.5 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. K. Telson. Scale lines represent 1 mm.

*Distribution*

Known only from caves in the Kalk Bay Mountains, Cape Peninsula (Fig. 29).

*Paramelita capensis* (Barnard, 1916)

Fig. 13

*Gammarus capensis* Barnard, 1916: 203–205, pl. 27 (figs 20–22) (*part.*, non SAM–A3083); 1927: 169.

*Paramelita ctenodactyla* Schellenberg, 1926: 367, fig. 57.

*Paramelita capensis* (Barnard) Griffiths, 1981: 85, fig. 4. Stewart, 1992: 288.

*Material examined*

*Types.* Syntypes, SAM–A2259, from Table Mountain.

*Other material.* SAM–A195, A2258, A2459, A2552, A2598, A2963, A2967, A2968, A3033, A3866, A4008 and A41009, all from various localities on Table Mountain. SAM–A2960, from Muizenberg Mountains. SAM–A4565, from Hout Bay. SAM–A6604, from the Cedarberg. SAM–A7328, from Noordhoek forest. SAM–A40242, Echo Valley, Table Mountain. SAM–A40524, Bokkeman's Kloof, Hout Bay. SAM–A40532 and A41006, Constantiaberg. SAM–A40813, The Baths, Citrusdal. SAM–A40814, Grotto Ravine, Table Mountain. SAM–A40815, Blackburn Ravine, Hout Bay. SAM–A40817, Platteklip Gorge, Table Mountain. SAM–A40818, tributary of the Spansemat River, Cape Peninsula. SAM–A41221, source of Disa River, above Hout Bay.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum approximately 40- to 80-articulate, accessory flagellum 5- to 8-articulate. Antenna 2 usually shorter than 1, moderately setose, peduncle long and slender, stouter than 1, flagellum with about 15–35 articles. Coxa 4 strongly excavate posteriorly. Gnathopod 2, article 2 either with long spine-like setae, or with stout spines on medial, posterior margin, palm strongly oblique, with 3–5 defining spines. Pereopods 3 and 4 moderately setose, unmodified, article 2 usually either with spine-like setae or strong spines medially, dactyl with 3–6 spinules. Pereopods 5–7 moderately setose, dactyl with 8–13 spinules. Uropod 1, peduncle spinose, with very few setae, rami subequal, inner ramus with marginal spines and setae, outer ramus with marginal spines, rarely with setae, both ending in apical spines. Uropod 2, peduncle spinose, inner ramus slightly longer than outer, both with marginal and apical spines and marginal setae. Uropod 3, inner ramus 0.2 length of outer, apically spinose, outer ramus with marginal and apical spines, strongly setose, distinct second segment. Telson deeply cleft, each lobe bearing one spine and many apical and subapical setae.

*Remarks*

This species closely resembles *Paramelita barnardi*, *P. kogelensis* and *P. parva*, but is distinguished from these species by its large size at maturity, strongly oblique palm of gnathopod 2, deeply excavate coxa 4, and densely setose uropod 3.

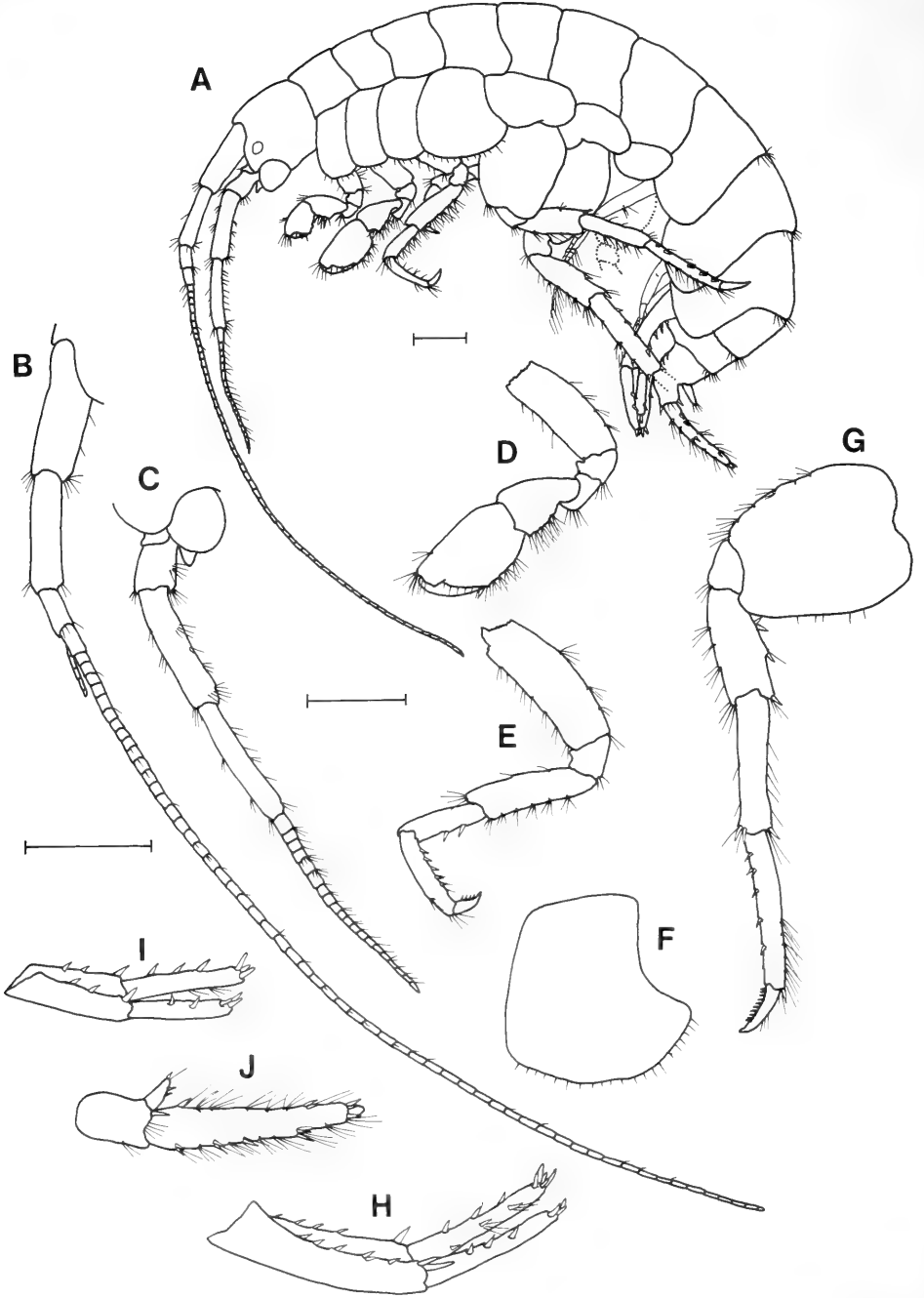


Fig. 13. *Paramelita capensis*, SAM-A2259, syntype, male, 16.3 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 5. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.



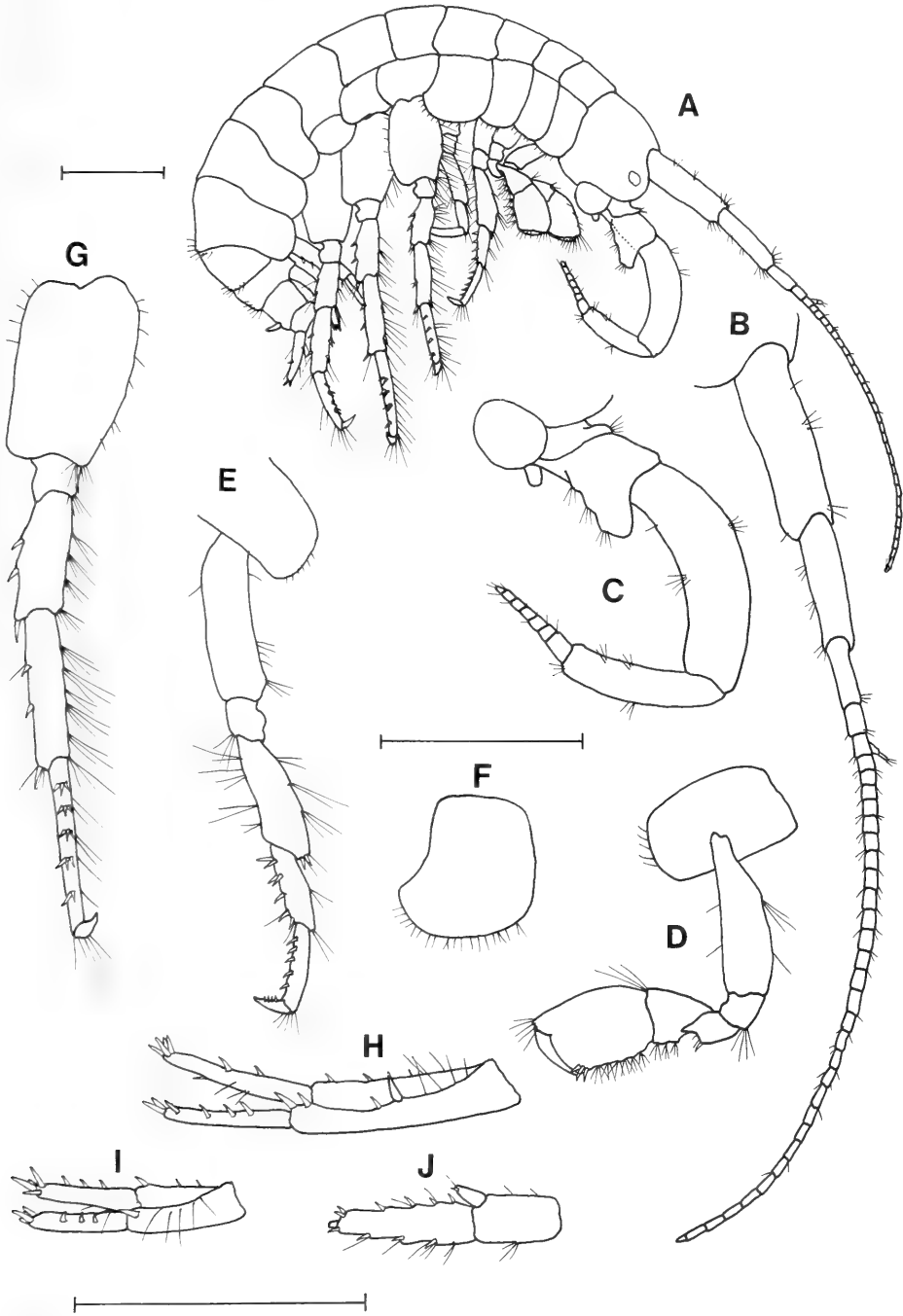


Fig. 14. *Paramelita flexa*, SAM-A40782, male, 7.9 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Distribution*

Apparently widespread, collected from streams in the Cedarberg area in the north, to the Cape Peninsula in the south (Fig. 29).

*Paramelita flexa* Griffiths, 1981

Fig. 14

*Paramelita flexa* Griffiths, 1981: 86-89, fig. 5.

*Material examined*

*Types.* Holotype, Albany Museum MISC 52B, from a tributary of the Palmiet River between Elgin and Grabouw. Paratypes, SAM-A16776, from the same locality as the holotype.

*Other material.* SAM-A40782 and A40788, Highlands State Forest, Kleinmond.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum about 26-articulate, accessory flagellum 5-articulate. Antenna 2 shorter than 1, in males, article 3 strongly lobed posterodistally, article 4 curved ventrally and article 5 bent at right angles to 4, flagellum 16-articulate. Coxa 4 distinctly excavate posteriorly. Gnathopod 2, palm slightly oblique, with three defining spines. Pereopods 3 and 4 unmodified, dactyl with 3-4 spinules. Pereopods 5-7, dactyl with 4-9 spinules. Uropod 1, peduncle spinose, lacking setae, rami subequal, with marginal and apical spines, no setae. Uropod 2, peduncle spinose and setose, inner ramus slightly longer than outer, both with marginal and apical spines, lacking setae. Uropod 3, inner ramus 0.3 length of outer, with some spines on apex, outer ramus with marginal and apical spines and setae, second segment distinct. Telson deeply cleft, each lobe with one spine and some setae.

*Remarks*

The combination of a protruded posterior margin in article 3 of antenna 2, an excavate coxa 4, multispinose dactyls and the presence of a second segment on the outer ramus of uropod 3 makes this species distinctive. It is highly unlikely that the 'lobe' on article 3 of antenna 2 is homologous to the semi-circular lobe found in *Aquadulcaris auricularia*, *A. andronyx* and *A. pheronyx*.

*Distribution*

Known from a stream flowing through the Highlands State Forest and also from a tributary of the Palmiet River on the Grabouw-Elgin road, between Hottentots Holland and Groenland mountains (Fig. 29).

*Paramelita granulicornis* (Barnard, 1927)

Fig. 15

*Gammarus granulicornis* Barnard, 1927: 175-177, pl. 10 (figs 10-11, 20).

*Paramelita granulicornis* (Barnard) Thurston, 1973: 167. Griffiths, 1981: 89, fig. 2H-I.

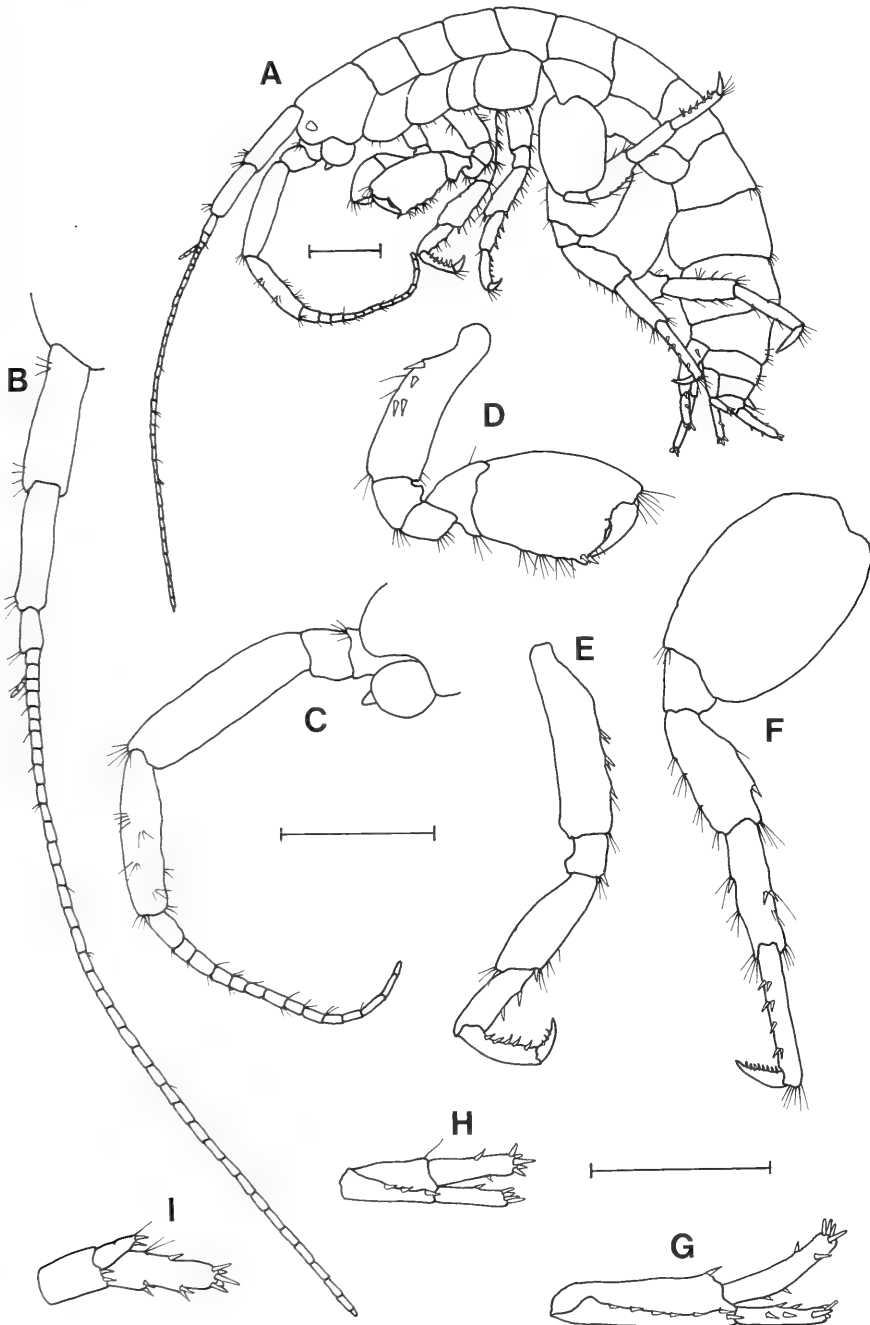


Fig. 15. *Paramelita granulicornis*, SAM-A40236, male, 10.3 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Pereopod 6. G. Uropod 1. H. Uropod 2. I. Uropod 3. Scale lines represent 1 mm.

*Material examined*

*Types.* Syntypes, SAM-A4874 and A5178, from Steenbras River.

*Other material.* SAM-A5182, A5183 and A5185, all from the Hottentots Holland Mountains. SAM-A40236, from a stream on Houhoek Pass. SAM-A40237, from a tributary of the Palmiet River flowing near the Orchard's Farm Stall. SAM-A40238 and A40787, from a tributary of the Palmiet River below Elephant Rock. SAM-A40781 and A40786, Grabouw Forest. SAM-A40779, between Kleinmond and Betty's Bay. SAM-A40945, Gordon's Bay.

*Diagnosis*

Eyes white. Antenna 1, sparsely setose, flagellum about 27- to 40-articulate, accessory flagellum 4- to 5-articulate. Antenna 2 sparsely to moderately setose, shorter than 1, moderately stout, peduncle sometimes elongate in males, flagellum with about 12-16 articles. Coxa 4 quadrate. Gnathopod 2, article 2 posteriorly spinose, palm transverse, defining angle forming a small protruding rounded tooth, with three spines. Pereopods 3 and 4, article 2 strongly spinose posteriorly, article 4 often considerably longer and wider than 5, dactyl with 2-3 spinules. Pereopods 5-7, dactyl with 4-8 spinules. Uropod 1, peduncle spinose, lacking setae, rami subequal, bearing marginal and apical spines, lacking setae. Uropod 2, peduncle with spines and usually at least one seta, inner ramus longer than outer, both with marginal and apical spines, lacking setae. Uropod 3, inner ramus about 0.4 length of outer ramus, with some apical setae and at least one seta, outer ramus with marginal and apical spines and setae, second segment rudimentary. Telson deeply cleft, each lobe bearing one spine and several setae.

*Remarks*

This species is most like *Paramelita aurantia*, from which it is distinguished by the possession of a strongly convex palm with palmar tooth in gnathopod 2. *Paramelita granulicornis* shares this condition with *P. platypus*, and it is possible that these two species are closely related. Both species have almost quadrate fourth coxal plates, and Barnard (1927: 176) commented on how article 4 in pereopods 3 and 4 is 'strongly expanded distally', and article 5 is 'noticeably shorter' than article 4 in *P. granulicornis*. This condition is extremely well developed in *P. platypus*. Any further decisions regarding the position of *P. granulicornis* will be taken once genetic analysis of *Paramelita* is complete.

*Distribution*

Known from the Hottentots Holland Mountains and adjacent areas (Fig. 29).

*Paramelita kogelensis* (Barnard, 1927)

Fig. 16

*Gammarus kogelensis* Barnard, 1927: 172-173, pl. 10 (figs 9, 21).

*Paramelita kogelensis* (Barnard) Thurston, 1973: 167. Griffiths, 1981: 89, fig. 2G.

*Material examined*

*Types.* Syntypes, SAM-A4873, west of Kogelberg.

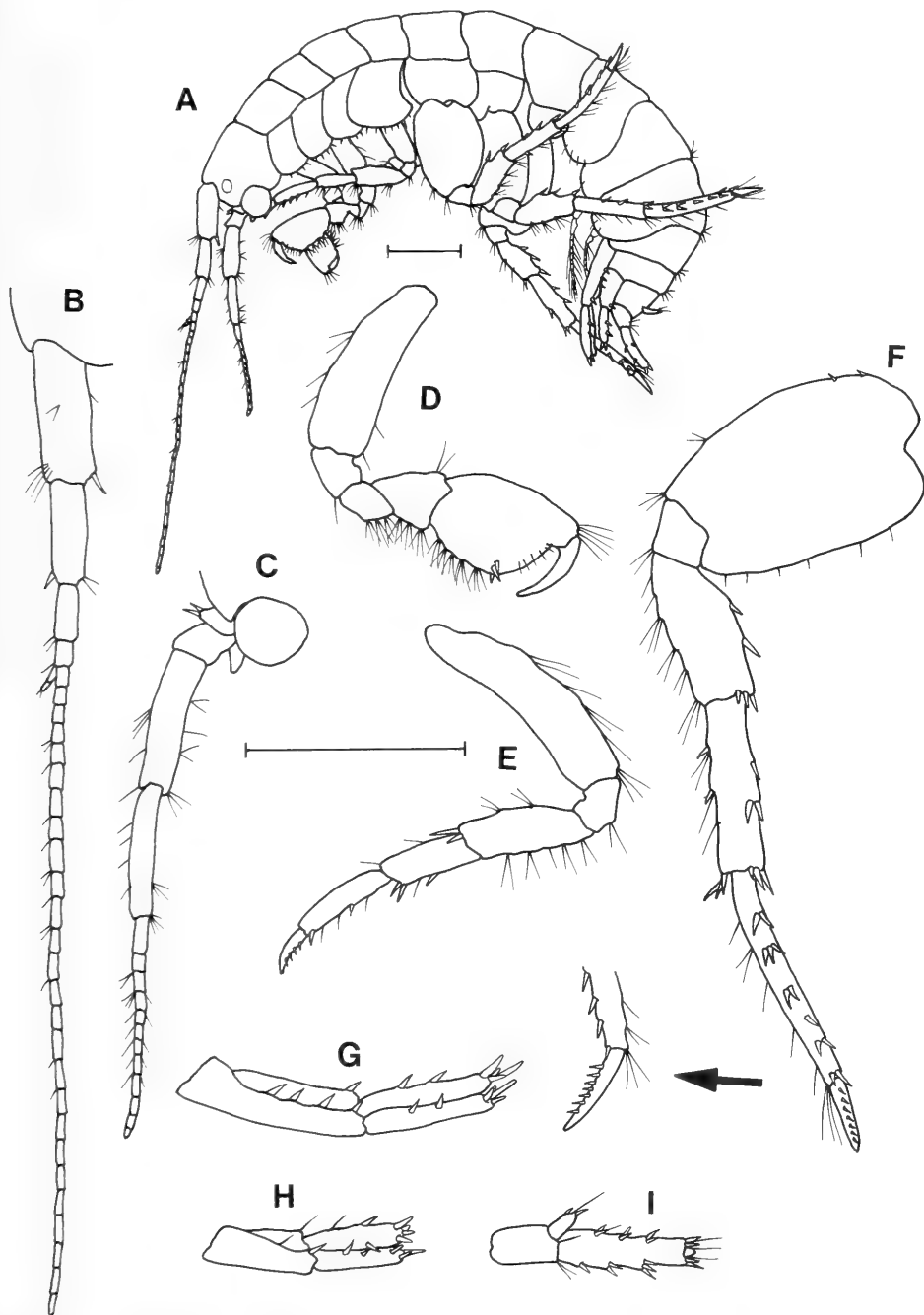


Fig. 16. *Paramelita kogelensis*, SAM-A40243, male, 8.0 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Pereopod 6. G. Uropod 1. H. Uropod 2. I. Uropod 3. Scale lines represent 1 mm.

*Other material.* SAM-A5174, Kogelberg. SAM-A5190, on way to Kogelberg from Steenbras. SAM-A40243, Viljoen's Pass, Nuweberg State Forest. SAM-A40529, Steenbras River.

### *Diagnosis*

Eyes white. Antenna 1 sparsely setose, peduncle sometimes spinose, flagellum 27- to 34-articulate, accessory flagellum 3- to 5-articulate. Antenna 2 shorter than 1, sparsely to densely setose, flagellum 12- to 16-articulate. Coxa 4, posterior margin, distinctly excavate. Gnathopod 2, article 2 not medially spinose, palm slightly to moderately oblique, with 2-3 defining spines. Pereopods 3 and 4 unmodified, dactyl with 2-4 spinules. Pereopods 5-7, dactyl with 5-8 spinules. Uropod 1, peduncle spinose, lacking setae, rami subequal, with marginal and apical spines, inner ramus rarely with setae. Uropod 2, peduncle spinose, rarely with one seta, inner ramus slightly longer than outer, both with marginal and apical spines, inner ramus rarely with 1-2 setae. Uropod 3, inner ramus 0.2-0.3 length of outer, apically spinose and sometimes with 1-2 setae, outer ramus with marginal and apical spines, sparsely setose, distinct second segment present. Telson deeply cleft, each lobe with one spine and 3-4 setae.

### *Remarks*

One of four morphologically similar species, *Paramelita kogelensis* is distinguished from *P. parva*, *P. barnardi* and *P. capensis* by the number of articles in the flagella of antennae 1 and 2, spination of the dactyl of pereopods 3 and 4, and the setation of the inner rami of uropod 1 and the outer ramus of uropod 3.

### *Distribution*

Collected from localities on the Hottentots Holland and adjacent mountains (Fig. 29).

### *Paramelita magna* Stewart & Griffiths, 1992

Fig. 17

*Paramelita magna* Stewart & Griffiths, 1992c: 491-494, figs 2-3.

### *Material examined*

*Types.* Holotype, SAM-A40208; paratypes, SAM-A40209, from a tributary of the Krom River in the Cape of Good Hope Nature Reserve.

*Other material.* SAM-A3083, Kalk Bay (= Barnard's 1916: 205, SAM-A3084—typographical error). SAM-A4563, from Noordhoek. SAM-A40210, from the Booiskraal River, and SAM-A40211 and A41011, from the Buffels River, both in the Cape of Good Hope Nature Reserve. SAM-A40212, from Nellies Pool, and SAM-A40213 and A40798, from the Silvermine River, both in the Silvermine Nature Reserve. SAM-A40515, Klassjagers River, Cape Point. SAM-A40930 and A40932, De Goede Hoop Estate, Noordhoek (latter incorrectly assigned to A40214 in Stewart & Griffiths (1992c)).

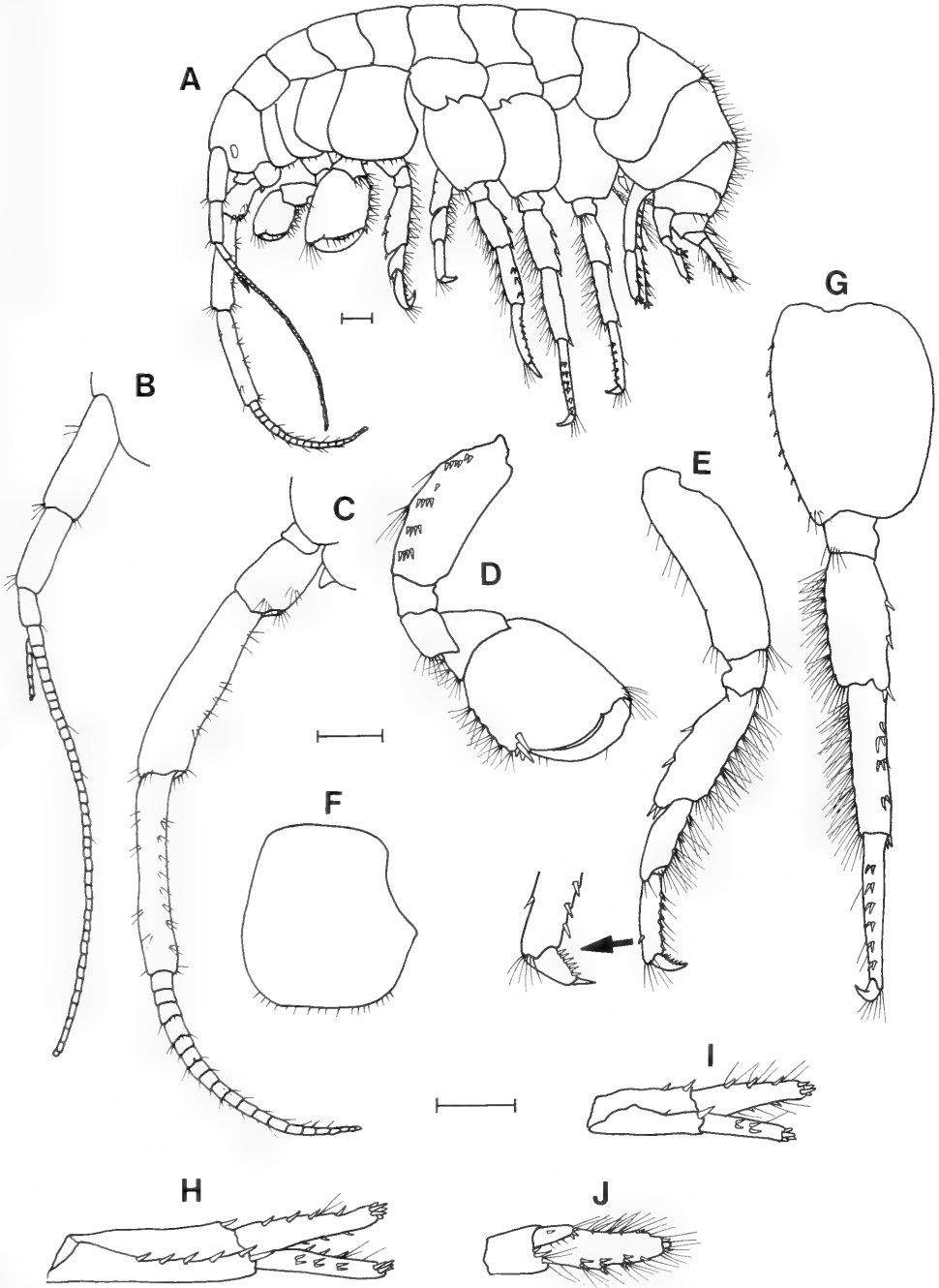


Fig. 17. *Paramelita magna*, SAM-A40208, holotype, male, 22.3 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 37- to 42-articulate, accessory flagellum 6- to 8-articulate. Antenna 2 sparsely to moderately setose, in males, peduncle stout and elongate so that antenna 2 equal to, or exceeding antenna 1 in length, flagellum with 16-19 articles. Coxa 4, posterior margin excavate. Gnathopod 2, medial posterior margin of article 2 strongly spinose in males, palm slightly oblique, defined by five spines. Pereopods 3 and 4 unmodified, moderately to densely setose posteriorly, dactyl with 4-6 spinules. Pereopods 5-7 strongly setose anteriorly, dactyl with 8-10 spinules. Uropod 1, peduncle spinose, usually lacking setae, rami subequal, with marginal spines and setae and apical spines. Uropod 2, peduncle spinose, sometimes with a few setae, inner ramus longer than outer, both with marginal spines and setae and apical spines. Uropod 3, inner ramus 0.3 length of outer, apex spinose and setose, outer ramus with marginal and apical spines and setae, second segment distinct, about 6 per cent length of first. Telson deeply cleft, each lobe usually with one spine and many setae, right lobe sometimes with two spines.

*Remarks*

Some of the largest specimens of *Paramelita* collected are members of this species. *Paramelita magna* is easily recognized by its dark brown colour, markedly setose urosome and pereopods, and the possession of stout elongate second antennae in males. It is distinguished from *P. validicornis* by the relative length of the peduncle and outer ramus in uropod 3, and from *P. magnicornis* by the setation of the uropods, body colour, and the lack of modification of pereopod 3.

*Distribution*

In streams draining mountainous areas in the southern part of the Cape Peninsula (Fig. 29).

*Paramelita magnicornis* Stewart & Griffiths, 1992

Fig. 18

*Paramelita magnicornis* Stewart & Griffiths, 1992a: 144-148, figs 3-4.

*Material examined*

*Types.* Holotype, SAM-A40009; paratypes, SAM-A40010, from a stream draining the Swartkop Mountains near Miller's Point.

*Other material.* SAM-A40011 and SAM-A40015, from a stream draining Chapman's Peak. SAM-A40012, from a stream in the Kalk Bay Mountains near Clovelly. SAM-A40013, from a stream near Miller's Point. SAM-A40014, A40016, and A40940, from Peck's Valley on Boyes Drive. SAM-A40773, Swellendam Mountains.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 27- to 40-articulate, accessory flagellum 4- to 6-articulate. Antenna 2 sparsely to moderately setose,



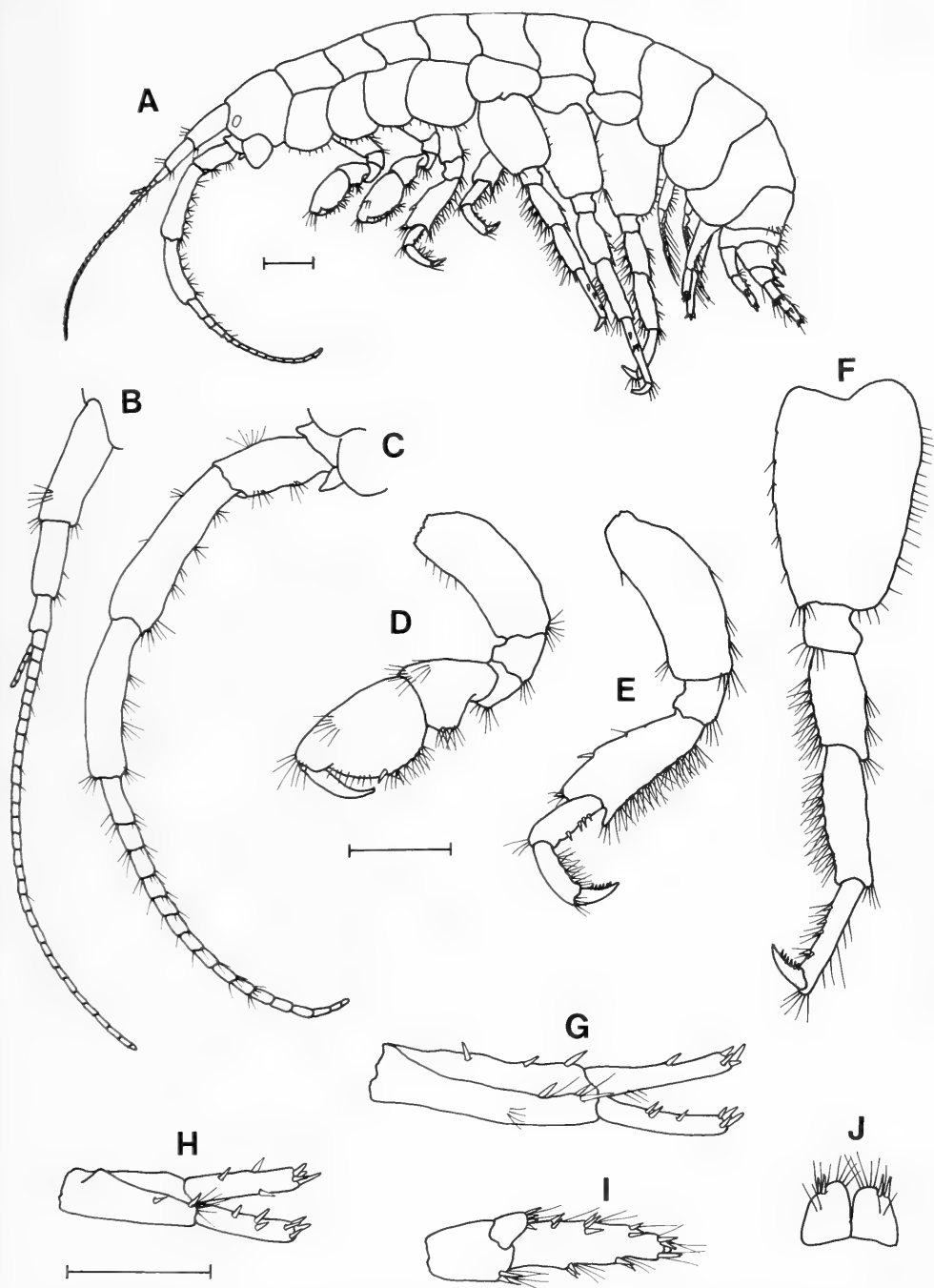


Fig. 18. *Paramelita magnicornis*, SAM-A40009, holotype, male, 15.0 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Pereopod 7. G. Uropod 1. H. Uropod 2. I. Uropod 3. J. Telson. Scale lines represent 1 mm.

in males, articles 3, 4 and 5 of peduncle elongate and stout, with articles 4 and 5 distally swollen, antenna 2 exceeding 1 in length, flagellum 13- to 21-articulate. Coxa 4, posterior margin excavate. Gnathopod 2, article 2 spinose on medial posterior margin in males, palm oblique, defined by 3-4 stout spines. Pereopods 3 and 4 moderately to densely setose posteriorly, in males, article 4 posterodistally protruded into a triangular tooth, dactyl with 4-6 spinules. Pereopods 5-7, moderately to densely setose, dactyl with 6-9 spinules. Uropod 1, peduncle spinose and setose, rami subequal, both with marginal and apical spines, inner ramus with a few setae. Uropod 2, peduncle spinose and setose, inner ramus slightly longer than outer, both with marginal and apical spines, inner ramus sometimes with a few setae, outer ramus lacking setae. Uropod 3, inner ramus 0.3 length of outer, apex spinose, outer ramus with marginal and apical spines and setae, second segment distinct but small, about 5 per cent length of first. Telson deeply cleft, each lobe with 1-2 spines and many setae.

### Remarks

This species is usually distinguished by the elongation of antenna 2, and the posterodistal projection of article 4 in pereopods 3 and 4. Populations in which this 'tooth' on article 4 is absent or poorly developed are distinguished from *Paramelita magna* by setation of the uropods and body colour and size.

### Distribution

Originally thought to be confined to the Cape Peninsula, this species has recently been discovered in the Swellendam Mountains (Fig. 29).

### *Paramelita nigroculus* (Barnard, 1916)

Fig. 19

*Gammarus nigroculus* Barnard, 1916: 206-207, pl. 27 (fig. 23); 1927: 168-169.

*Paramelita nigroculus* (Barnard) Thurston, 1973: 166. Griffiths, 1981: 89-90, fig. 6.

*Paramelita nigroculus* var. *persetosus* Barnard, 1927: 168-169.

### Material examined

*Types.* Syntypes, SAM-A3059, from a stream above Oranjezicht, Table Mountain. Syntypes, *Paramelita nigroculus* var. *persetosa*, SAM-A4877, from Sneeuwgat near Tulbagh.

*Other material.* SAM-A1270, Devil's Peak, Table Mountain. SAM-A2461 and A4009, Platteklip Gorge, Table Mountain. SAM-A2966 and A3060-A3062, Table Mountain. SAM-A3038, Kirstenbosch. SAM-A4002, north of Landdroskloof, Caledon side. SAM-A4016 and A4871, Steenbras River. SAM-A4560, Jonkershoek, opposite Diep Gat. SAM-A4876, Tulbagh. SAM-A4878-A4884, all from localities near Sneeuwgat, north of Tulbagh. SAM-A4885, Franchhoek Mountains. SAM-A4887, Vlakte, Ceres. SAM-A5188, Hottentots Holland Mountains. SAM-A6054, A6055 and A8273, Zonderend Mountains. SAM-A6296, Montagu. SAM-A6602, Middelberg plateau, Cedarberg. SAM-A6603 and A6965, Tafelberg, Cedarberg. SAM-A6936-A6938, Swellendam Mountains. SAM-A6944, Simonsberg. SAM-A6945,

Witte River. SAM-A7335, Schuiffenberge, east of Citrusdal. SAM-A8196, Krom River, Cedarberg. SAM-A12308, Porterville. SAM-A40264, A40266 and A40271, Du Toit's Kloof. SAM-A40267, Bain's Kloof Pass. SAM-A40269, Steenboks Nature Reserve. SAM-A40270, Paarl Rocks. SAM-A40273, Dwarsrivierhoek, near Stellenbosch. SAM-A40274 and A40941, Wemmershoekdam. SAM-A40275, Franchhoek Pass. SAM-A40519, A40522 and A40937, Cedarberg Mountains. SAM-A40520, A40790, A40791 and A40792, Piketberg. SAM-A40523, Tradouw Pass, Barrydale. SAM-A40527, Grey's Pass. SAM-A40533 and A41008, Kasteelberg. SAM-A40774 and A40793, Grootvadersbos, east of Swellendam. SAM-A40776, between Kleinmond and Betty's Bay. SAM-A40926 and A40943, Mitchell's Pass, Ceres. SAM-A40931, Keyers River, Cape Peninsula. SAM-A40938, Winterhoek Mountains, Tulbagh. SAM-A40944, Swellendam Mountains.

### Diagnosis

Eyes black. Antenna 1 sparsely setose, flagellum 20- to 70-articulate, accessory flagellum 4- to 5-articulate. Antenna 2 shorter than 1, sparsely to densely setose, slender to stout, flagellum 15- to 22-articulate. Coxa 4, posterior margin strongly excavate. Gnathopod 2, article 2 not medially spinose, articles 5 and 6 markedly elongate or not, palm slightly oblique, with 2-4 defining spines. Pereopods 3 and 4 unmodified, moderately to densely setose, dactyl with 3-7 spinules. Pereopods 5-7 moderately to densely setose, dactyl with 5-10 spinules. Uropod 1, peduncle spinose and setose, rami subequal, both with marginal and apical spines, inner ramus setose or not. Uropod 2, peduncle spinose and setose, both rami with marginal and apical spines, inner ramus setose or not. Uropod 3, inner ramus 0.2-0.3 length of outer, apically spinose, margins and apex setose, outer ramus with marginal and apical spines, sparsely to densely setose, second segment present or not. Telson deeply cleft, each lobe with one spine and many apical and dorsal setae.

### Remarks

All populations of *Paramelita* that have black eyes have been considered members of a single widespread species, *P. nigroculus*, despite morphological variation between them. For example, some populations have individuals with elongate, stout second antennae, whereas in others these antennae are relatively slender and short. Barnard (1927) recognized a variety, *P. nigroculus* var. *persetosus*, based mainly on specimens from the Sneeuwgat valley north of Tulbagh. These animals have densely setose second antennae, pereopods and uropods. Setation in *P. nigroculus* can vary considerably between populations as well as within one population, and is usually related to maturity, with the larger older individuals more setose than younger specimens. Therefore, Barnard (1927) was reluctant to consider these populations with highly setose second antennae as a separate species. There is a need for a thorough, morphological and genetic investigation of all black-eyed *Paramelita* populations.

### Distribution

Widely distributed from the Cedarberg in the north to Swellendam in the east (Fig. 29).

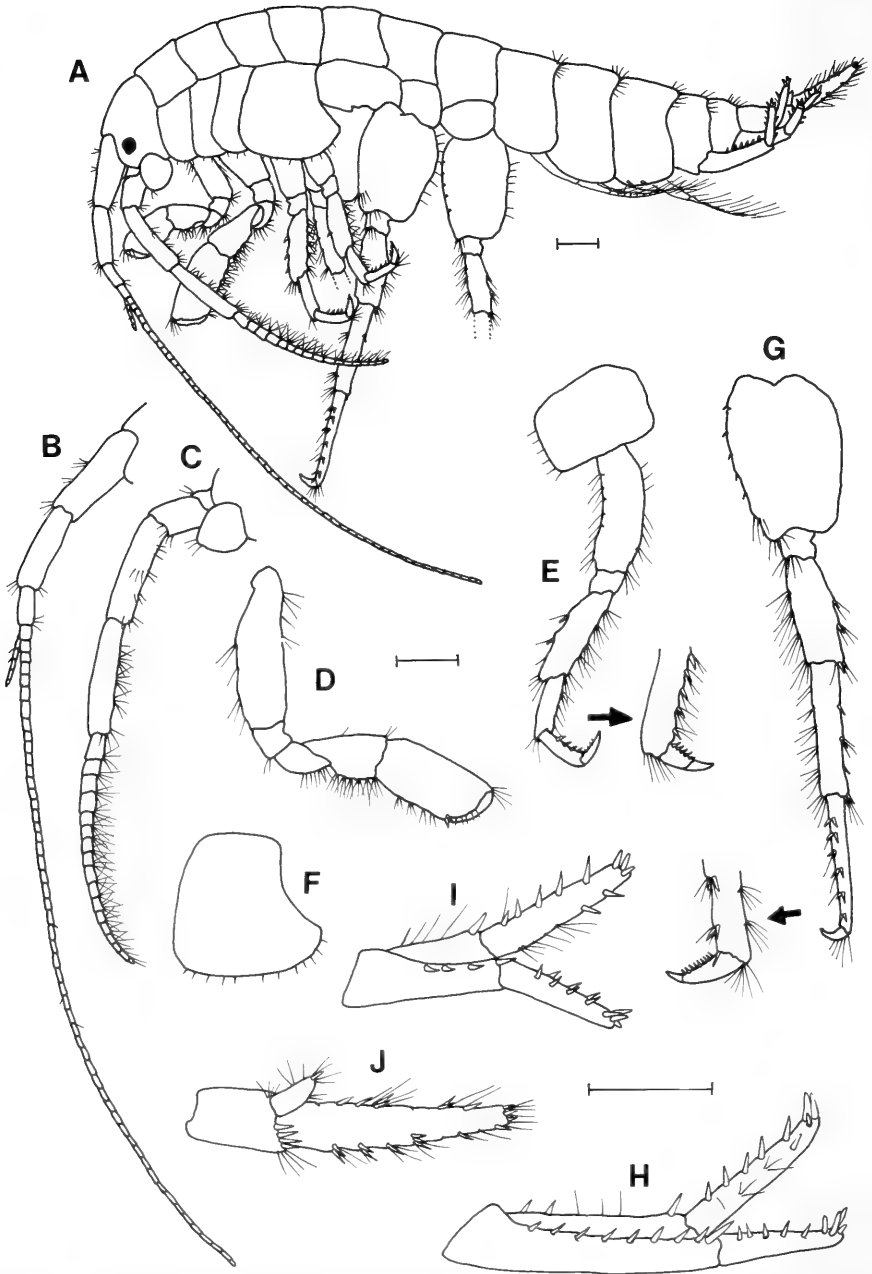


Fig. 19. *Paramelita nigroculus*, SAM-A8273, male, 18.0 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

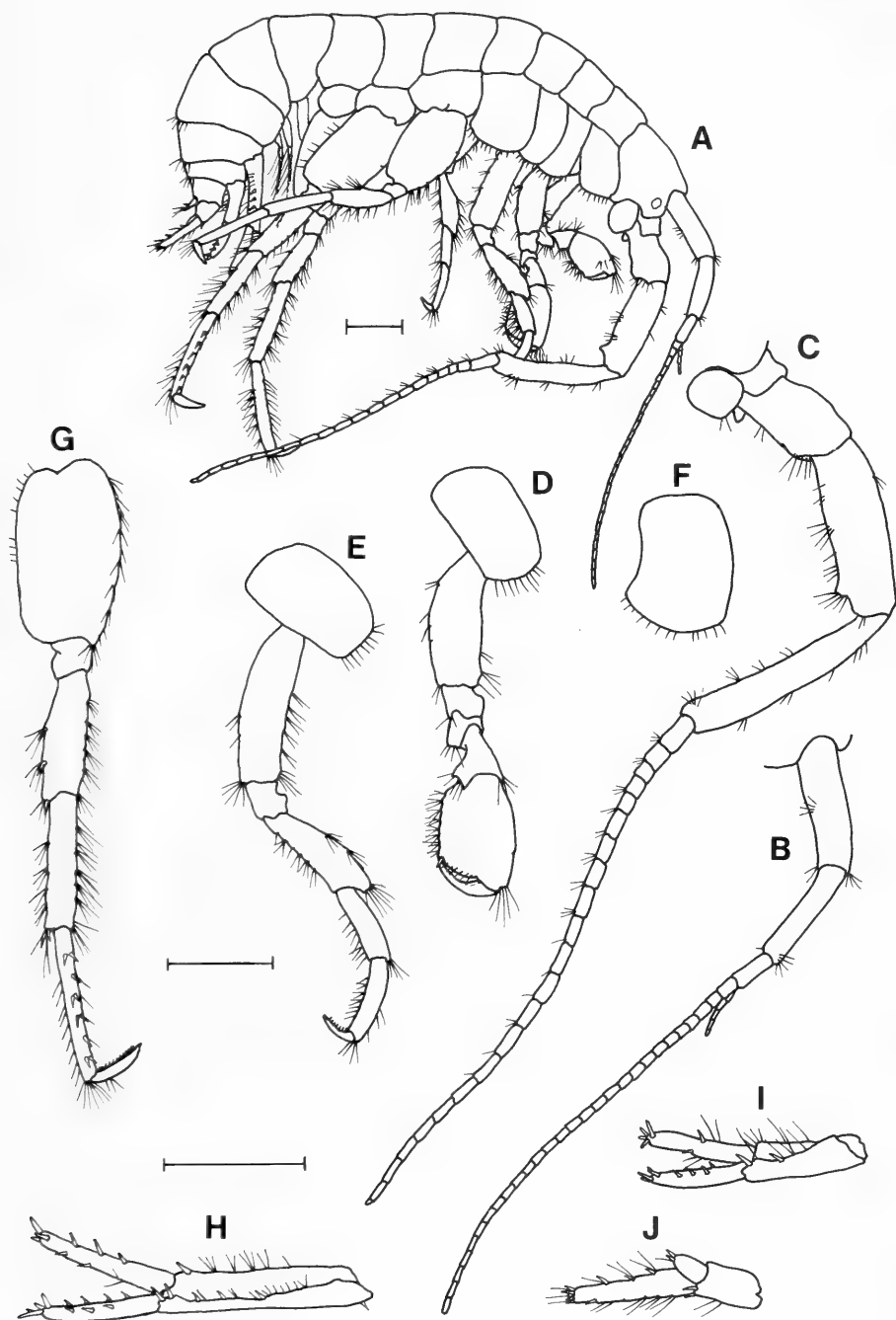


Fig. 20. *Paramelita odontophora*, SAM-A40241, paratype, male, 11.1 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Paramelita odontophora* Stewart, Snaddon & Griffiths, 1994

Fig. 20

*Paramelita odontophora* Stewart *et al.*, 1994: 191–194, figs 5–6.*Material examined*

*Types.* SAM–A40240, holotype, SAM–A40241; paratypes, from a tributary of the Palmiet River, near Elgin.

*Other material.* SAM–A40250, tributary of the Palmiet River, near Kleinmond. SAM–A40783, A40939, tributary of the Palmiet River, near Elgin. SAM–A40936, Grabouw Forest.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 35- to 38-articulate, accessory flagellum 4- to 5-articulate. Antenna 2 sparsely setose, in males, both peduncle and flagellum extremely elongate so that antenna 2 is considerably longer than 1, article 4 with a subterminal posterodistal tooth, flagellum with 19–22 articles. Coxa 4, posterior margin excavate. Gnathopod 2, article 2 spinose on posterior, medial margin in males, palm slightly oblique, with four defining spines. Pereopods 3 and 4 unmodified, moderately setose, dactyl with 4–7 spinules. Pereopods 5–7 moderately to densely setose, dactyl with 11–13 spinules. Uropod 1, peduncle spinose and setose, rami subequal, both with marginal and apical spines, inner ramus sometimes with a single seta. Uropod 2, peduncle spinose and setose, rami approximately subequal, both with marginal and apical spines, inner ramus with a few marginal setae. Uropod 3, inner ramus 0.3 length of outer, with two apical spines, outer ramus with marginal and apical spines and setae, second segment distinct but small, about 4–5 per cent of first. Telson deeply cleft, each lobe with a single spine and about 6–8 setae.

*Remarks*

The extremely elongate antenna 2 with a subterminal ‘tooth’ on article 4 of the peduncle in males makes this species unmistakable.

*Distribution*

Known from tributaries of the Palmiet River (Fig. 29).

*Paramelita parva* Stewart & Griffiths, 1992

Fig. 21

*Paramelita parva* Stewart & Griffiths, 1992c: 501–504, figs 8–9.*Material examined*

*Types.* Holotype, SAM–A40226; paratypes, SAM–A40227, from a tributary of the Storms River, eastern Cape.

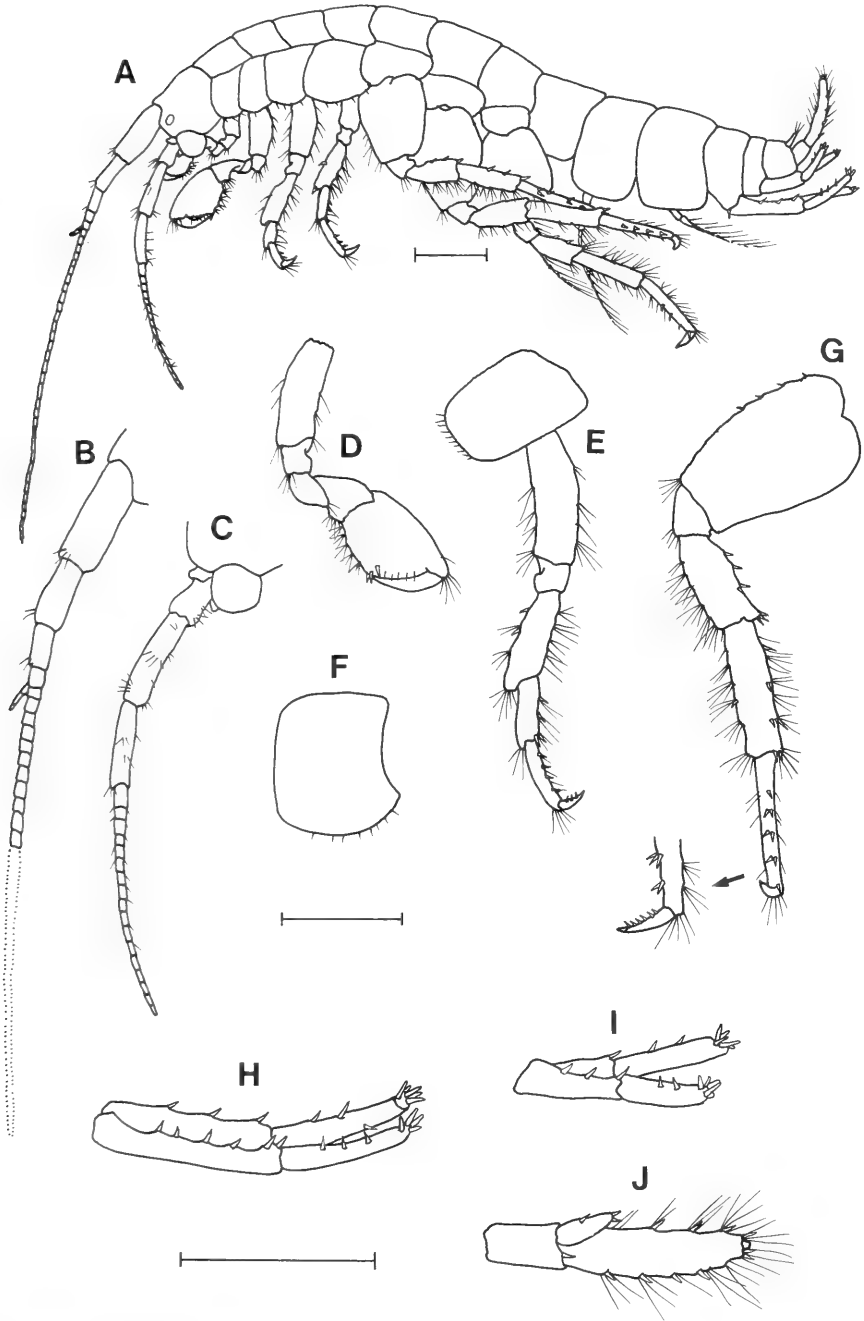


Fig. 21. *Paramelita parva*, SAM-A40226, holotype, male, 8.7 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Other material.* SAM-A40228, A40229, A40230 and A40775, all from tributaries of the Storms River, eastern Cape.

### *Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 22- to 26-articulate, accessory flagellum 4- to 5-articulate. Antenna 2 sparsely to moderately setose, shorter than 1, peduncle not enlarged in males, flagellum with 11–18 articles. Coxa 4, posterior margin excavate. Gnathopod 2, palm moderately oblique, with 3–4 defining spines. Pereopods 3 and 4 moderately setose, unmodified, dactyl with 2–3 spinules. Pereopods 5–7 moderately setose, dactyl with 4–7 spinules. Uropods 1 and 2, peduncle spinose, lacking setae, rami with marginal and apical spines, lacking setae. Uropod 3, inner ramus 0.3 length of outer, apically spinose, outer ramus with marginal and apical spines, moderately to densely setose, second segment small but distinct. Telson deeply cleft, each lobe with 1–2 spines and 1–4 setae.

### *Remarks*

This species is morphologically similar to *Paramelita kogelensis*, from which it is distinguished by the number of spinules on the dactyl of pereopods 3 and 4, and the setation of the uropods.

### *Distribution*

The most isolated of all the paramelitid species, *P. parva* has been collected from the Storms River catchment, eastern Cape (Fig. 29).

### *Paramelita pillicornis* Stewart & Griffiths, 1992

Fig. 22

*Paramelita pillicornis* Stewart & Griffiths, 1992c: 494–497, figs 4–5.

### *Material examined*

*Types.* Holotype, SAM-A40214; paratypes, SAM-A40215, from a tributary of Waboomsrivier on Gydo Pass, north of Ceres.

### *Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 18- to 33-articulate, accessory flagellum 3- to 4-articulate. Antenna 2 shorter than 1, densely setose posteriorly in males, flagellum with 13–16 articles. Coxa 4, posterior margin excavate. Gnathopod 2, palm distinctly oblique, with three defining spines. Pereopods 3–7 moderately to densely setose. Pereopods 5–7, article 2 markedly poorly expanded, dactyl with 3–5 spinules. Uropod 1, peduncle spinose and setose, both rami with marginal and apical spines and sometimes marginal setae. Uropod 2, peduncle spinose, lacking setae, inner ramus with marginal spines, outer ramus with marginal spines and sometimes setae, both with apical spines. Uropod 3, inner ramus 0.3–0.4 length of outer, apically spinose and setose, outer ramus with marginal and apical spines, moderately setose, second segment small but distinct. Telson deeply cleft, each lobe with one spine and 3–8 setae.



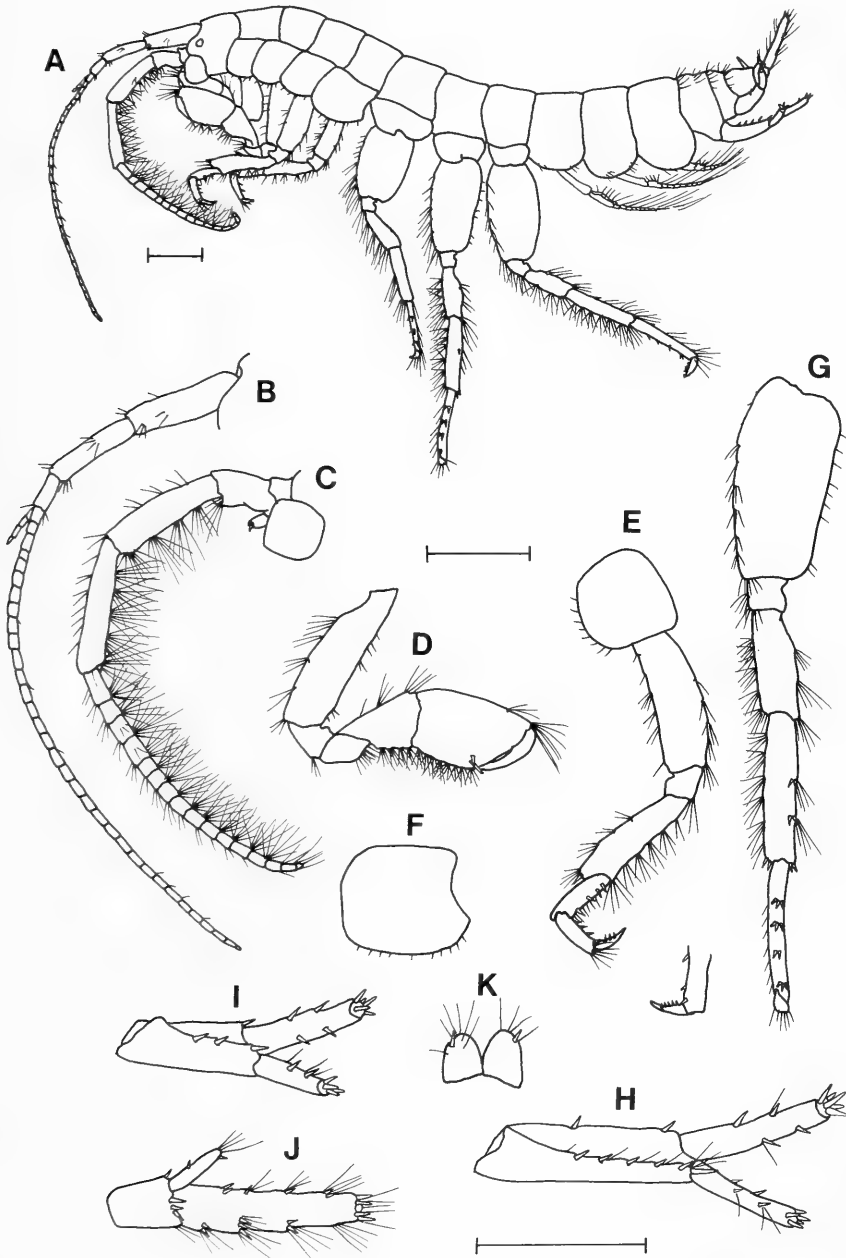


Fig. 22. *Paramelita pillicornis*, SAM-A40214, holotype, male, 10.8 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. K. Telson. Scale lines represent 1 mm.

*Remarks*

One of two white-eyed *Paramelita* species with a highly setose antenna 2, *P. pillicornis* is distinguished from *P. seticornis* by the relative length of the peduncle and the number of articles in the flagellum of this antenna, the width of article 2 in pereopods 5–7, and the setation of the rami in uropods 1 and 2.

*Distribution*

Known only from the type locality, Gydo Pass, north of Ceres (Fig. 29).

*Paramelita pinnicornis* Stewart & Griffiths, 1992

Fig. 23

*Paramelita pinnicornis* Stewart & Griffiths, 1992a: 140–144, figs 1–2.

*Material examined*

*Types.* Holotype, SAM–A40004; paratypes, SAM–A40005, from a tributary of the Burgersbos River, Cape Peninsula.

*Other material.* SAM–A10017, from Newlands, Cape Peninsula. SAM–A40008, from Kenilworth Race Course, Cape Peninsula. SAM–A40006 and A40007, from adjacent streams in the Cape Hangklip area, east coast of False Bay.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 31- to 46-articulate, accessory flagellum 5- to 6-articulate. Antenna 2 sparsely to moderately setose, of equal length to 1, articles 4 and 5 of peduncle in males extremely elongate and outer margin and tip of article 5 extended into an elongate triangular flange, flagellum with 16–23 articles. Coxa 4, posterior margin excavate. Gnathopod 2, article 2 strongly spinose medially, palm oblique, with 3–5 defining spines. Pereopod 3 moderately setose, modified in males, article 4 elongate, article 5 with a posterior lump and a few long, blade-like spines, article 6 curved, attached at right angle to 5, dactyl with 6–7 spinules. Pereopod 4 unmodified, dactyl with 6–7 spinules. Pereopods 5–7, dactyl with 10–14 spinules. Uropods 1 and 2, peduncle spinose and setose, rami with marginal spines and setae and apical spines. Uropod 3, inner ramus 0.1–0.2 length of outer, apically spinose, outer ramus with marginal and apical spines, densely setose, second segment small but distinct, apically spinose. Telson deeply cleft, each lobe with one spine and several setae.

*Remarks*

The unusual form of antenna 2 and pereopod 3 is unique to this species.

*Distribution*

This species has a rather disjunct distribution, and is known from the northern and eastern parts of the Cape Peninsula and also the Cape Hangklip area, along the east coast of False Bay (Fig. 29).

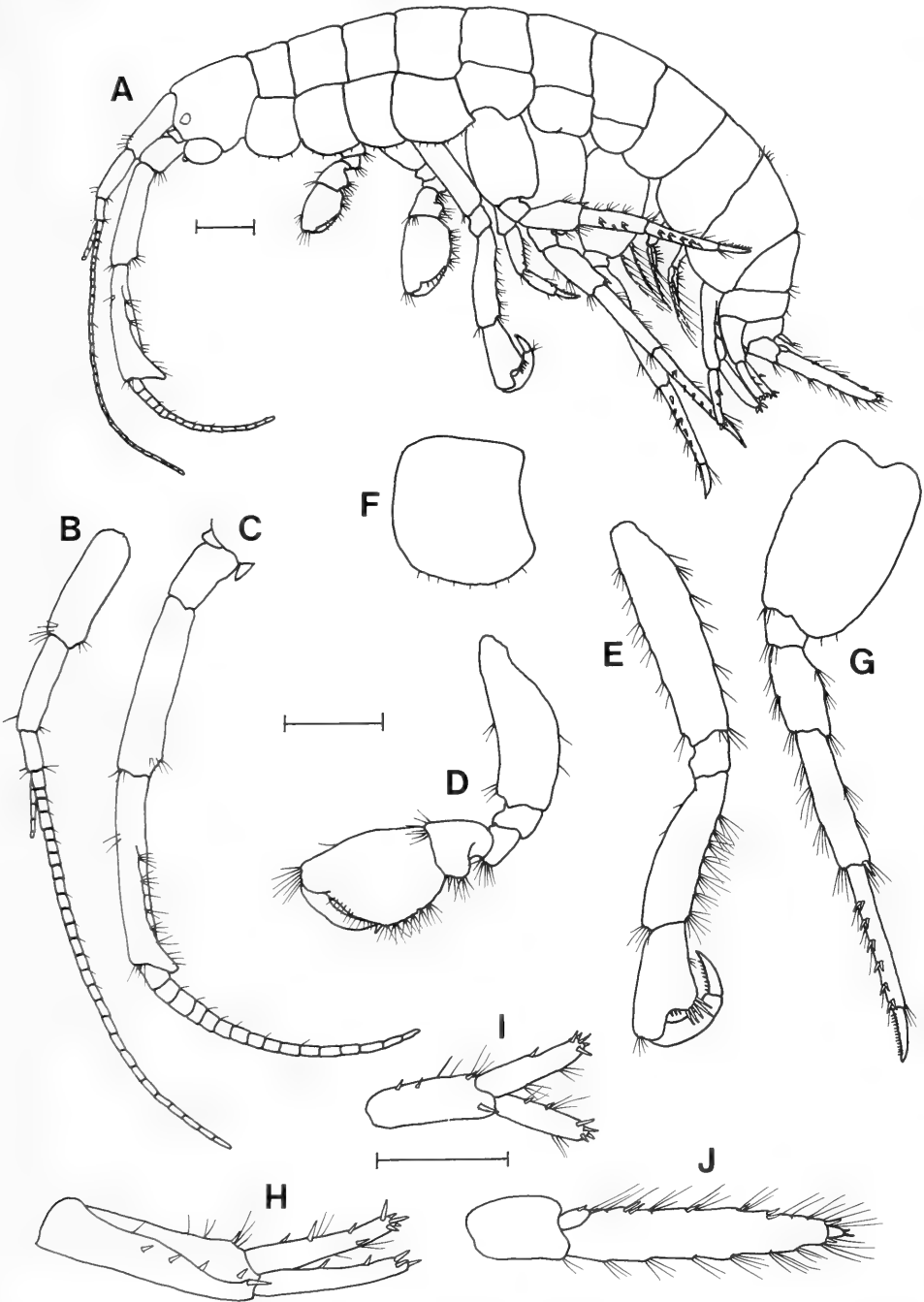


Fig. 23. *Paramelita pinnicornis*, SAM-A40004, holotype, male, 13.5 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 7. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

*Paramelita platypus* Stewart & Griffiths, 1992

Fig. 24

*Paramelita platypus* Stewart & Griffiths, 1992a: 153–157, figs 7–8.*Material examined*

*Types.* Holotype, SAM–A40020; paratypes, SAM–A40021, from a tributary of the Fernkloof River in the Fernkloof Nature Reserve.

*Other material.* SAM–A40022 and A40516, from a stream near Stanford.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 28- to 41-articulate, accessory flagellum 4- to 5-articulate. Antenna 2 sparsely setose, of equal length to 1 in adult males, both peduncle and flagellum extremely elongate and stout, flagellum with 16–22 articles. Coxa 4, posterior margin very slightly emarginate. Gnathopod 2, article 2 sparsely medially spinose, palm transverse, markedly convex, with a tooth and 2–5 spines. Pereopods 3 and 4 densely setose posteriorly, modified in males, article 4 greatly expanded laterally, dactyl with 3–5 spinules. Pereopods 5–7 moderately to densely setose, dactyl with 6–10 spinules. Uropods 1 and 2, peduncle spinose and setose, inner rami with marginal spines and setae, outer rami with marginal spines, lacking setae, each rami with apical spines. Uropod 3, inner ramus 0.2 length of outer, apically spinose, outer ramus with marginal and apical spines, moderately setose, second segment small but distinct. Telson deeply cleft, each lobe with one spine and 6–8 setae.

*Remarks*

The combination of an extremely elongate antenna 2, a markedly convex palm with a distinct palmar tooth in gnathopod 2, laterally expanded article in pereopods 3 and 4, almost quadrate coxa 4, and a distinct, albeit small, second segment on the outer ramus of uropod 3 make this species unmistakable.

*Distribution*

This species has been collected from streams draining the slopes of the Kleinriviersberge between Hermanus and Stanford (Fig. 29).

*Paramelita seticornis* (Barnard, 1927)

Fig. 25

*Gammarus seticornis* Barnard, 1927: 171–172, pl. 10 (figs 7, 17).

*Paramelita seticornis* (Barnard) Thurston, 1973: 166–167. Griffiths, 1981: 90, fig. 2D–F.

*Material examined*

*Types.* Syntypes, SAM–A3994, from Landdrost Kloof, Caledon side, Hottentots Holland Mountains.

*Other material.* SAM–A40933, from Sir Lowry's Pass, Somerset West side, Hottentots Holland Mountains. SAM–A40946, from Malkopvlei, Betty's Bay. SAM–A40525, Outeniqua Mountains. SAM–A40777 and A40947, Betty's Bay.

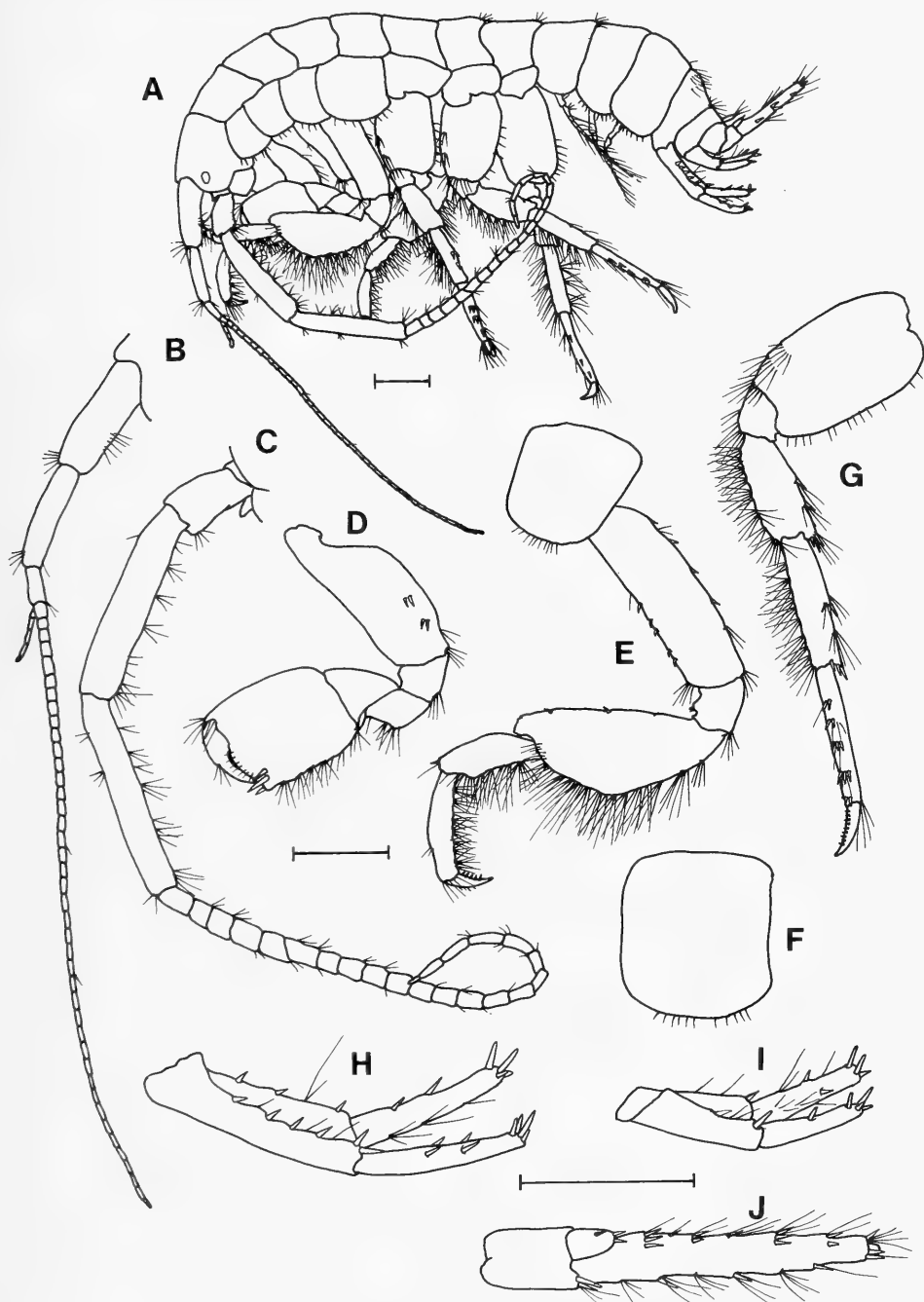


Fig. 24. *Paramelita platypus*, SAM-A40020, holotype, male, 12.8 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, right side, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

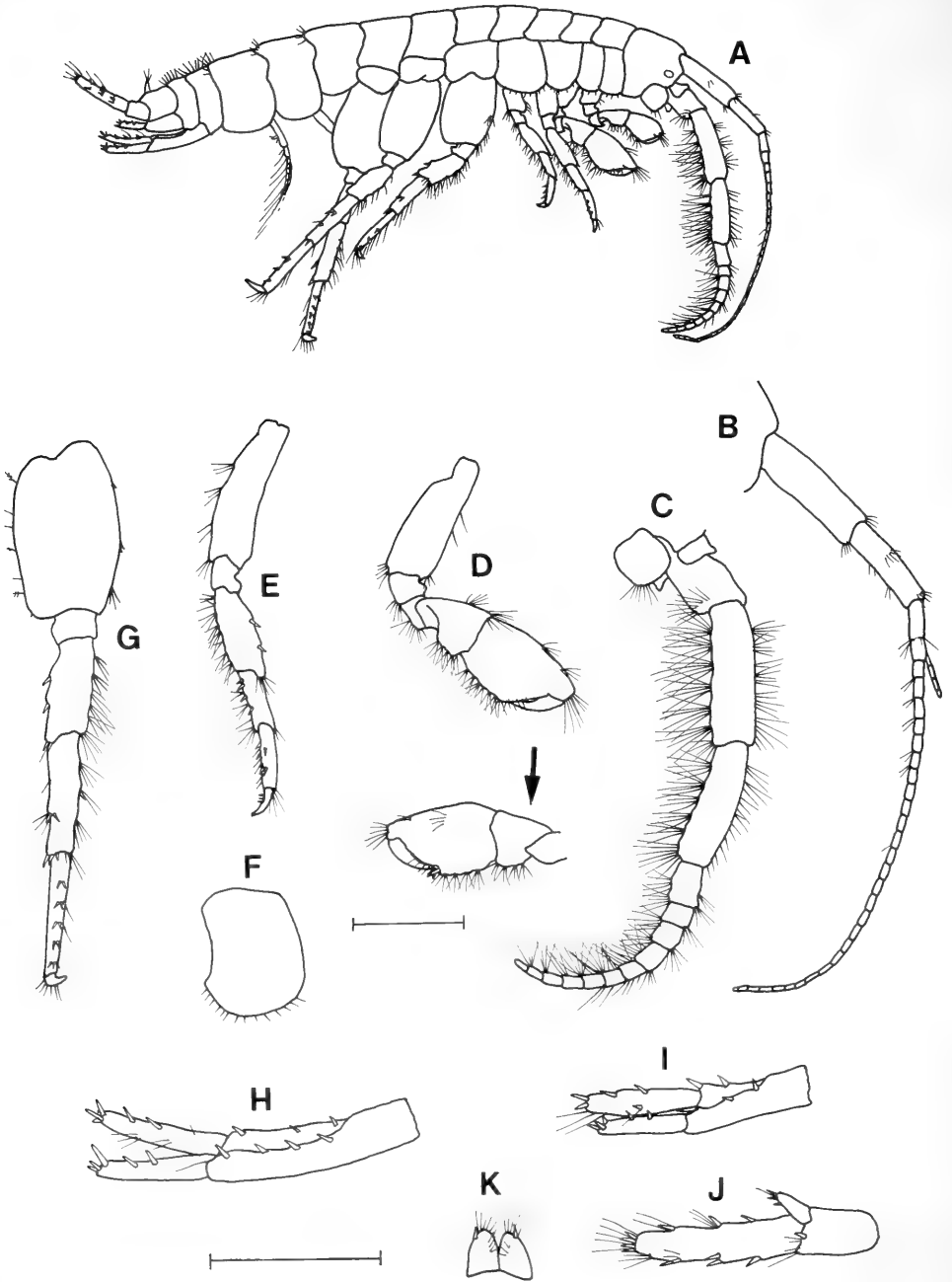


Fig. 25. *Paramelita seticornis*, SAM-A40933, male, 9.0 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, lateral and medial views. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. K. Telson. Scale lines represent 1 mm.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 20- to 30-articulate, accessory flagellum with 4–5 articles. Antenna 2 stout and densely setose in males, moderately stout and setose in females, flagellum 8- to 12-articulate. Coxa 4, posterior margin with a shallow but distinct emargination. Gnathopod 2, palm oblique, with 2–4 palmar spines. Pereopods 3 and 4 unmodified, dactyl with 2–4 spinules. Pereopods 5–7, dactyl with 4–10 spinules. Uropod 1, peduncle with spines and setae, rami subequal, with marginal and apical spines, inner ramus with some setae. Uropod 2, peduncle with spines and setae, inner ramus longer than outer, both with marginal and apical spines, inner ramus with some setae. Uropod 3, inner ramus about 0.3 length of outer ramus, with 2–3 apical spines, outer ramus with marginal and apical spines and setae, second segment rudimentary. Telson deeply cleft, each lobe with a single spine and several setae.

*Remarks*

This species is distinguished from an allied Hottentots Holland form, *Paramelita kogelensis*, by its densely setose antenna 2, a condition it shares with *P. pillicornis*.

*Distribution*

Known from Hottentots Holland and adjacent mountain ranges (Fig. 29).

*Paramelita spinicornis* (Barnard, 1927)

Fig. 26

*Gammarus spinicornis* Barnard, 1927: 174–175, pl. 10 (figs 8, 18–19).

*Paramelita spinicornis* (Barnard) Thurston, 1973: 166–167. Griffiths, 1981: 91, fig. 3D. Stewart *et al.*, 1994: 179–190, figs 1–4.

*Material examined*

*Types.* Syntypes, SAM–A5177, from Hottentots Holland Mountains.

*Other material.* SAM–A5180, Hottentots Holland Mountains. SAM–A5186, Steenbras Valley. SAM–A6053, Zonderend Mountains. SAM–A6939, Swellendam Mountains. SAM–A6940, Swellendam Mountains. SAM–A6941, Zuurbraak Peak. SAM–A6942, Tradouw Peak. SAM–A6943, south of Barrydale. SAM–A40253, Betty's Bay. SAM–A40254, Disa Kloof, Betty's Bay. SAM–A40255, Fernkloof Ravine, Hermanus. SAM–A40256, Harold Porter Gardens, Betty's Bay. SAM–A40257, Lamloch Stream, Kleinmond. SAM–A40258, between Betty's Bay and Kleinmond. SAM–A40517, Nuweberg State Forest. SAM–A40526, Grabouw Forest. SAM–A40528, Swartberg, near Caledon. SAM–A40784 and A40785, Betty's Bay. SAM–A40948, between Hermanus and Stanford. SAM–A41010, Grotto Beach, Hermanus.

*Diagnosis*

Eyes white. Antenna 1 sparsely setose, flagellum 20- to 25-articulate, accessory flagellum 4-articulate. Antenna 2 shorter than 1, sparsely setose,

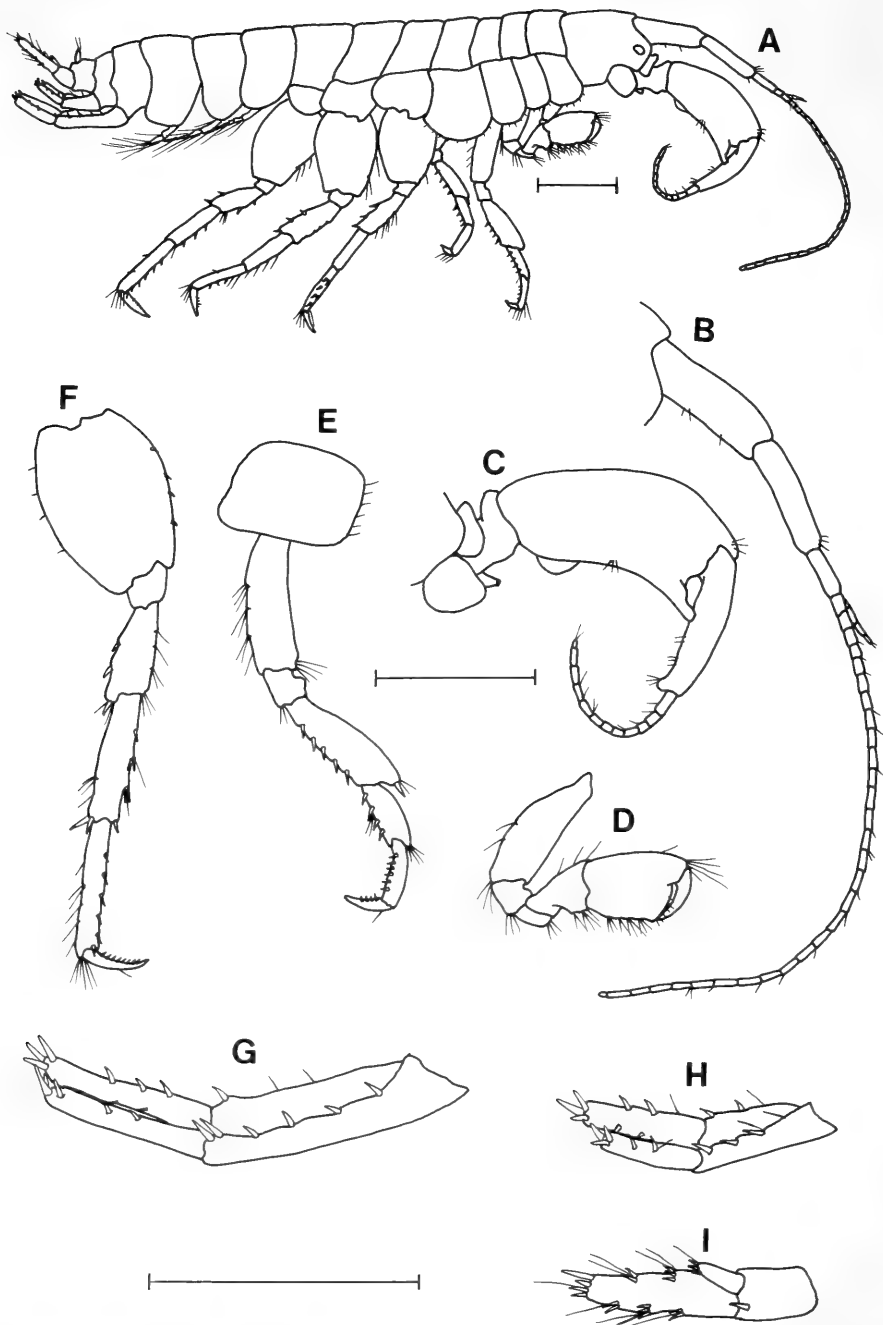


Fig. 26. *Paramelita spinicornis*, SAM-A40253, male, 7.0 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Pereopod 6. G. Uropod 1. H. Uropod 2. I. Uropod 3. Scale lines represent 1 mm.



article 4 of peduncle strongly laterally swollen and with a proximal medial lobe and a posterodistal tooth in males, flagellum 9- to 11-articulate. Coxa 4, posterior margin excavate. Gnathopod 2, article 2 not medially spinose, palm slightly oblique, with 3-4 defining spines. Pereopods 3 and 4 sparsely setose, unmodified, articles 4, 5 and 6 strongly spinose, dactyl with 3-4 spinules. Pereopods 5-7 sparsely to moderately setose, dactyl with 5-8 spinules. Uropod 1, peduncle spinose, usually with a single seta, rami subequal, both with marginal and apical spines, lacking setae. Uropod 2, peduncle spinose, usually with 1-2 setae, outer ramus longer than inner, both rami with marginal and apical spines, inner ramus sometimes with a single seta. Uropod 3, inner ramus 0.3 length of outer, apically spinose, outer ramus with marginal and apical spines, sparsely setose, small but distinct second segment present. Telson deeply cleft, each lobe with one spine and 3-5 setae.

#### Remarks

The possession of a terminal, posterodistal tooth on the laterally swollen article 4 of antenna 2 in males, excavate coxa 4, multispinose dactyls on the pereopods, and the presence of a distinct second segment on the outer ramus of uropod 3 make this species unmistakable, despite its superficial resemblance to *Aquadulcaris dentata* and *Paramelita odontophora*.

#### Distribution

Collected from Hottentots Holland to Swellendam mountains (Fig. 29).

#### *Paramelita tulbaghensis* (Barnard, 1927)

Fig. 27

*Gammarus tulbaghensis* Barnard, 1927: 170-171, pl. 10 (figs 5, 15).

*Paramelita tulbaghensis* (Barnard) Thurston, 1973: 166-167. Griffiths, 1981: 91, fig. 3H-I.

#### Material examined

*Types.* Syntypes, SAM-A4875, from the Sneeuwgat Valley near Tulbagh.

*Other material.* SAM-A40934, from a stream on the path to Sneeuwgat Peak above the farm Bergplaas, foot of the Winterhoek Mountains, near Tulbagh. SAM-A40935, from a stream in the Ceres municipal campsite. SAM-A40232, from a tributary of the Molenaar's River, Worcester end of Du Toit's Kloof Pass.

#### Diagnosis

Eyes white. Antenna 1 sparsely setose, flagellum 16- to 25-articulate, accessory flagellum 3- to 4-articulate. Antenna 2 shorter than 1, sparsely setose, slender in females, articles 3, 4 and 5 of peduncle swollen in males, article 4 the longest, flagellum 9- to 12-articulate. Coxa 4, posterior margin with a distinct but shallow emargination. Gnathopod 2, palm transverse to slightly oblique, with 2-4 spines. Pereopods 3 and 4 unmodified, dactyl usually with two, but sometimes with one spinule. Pereopods 5-7, dactyl usually with 2-4,

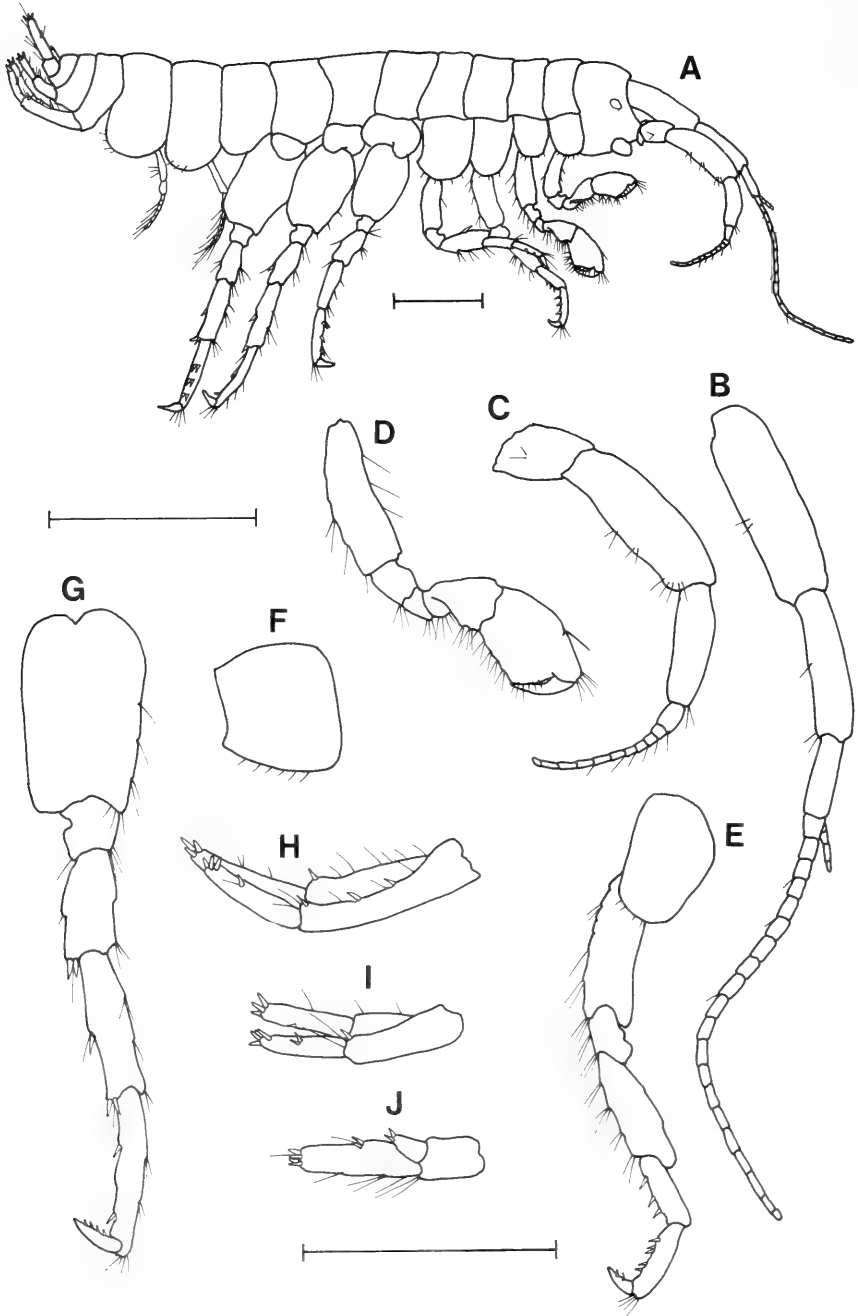


Fig. 27. *Paramelita tulbaghensis*, SAM-A4875, syntype, male, 6.3 mm. A. Lateral view. B. Antenna 1. C. Antenna 2. D. Gnathopod 2. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

but sometimes with one spinule. Uropod 1, peduncle with spines and setae, rami subequal, usually with marginal, and always with apical spines, sometimes with a few marginal setae. Uropod 2, peduncle with spines and setae, inner ramus longer than outer, both with marginal and apical spines, inner ramus with at least one seta. Uropod 3, inner ramus about 0.3 length of outer, with some apical setae, outer ramus with a few marginal and apical spines and setae, second segment rudimentary. Telson deeply cleft, each lobe usually with a single spine and a few setae.

#### Remarks

*Paramelita tulbaghensis* is most similar to *Aquadulcaris crassicornis*, from which it is most easily distinguished by the possession of usually 2–4 spinules on the dactyl of pereopods 3–7, and by the lack of tooth-like spines on article 5 of pereopod 3.

#### Distribution

This species has been collected from the Winterhoek Mountains near Tulbagh in the north to Du Toit's Kloof on the Dutoitsberg in the south (Fig. 29).

#### *Paramelita validicornis* Stewart & Griffiths, 1992

Fig. 28

*Paramelita validicornis* Stewart & Griffiths, 1992c: 497–501, figs 6–7.

#### Material examined

*Types.* Holotype, SAM–A40216; paratypes, SAM–A40217, from a stream flowing into Kleinrivierlei, near Hermanus.

*Other material.* SAM–A7394, from near Bredasdorp. SAM–A40218, from a tributary of the Afdakrivier. SAM–A40219, A40514, and A40789, from Fernkloof Nature Reserve, Hermanus. SAM–A40518, Salmonsdam Nature Reserve. SAM–A40924, Hermanus Yacht Club. SAM–A41007, Grotto Beach, Hermanus.

#### Diagnosis

Eyes white. Antenna 1 sparsely setose, flagellum with 44–48 articles, accessory flagellum 5- to 6-articulate. Antenna 2 sparsely setose, peduncle elongate and stout in males, flagellum with 19–22 broad, flattened articles. Coxa 4, posterior margin excavate. Gnathopod 2, article 2 medially spinose, palm distinctly oblique, with 4–5 spines. Pereopods 3–7 moderately setose, unmodified, dactyl with 4–9 spinules. Uropods 1 and 2, peduncle spinose, 1 sometimes with 1–2 setae, inner rami with marginal spines and setae, outer rami with marginal spines, lacking setae, all rami with apical spines. Uropod 3, inner ramus 0.2 length of outer, apically spinose and setose, outer ramus with marginal and apical spines, moderately to densely setose, second segment small but distinct. Telson deeply cleft, each lobe with 1–2 spines and 6–10 setae.

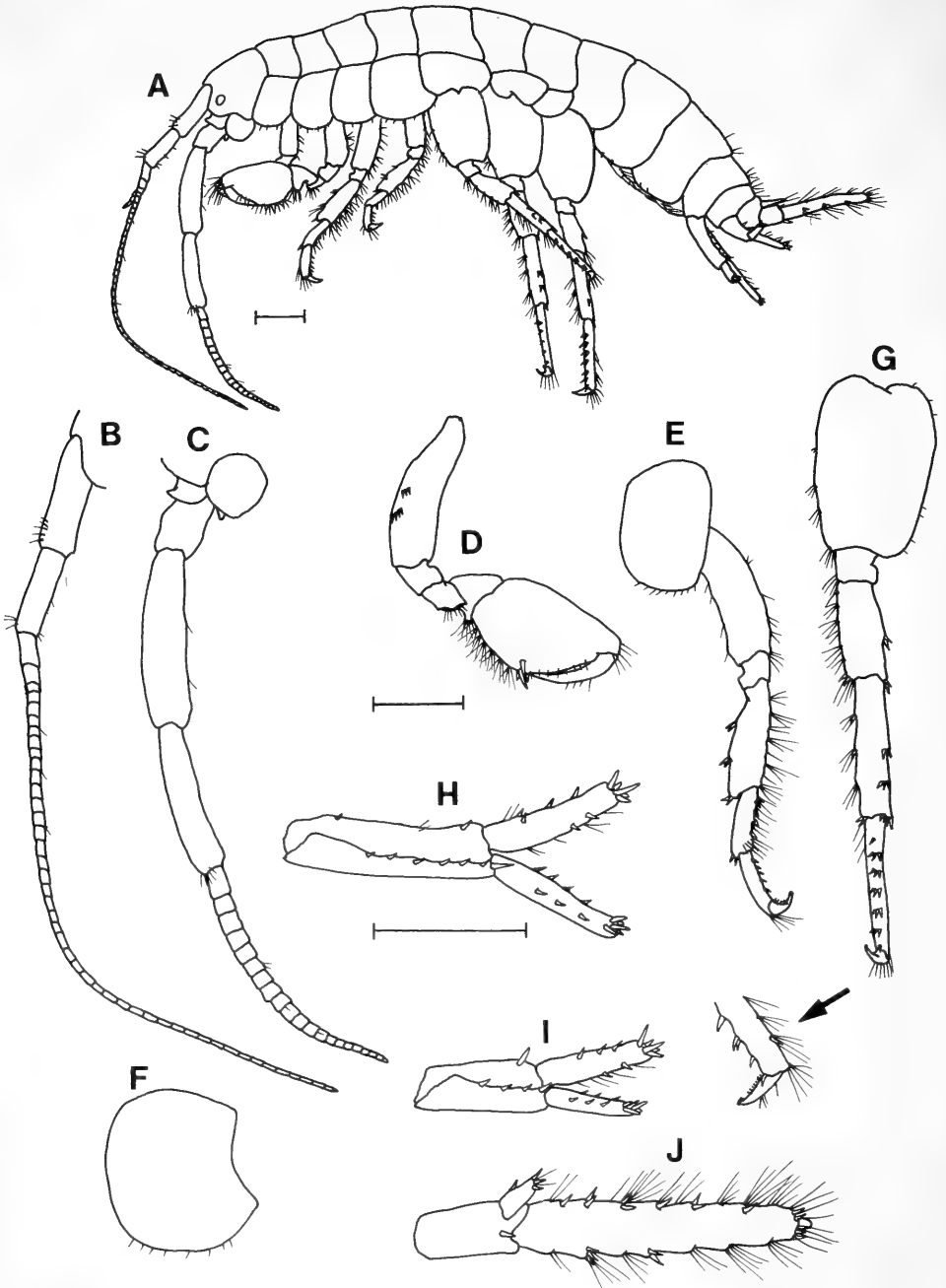


Fig. 28. *Paramelita validicornis*, SAM-A40216, holotype, male, 13.8 mm. A. Lateral aspect. B. Antenna 1. C. Antenna 2. D. Gnathopod 2, medial view. E. Pereopod 3. F. Coxa 4. G. Pereopod 6. H. Uropod 1. I. Uropod 2. J. Uropod 3. Scale lines represent 1 mm.

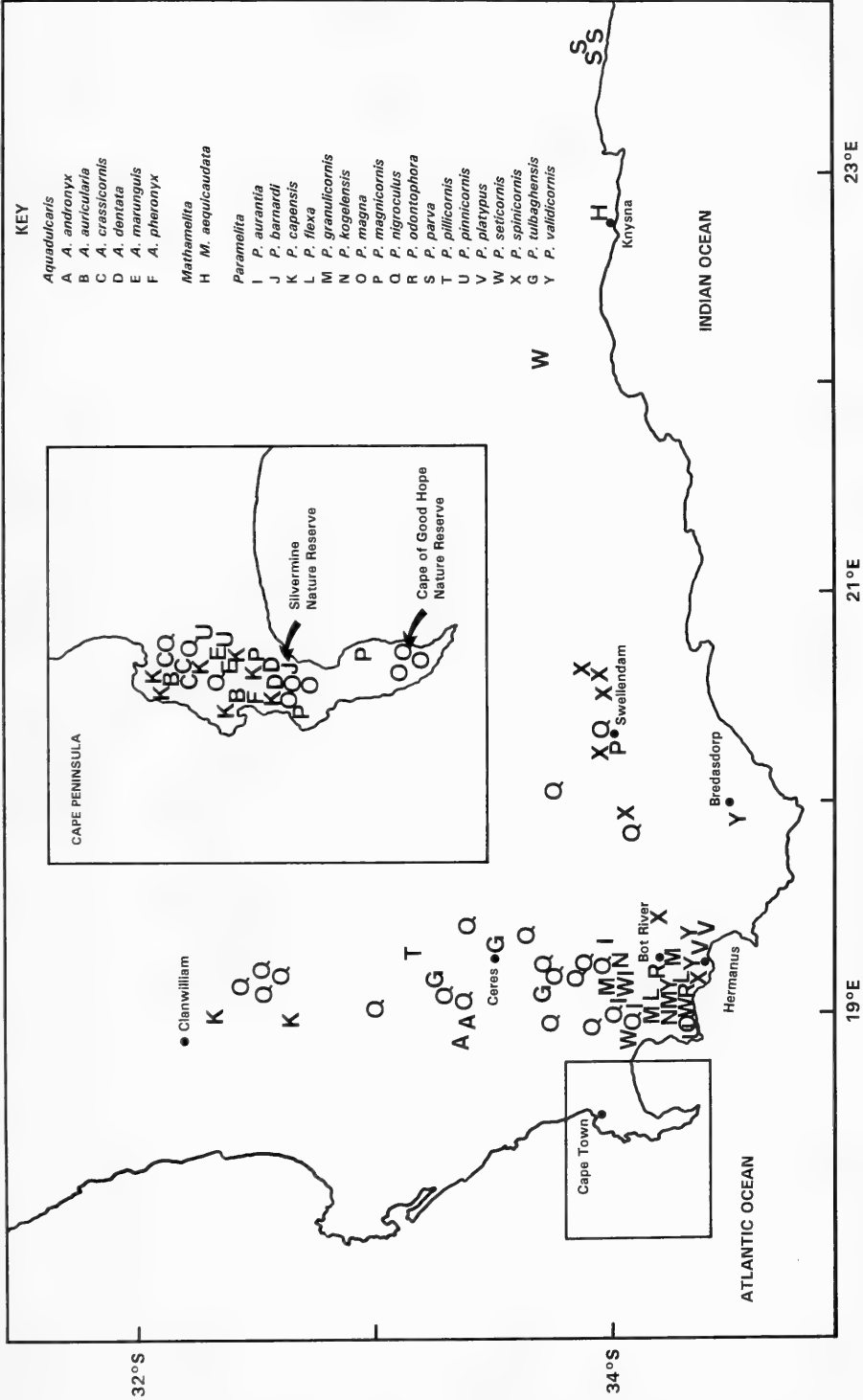


Fig. 29. Map of south-western Cape, showing distribution of paramelitid species.

*Remarks*

The most distinguishing features of this species are the stout and elongate antenna 2, particularly in males, and the relatively long outer ramus in uropod 3. The latter condition, along with differences in setation of the rami of uropods 1 and 2, is used to separate *Paramelita validicornis* from *P. magna* and *P. magnicornis*.

*Distribution*

Although this species is known from Bredasdorp in the west to the Kleinriviersberge in the east, it is possibly more widespread (Fig. 29).

## ACKNOWLEDGEMENTS

Special thanks go to all those willing hands who assisted in the field. Michelle van der Merwe kindly assisted with the drafting of figures. Financial support was provided by the Foundation for Research Development through a grant from the Inland Waters Ecosystems Programme, and through the Special Programme on Rivers directed by Professor Bryan Davies.

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6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family **Nuculanidae**

*Nuculana* (*Lembulus*) *bicuspidata* (Gould, 1845)

Figs 14–15A

*Nucula* (*Leda*) *bicuspidata* Gould, 1845: 37.

*Leda plicifera* A. Adams, 1856: 50.

*Laeda bicuspida* Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).

*Nucula largillierti* Philippi, 1861: 87.

*Leda bicuspida*: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

*Note* punctuation in the above example:

comma separates author's name and year

semicolon separates more than one reference by the same author

full stop separates references by different authors

figures of plates are enclosed in parentheses to distinguish them from text-figures

dash, not comma, separates consecutive numbers.

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

*Holotype*

SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach, Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

*Note* standard form of writing South African Museum registration numbers and date.

## 7. SPECIAL HOUSE RULES

### *Capital initial letters*

- (a) The Figures, Maps and Tables of the paper when referred to in the text  
e.g. '... the Figure depicting *C. namacolus* ...'; '... in *C. namacolus* (Fig. 10) ...'
- (b) The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names  
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene
- (c) Scientific names, but not their vernacular derivatives  
e.g. Therocephalia, but therocephalian

*Punctuation* should be loose, omitting all not strictly necessary

*Reference to the author* should preferably be expressed in the third person

*Roman numerals* should be converted to arabic, except when forming part of the title of a book or article, such as

'Revision of the Crustacea. Part VIII. The Amphipoda.'

*Specific name* must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively. The generic name should not be abbreviated at the beginning of a sentence or paragraph.

*Name of new genus or species* is not to be included in the title; it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.



BARBARA A. STEWART  
&  
CHARLES L. GRIFFITHS

REVISION OF THE FAMILY PARAMELITIDAE  
(CRUSTACEA, AMPHIPODA)  
FROM SOUTH AFRICAN FRESH WATERS