Guides to the

Freshwater Invertebrates of Southern Africa

Volume 4: Crustacea III

Bathynellacea, Amphipoda, Isopoda, Spelaeogriphacea, Tanaidacea, Decapoda

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Prepared for the Water Research Commission

March 2001

WRC Report No. TT 141/01

Obtainable from:

Water Research Commission
PO Box 824
Pretoria
0001

The publication of this guide emanates from a project entitled:
The Invertebrates of South Africa - Identification Keys
(WRC Project No. 916)

ISBN 1 86845 676 5

Printed in the Republic of South Africa

Cover photograph: The Eerste River, Western Cape, in the foothill zone by WR Harding

Since there is a possibility that revised editions of this series of guides may be printed in the future, we welcome constructive suggestions, particularly in relation to keys used to identify various taxa. These suggestions should be submitted in writing to the Executive Director, Water Research Commission (address given above). All such correspondence must be marked "For the attention of Project K5/916/0/1").

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CHAPTER 3

ISOPODA

by

B. Kensley

The Isopoda form a group of crustaceans of which over 10 000 species have been described, with many new species constantly being discovered. Although primarily aquatic in habitat, one suborder, the Oniscidea, has invaded the terrestrial world with greater success than any other group of crustaceans. The other eight suborders have exploited aquatic habitats, primarily in the marine environment, and can be found from the upper intertidal zone to the abyss of the oceans. Whereas the majority of species are benthic dwellers, many species have adapted to highly specialized environmental niches, and accordingly display great morphological specialization. There are active predators, swarming scavengers, and parasites or micro-predators of fishes among the Flabellifera. The Limnoriidae burrow into wood, frequently wooden piers, where they can do considerable damage. The Gnathiidea are often commensals of sponges. One suborder, the Epicaridea, is entirely parasitic on other crustaceans.

Being peracaridans, the isopods bear their eggs in a marsupium formed by a variable number of ventral plates or oostegites of the pereonites. Transfer of spermatophores is usually accomplished with the aid of a copulatory stylet on the endopod of the second pleopods of males. The first and second pleopods are adapted for this purpose in the Oniscidea. There is direct development of the egg into a manca — which resembles the adult but lacks the seventh pereonite and leg — in all groups except the parasitic Epicaridea. In the latter a dramatic metamorphosis includes a pelagic epicaridium stage.

Although primarily marine, some members of most of the suborders have entered freshwater environments. Some of these, like the phreatocoideans (which are exclusively freshwater), and certain Asellota and

Microcerberidea, have long evolutionary histories in these environments. Others show indications of geologically far more recent invasions via estuaries, coastal lagoons, anchialine cave systems, and ground water.

The southern African freshwater isopod fauna has representatives of both of these groups. Among the forms with long histories in fresh water are the asellote genera *Namibianira*, *Protojanira* and *Protojaniroides*, the microcerberideans *Afrocerberus* and *Protocerberus*, and all the phreatocoideans. More recent invaders are the flabelliferan, *Pseudosphaeroma*, the anthuridean, *Cyathura*, and the asellote, *Uromunna*.

Morphological features of the Isopoda (Figs 3.1A, 3.3A, 3.8)

Body usually dorso-ventrally depressed, occasionally subcylindrical, rarely bilaterally compressed. Carapace lacking. First thoracic segment fused with head. Antennules and antennae uniramous (scale on antenna in some asellotes may represent rudimentary second ramus). Eyes present or absent; if present, sessile (eyes on non-mobile stalks in some asellotes). Mouthparts consisting of one pair of mandibles, two pairs of maxillae, one pair of maxillipeds (first thoracic or pereonal appendages). Mandible usually having palp of one to three articles; incisor, lacinia mobilis, and molar usually present; lacinia mobilis often differing on left and right sides; molar variable. Maxilliped usually having palp of no more than five articles; lamellar endite often carrying coupling hooks; epipod lamellar. Pereonites usually separate, but pereonite 1 sometimes fused with head. Pereopods (thoracic legs) consisting of seven articles: 1—coxa, 2—basis, 3—ischium, 4—merus, 5—carpus, 6—propodus, 7—dactylus. Coxae of pereopods variously fused with, and forming expanded lateral processes (coxal plates) of, pereonites. Pereopod 1 forming additional mouthpart appendage (pylopod) only in suborder Gnathiidea. Pereopods generally similar, ambulatory; pereopods 1–3 secondarily variously modified, becoming subchelate or prehensile. Pereopod 7 occasionally not developed (neotenous condition). In gnathiideans, second thoracic appendage a maxillipedal cheliped, last thoracic appendage missing. Thoracic brood pouch or marsupium of female formed by varying number of oostegites attached ventrally to pereopods; eggs held in anterior or posterior pockets or in internal pouches in some sphaeromatids. Abdomen (pleon) consisting of six free or variously fused pleonites, plus telson; if one or more pleonites fused with telson, resulting structure referred to as pleotelson. Pleopods (appendages of pleonites) on pleonites 1–5 biramous, lamellar, primarily for respiration; anterior pleopods occasionally forming

operculum over remaining pleopods. Pleopod 2 in male (additionally pleopod 1 in some Oniscidea) with inner ramus (endopod) bearing copulatory stylet. One pair of uropods on pleonite 6, sometimes forming tailfan together with telson; uropods forming operculum over ventral pleon in suborder Valvifera and in some oniscideans. Young leave brood pouch as manca, resembling adult but lacking pereopod 7.

KEY TO THE SUBORDERS OF ISOPODA

1. Parasitic on crustaceans; body of female nearly always asymmetrical ..... EPICARIDEA*
– Free-living or parasitic on fishes; body of female bilaterally symmetrical or, if parasitic, female somewhat distorted 2

2 Body more or less bilaterally compressed (Fig. 3.7) .... PHREATOICIDEA (p 68)
– Body more or less dorsoventrally depressed (Figs 3.2, 3.3, 3.5) or subcylindrical (Figs 3.1, 3.4) 3

3. Having six pereonites and five pairs of pereopods..... GNATHIIDEA*
– Having seven pereonites and six or seven pairs of pereopods (Fig. 3.1) 4

4. Body usually more than six times longer than wide, subcylindrical; uropods never operculiform (Figs 3.1, 3.5)..... 5
– Body usually less than six times longer than wide, usually dorsoventrally depressed (Figs 3.2, 3.3, 3.4); if subcylindrical, uropods operculiform 6

5. Uropodal exopod often folding dorsally over pleotelson (Fig. 3.5); rarely interstitial forms ..... ANTHURIDEA (p 63)
– Uropods terminal (Fig. 3.1); minute interstitial forms..... MICROCERBERIDEA (p 53)

6. Antennules minute; terrestrial forms, pleopods having respiratory trachea ..... ONISCIDEA*
– Antennules rarely minute; aquatic forms, pleopods never tracheate 7

7. Uropods ventral, operculiform, covering pleopods ..... VALVIFERA*
– Uropods never operculiform over pleopods 8

8. Uropods usually lateral or ventrolateral, forming tailfan with pleotelson (Fig. 3.6); pleopods 1 and 2 rarely operculiform ..... FLABELLIFERA (p 64)
– Uropods usually terminal or subterminal (Fig. 3.3); pleopods 1 and 2 variously operculiform ..... ASELLOTA (p 56)

*—Not represented in southern African freshwater fauna.

A few exceptional epicarideans have been recorded from fresh water; although primarily terrestrial, a few oniscideans have returned to freshwater habitats as well as to the marine intertidal; one species of valviferan has been recorded from fresh water; the gnathiideans are exclusively marine.

Suborder MICROCERBERIDEA
Family **Microcerberidae**

The microcerberideans are almost without exception interstitial forms, and have been collected from marine sediments, upper beach sediments, and many phreatic habitats. Part of their success in the invasion of such habitats lies in their tolerance of euryhaline and eurythermal conditions. These minute forms are thought to feed on suspended organic material in the interstitial water. Reproduction also shows adaptation to the interstitial habitat which, combined with the very small size, dictates only one or two eggs or larvae in the female marsupium (brood pouch). All forms lack eyes. Only three genera, representing four species (two undetermined), have been recorded from southern Africa. Undoubtedly, many forms remain to be discovered. Their small size makes them difficult to dissect. For further information, the reader is referred to such works as Coineau (1971, 1986).

KEY TO THE SOUTHERN AFRICAN SPECIES

1. Uropods uniramous ..... *Microcerberus* sp. (Fig. 3.1B)
– Uropods biramous 2

2. Uropods longer than last pleonite ..... *Protocerberus schminkei kruegeri* (Fig 3.1C)
– Uropods shorter than pleotelson segment .... *Afrocerberus letabai* (Fig. 3.1A)

Afrocerberus letabai Wägele, 1983
Fig. 3.1A

Characteristic features

Ovigerous female 1.9 mm total length. Body elongate, cylindrical. Pereopod 1 subchelate, propodus inflated. Pereopods 2–7 ambulatory, dactyli biunguiculate. Pleon consisting of two relatively elongate pleonites plus pleotelson. Pleopods 1 and 2 lacking. Uropodal sympod half length of endopod; exopod tiny.

Records

Riverbed sediments, 1.1 m depth, Letaba River, Kruger National Park (Mpumalanga).

Remarks

This genus and species is known from a single specimen.

Microcerberus sp.
Fig. 3.1B

Characteristic features

Adults under 2.0 mm total length. Body elongate, cylindrical. Pereopod 1 subchelate, propodus inflated. Pereopods 2–7 ambulatory, basis having spinose process at midlength, dactyli biunguiculate. Pleon consisting of two segments, anterior usually shorter than posterior, plus relatively elongate pleotelson. Uropod uniramous.

Records

Coineau (1986) recorded two unspecified *Microcerberus* specimens from 'interstitial beach sands in South Africa and Namibia' (no further details of localities were given). As species of this genus have been recorded from marine sediments as well as stenohaline and freshwater habitats, a freshwater record from South Africa would not be unexpected.

Protocerberus schminkei kruegeri Wägele, 1983
Fig. 3.1C

Characteristic features

Adult 1.2 mm total length. Body elongate, cylindrical. Pereopod 1 subchelate, inflated. Pereopods 2–7 ambulatory, dactyli biunguiculate. Pleon consisting of two subequal segments plus pleotelson. Pleopod 1 absent. Uropod elongate, endopod subequal to sympod in length, exopod about one-third length of endopod.

Records

Riverbed sediments, 1.3 m depth, Olifants River, Kruger National Park (Mpumalanga).

Remarks

Protocerberus schminkei kruegeri is distinguished from the nominate subspecies *P. s. schminkei* Wägele, 1983 (from the Mwanza River, Malawi) by subtle differences in the spination of the mouthparts and pereopod 1.

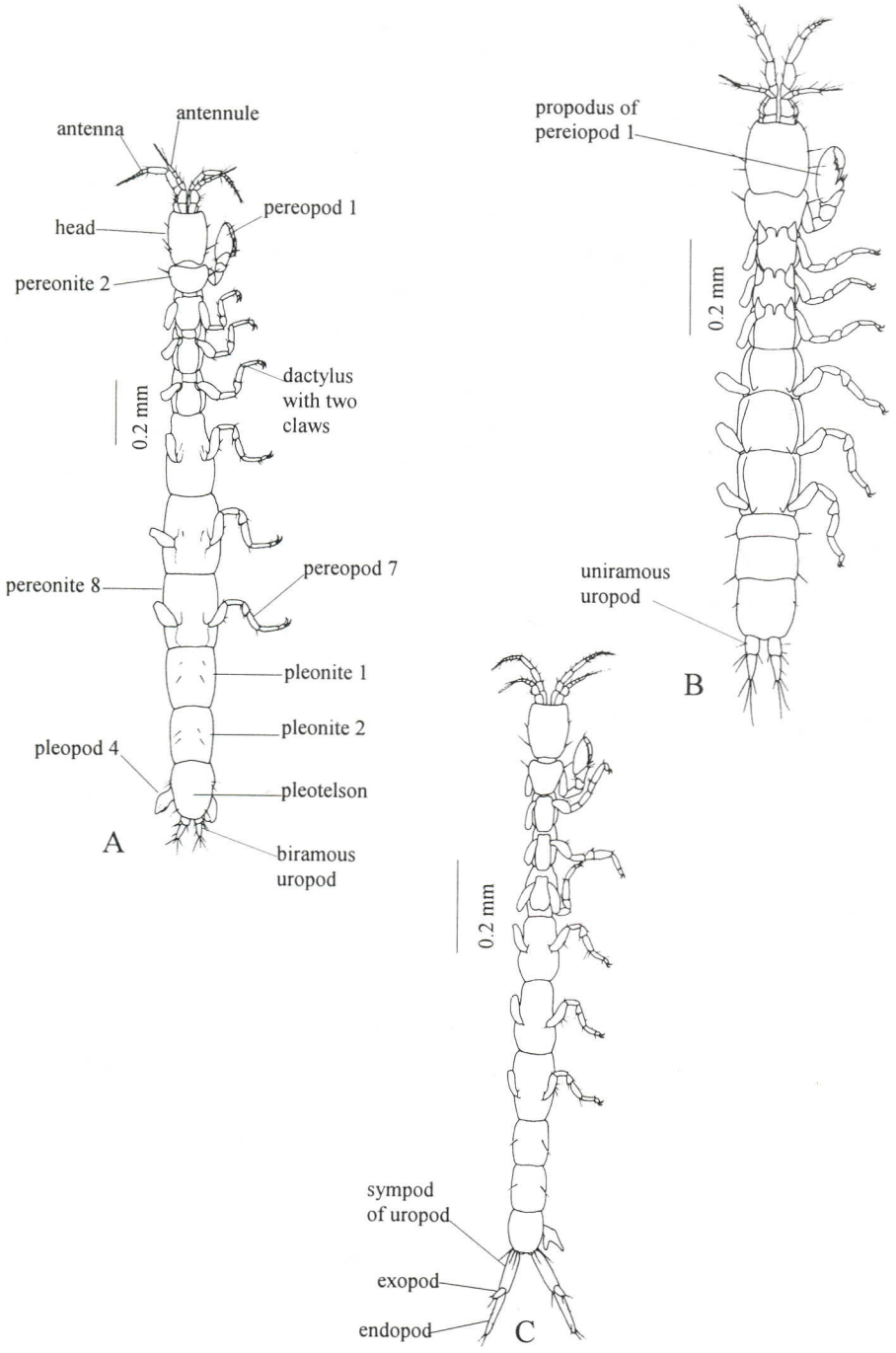

Fig. 3.1. A, *Afrocerberus letabai*, dorsal view: pleopod 4 shown projecting beneath pleotelson. B, *Microcerberus* sp., dorsal view. C. *Protocerberus schminkei kruegeri*, dorsal view: pleopod 4 shown projecting ventrally on right side. (Figs A and C adapted from Wägele 1983).

Suborder ASELLOTA
Family **Protojaniridae**

The protojanirids are generally superficially similar, lacking eyes, having an elongate body form — with six free pereonites — and a pleon consisting of a single free pleonite plus pleotelson, with terminal or subterminal projecting uropods. The animals live in the organically-rich bottom mud of mountain and cave streams. Examination of gut contents reveals minute organic particles and diatom tests, suggesting that they are detritivores. Nothing is known of the reproduction of the group. The taxonomy and relationships of the protojarinid and janiroid asellotes is unsettled, and reassignment of families and genera can be expected.

KEY TO SOUTHERN AFRICAN GENERA OF PROTOJANIRIDAE

1. Pereopod 1 ambulatory (Fig. 3.3C, D) 2
– Pereopod 1 subchelate (Fig. 3.3F) ..... *Protojaniroides*

2. Mandibular molar cylindrical, distally truncate (Fig. 3.3B) ..... *Protojanira*
– Mandibular molar conical, distally subacute (Fig. 3.2G) ..... *Namibianira*

Namibianira Kensley, 1995

KEY TO THE SOUTHERN AFRICAN SPECIES OF *NAMIBIANIRA*

1. Female marginal opercular setae fewer than ten per side (Fig. 3.2I)..... ..... *N. arnhemensis*
– Female marginal opercular setae more than ten per side 2

2. Female marginal opercular setae fewer than 18 per side (Fig. 3.2B); mandibular palp article 2 with nine spines ..... *N. dracohalitus*
– Female marginal opercular setae more than 18 per side; mandibular palp article 2 with five or eight spines..... 3

3. Female marginal opercular setae 20–22 per side (Fig. 3.2F); 7–12 antennular articles ..... *N. aigamasensis*
– Female marginal opercular setae 26–29 per side (Fig. 3.2D); 22–24 antennular articles ..... *N. aikabensis*

Nambianira aigamasensis Kensley, 1995
Fig. 3.2E–G

Characteristic features

Female 3.0–3.6 mm total length. Antennule consisting of 7–12 articles. Mandibular palp, article 2 bearing five spines, article 3 with nine to

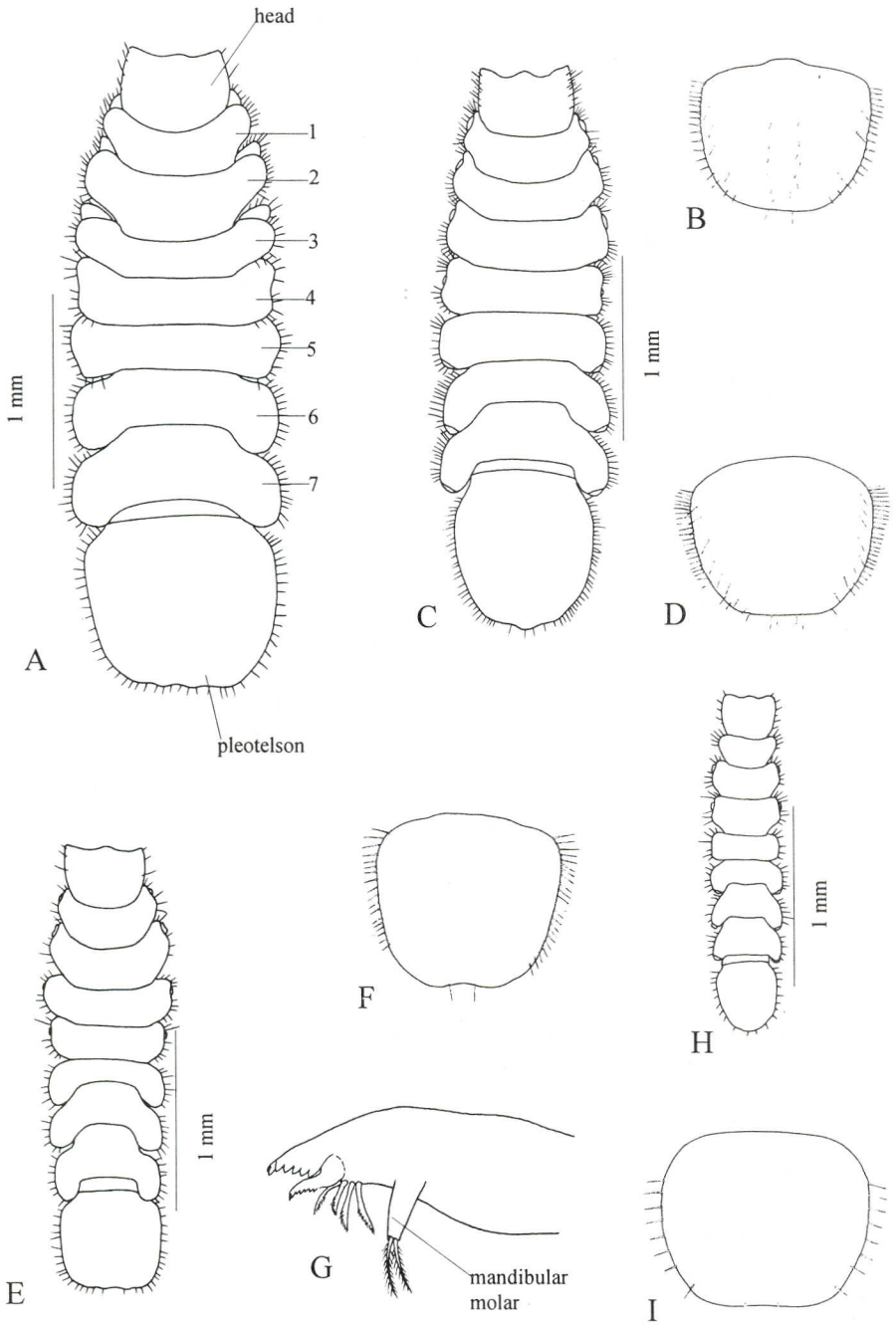

Fig. 3.2. A–B, *Namibianira dracohalitus*: A, dorsal view; B, female operculum.
C–D, *N. aikabensis*: C, dorsal view; D, female operculum.
E–G, *N. aigamasensis*: E, dorsal view; F, female operculum; G, right mandible, palp omitted.
H–I, *N. arnhemensis*: H, dorsal view; I, female operculum.

ten spines. Ratio of pleotelsonic length/width 0.94. Female pleopod 2 operculum bearing 20–22 marginal setae per side.

Records

Aigamas Cave, Otavi District, Namibia.

Namibianira aikabensis Kensley, 1995
Fig. 3.2C–D

Characteristic features

Female 4.2–4.9 mm total length; male 3.9–4.4 mm total length. Antennule consisting of 22–24 articles. Mandibular palp article 2 bearing eight spines, article 3 with 15 spines. Ratio of pleotelsonic length/width 1.15. Female pleopod 2 operculum bearing 26–29 marginal setae per side.

Records

Aikab Hemicenote, Etosha National Park, Namibia.

Namibianira arnhemensis Kensley, 1995
Fig. 3.2H–I

Characteristic features

Female 2.1–2.9 mm total length; male 1.8–2.0 mm total length. Antennule consisting of eight articles. Mandibular palp article 2 bearing four spines, article 3 with 10–12 spines. Ratio of pleotelsonic length/width 1.14–1.18. Female pleopod 2 operculum bearing eight marginal setae per side.

Records

Arnhem Cave, Windhoek District, Namibia.

Namibianira dracohalitus Kensley, 1995
Fig.3.2A–B

Characteristic features

Female 5.0 mm total length. Antennule consisting of 12–15 articles. Mandibular palp article 2 bearing nine spines, article 3 with 15 spines. Ratio of pleotelsonic length/width 0.91. Female pleopod 2 operculum bearing 18 marginal setae per side.

Records

Dragon's Breath Cave, Grootfontein District, Namibia.

Protojanira Barnard, 1927

KEY TO SOUTHERN AFRICAN SPECIES OF *PROTOJANIRA*

1. Uropodal rami distinctly unequal in length (Fig. 3.3A)..... *P. leleupi*
– Uropodal rami subequal in length (Fig. 3.3E) .....*P. prenticei*

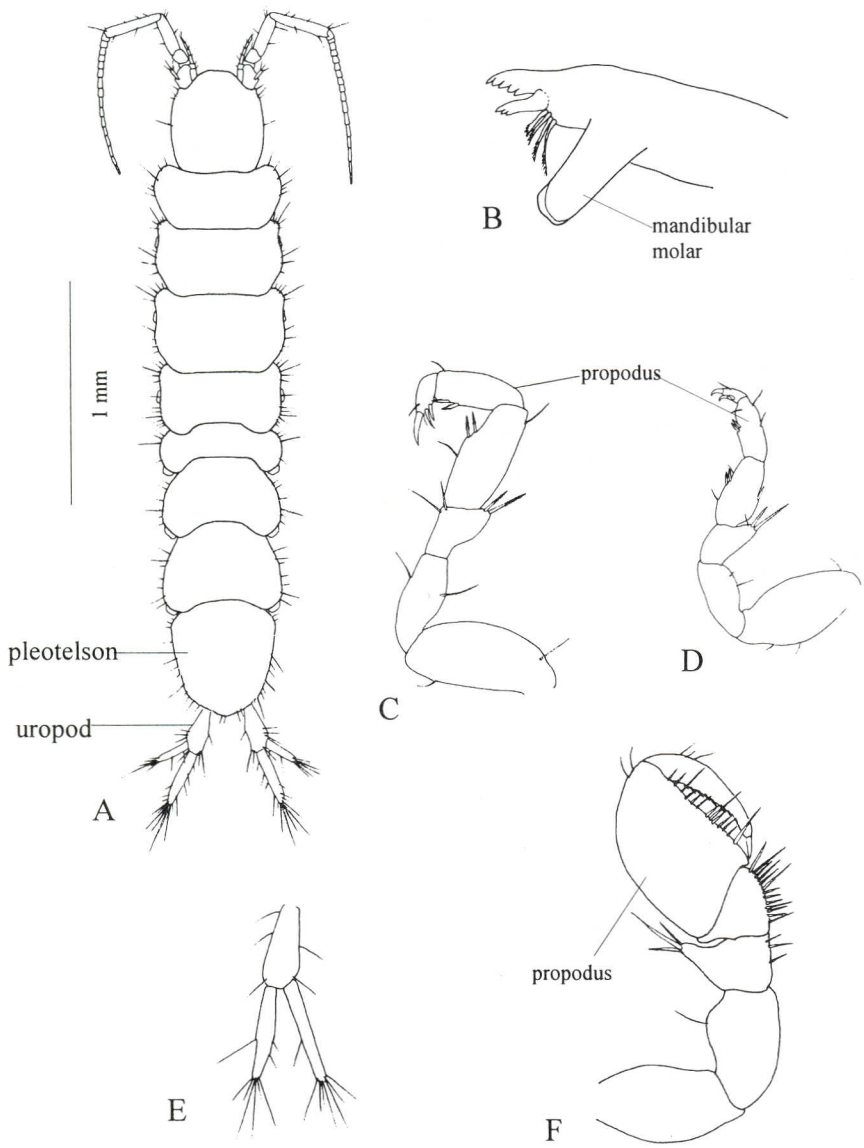

Fig. 3.3. A–C, *Protojanira leleupi*: A, adult, dorsal view; B, right mandible, palp omitted; C, pereopod 1. D–E, *P. prenticei*: D, pereopod 1; E, right uropod.
F, *Protojaniroides ficki*, pereopod 1. (F from Chappius & Delamare 1957).

Protojanira leleupi Grindley, 1963
Fig. 3.3A–C

Characteristic features

Ovigerous female 2.8 mm total length; with about 12 eggs in marsupium. Body with scattered integumental setae. Antennular flagellum of four articles. Antennal peduncle having small lateral scale. Pereopod 1, propodus roughly rectangular, not expanded; dactylus having large terminal spine or unguis plus two smaller accessory spines. Uropodal endopod longer than sympod, exopod about two-thirds length of endopod.

Records

Pools in Boomslang and Tartarus Caves, Kalk Bay Mountains, Cape Peninsula (Western Cape). In summer, these pools are reduced to a depth of less than two inches (50 mm), with the fine ooze-like black mud on the bottom inhabited by copepods (*Paracyclops chiltoni*), as well as nematodes, fly larvae, and oligochaetes. The isopods can be seen walking on the surface of the mud.

Protojanira prenticei Barnard, 1927
Fig. 3.3D–E

Characteristic features

Ovigerous female 2.5 mm total length, with about six eggs in marsupium. Body with scattered integumental setae. Antennular flagellum of six articles. Antennal peduncle having small lateral scale. Pereopod 1, propodus roughly rectangular, not expanded; dactylus having large terminal spine plus two subterminal accessory spines. Uropodal endopod longer than sympod, exopod subequal in length to endopod.

Records

Stream in the Kogelberg, Hottentots Holland Mountains (Western Cape).

Protojaniroides Fresi, Idato & Scipione, 1980

KEY TO SOUTH AFRICAN SPECIES OF *PROTOJANIROIDES*

1. Antennular flagellum of about eight articles; antennal flagellum of about 65 articles ..... *P. ficki*
– Antennular flagellum of about 12 articles; antennal flagellum of about 18–24 articles ..... *P. perbrincki*

Protojaniroides ficki (Chappuis & Delamare, 1957)

Fig. 3.3F

Characteristic features

Male and female 5.0 mm total length. Pereopod 1 subchelate, propodus expanded, with row of spines on cutting edge, dactylus with row of tiny spines on posterior margin. Operculum (pleopod 2) of female having two pairs of low rounded lobes on distal margin.

Records

Under stones in a freshwater spring near Kaapsehoop (Drakensberg Mountains, Mpumalanga) at an elevation of 1 500 m.

Protojaniroides perbrincki (Barnard, 1955)

Characteristic features

Male and female 4.0 mm total length. Pereopod 1 subchelate, propodus expanded, with dense row of short spines on cutting edge, dactylus with row of tiny spines on posterior margin. Operculum (pleopod 2) in female subcircular to ovate, distal margin undulate.

Records

Tugela River system, 6 000 ft (1 828 m), KwaZulu–Natal; Hluhluwe Game Reserve, KwaZulu–Natal.

Superfamily JANIROIDEA
Family **Munnidae**
Uromunna sheltoni (Kensley, 1977)

Fig. 3.4

Characteristic features

Male 1.2 mm, ovigerous female 1.6 mm total length. Antennule having single terminal aesthetasc. Mandible lacking palp; incisor of four cusps, spine-row of three or four spines; molar stout, distally truncate. Pereon

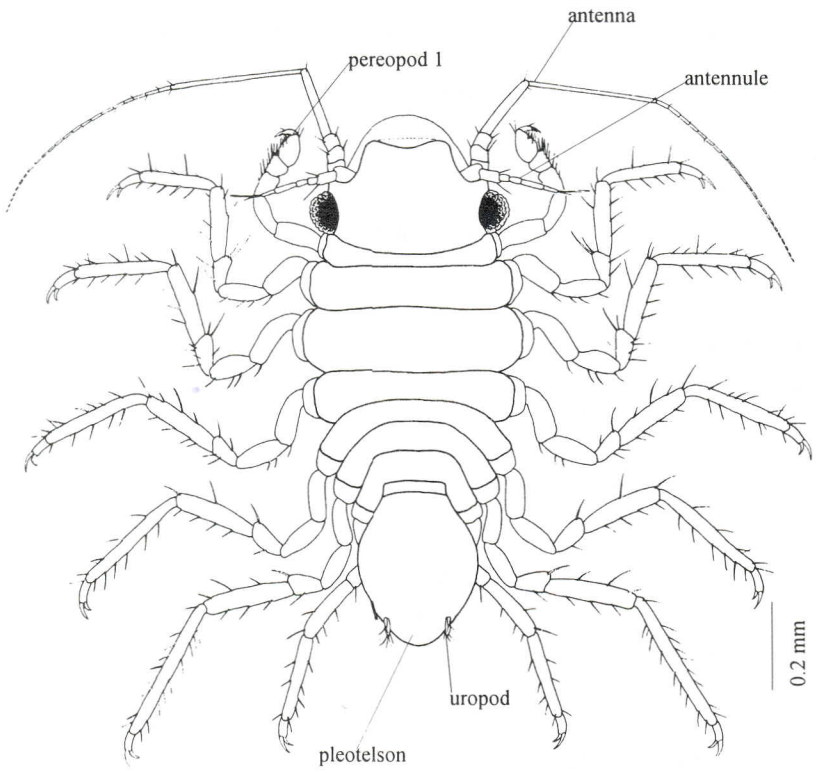

Fig. 3.4. *Uromunna sheltoni*, adult male, dorsal view.

dorsally lacking setae. Pereopod 1 in both sexes similar, shorter than following pereopods, with propodus ovate. Pereopods 2–7 elongate-slender, with sensory spines on posterior surface of propodi and carpi. Operculum of female (pleopod 2) roughly hexagonal, distal margin short, truncate. Pleopods 1 and 2 in male forming operculum over pleopods 3–5.

Records

Sandvlei Estuary, False Bay, Western Cape, on *Ruppia* weed in water of 9‰ salinity; Kosi Lake complex (Kwa–Zulu Natal), on *Potamogeton* weed; Lake Sibaya (KwaZulu–Natal) on submerged vegetation.

Remarks

In the various studies on the coastal lakes of KwaZulu–Natal, this species was erroneously referred to as *Paramunna laevifrons* Stebbing, a species originally described from 75 m off East London. Described from Sandvlei Estuary (where it was extremely abundant) this species is adapted to conditions of reduced salinity. Ovigerous females have been

taken in water of 9‰ salinity.

The genus *Uromunna* has a world-wide distribution (Poore 1984), with some species being shallow-water marine inhabitants, others being adapted to euryhaline conditions.

Suborder ANTHURIDEA

The anthuridean isopods have been divided into four families: the Antheluridae, Anthuridae, Hyssuridae and Paranthuridae. All species characteristically have a slender and elongate, often worm-like, body form. All have lost the second maxilla in the mouthparts. The pleonites may be large and free, short and free, or short and fused. The telson which, with the uropods often forms a sclerotized cup-like structure, may lack statocysts, or have a single median one basally, or a basal pair. Many species are protogynous hermaphrodites, with some ovigerous females in the population becoming pre-males and then males via a series of moults. Males are characterized by the possession of larger eyes than females, increased numbers of articles in the flagellum of the antennule, and increased numbers of aesthetascs on these articles. Most anthurideans are benthic dwellers, where they are detritivores, but some species prey on tube-dwelling polychaete worms, whereas the paranthurids, with their piercing mouthparts, are thought to feed on algal saps or on soft-bodied invertebrates. The greatest diversity of species is found in and around the many cryptic habitats of coral reefs.

Family **Anthuridae**

The anthurids are characterized by having the first pereopod subchelate, with the propodus expanded or inflated and the dactylus folding against its palmar surface. The pleonites are short and fused, often with the fused segments indicated by lateral slits. The exopod of the first pleopod is operculiform and covers the rest of the pleopods. The telson possesses two basal statocysts that open to the exterior via narrow slits on the dorsal surface. Many species are protogynous hermaphrodites with females outnumbering males in the population. Primary males, which develop directly from the egg, have been recorded for a few species. The anthurids are almost exclusively benthic animals. With their mouthparts adapted for cutting and tearing, they feed on organic detritus in the cryptic niches they inhabit. The genus *Cyathura* has a worldwide temperate/tropical distribution, and is often found in coral reefs, but has also successfully invaded estuaries and freshwater cave systems.

Cyathura estuaria Barnard, 1914
Fig. 3.5

Characteristic features

Female 27.5 mm total length. Body elongate, cylindrical, about eight times longer than greatest width. Head with small dorsolateral eyes; low, rounded rostrum. Maxilliped consisting of four articles (including basal article fused to cephalon); endite lacking. Pereopod 1 subchelate, with propodus inflated; pereopods 2–7 ambulatory. Pleon consisting of anterior five fused pleonites (fusion lines being indicated by faint lateral grooves), plus pleonite 6 fused with telson; telson roughly parallel-sided for anterior three-fourths, then tapering to rounded apex; two basal statocysts indicated by oblique dorsal slits.

Records

Langebaan Lagoon (WC); east coast estuaries and coastal lakes from Knysna Lagoon (WC) to KwaZulu–Natal and Mozambique, including the Swartkops Estuary, Buffalo River Estuary (EC) and St Lucia Estuary, Lake Sibaya, and Lake Msingazi (KZ–N).

Remarks

This species has been taken from muds, often in *Zostera* beds, in salinities ranging from 0–35‰. In many genera of the Anthuridea, including *Cyathura*, protogynous hermaphroditism occurs. Once the ovigerous female has released the manca from the brood pouch, she moults one or more times, to become first a premale, and then a sexually mature male. The male is characterized by the possession of an increased number of articles and sensory aesthetascs on the antennular flagellum, and often by an increase in spination of the subchelate pereopod 1. As a result of this phenomenon, there are usually many more immature and mature females than pre-males and males in any population. The male of *Cyathura estuaria* has yet to be recorded.

Suborder FLABELLIFERA
Family **Sphaeromatidae**

The Sphaeromatidae includes all those forms capable of enrolling into a ball (conglobating) or folding in half transversely. Most have bodies that are strongly domed dorsally. The pleon consists of five partially or completely fused pleonites plus the pleotelson. In addition to the brood pouch or marsupium formed by oostegites, sphaeromatids may also have anterior

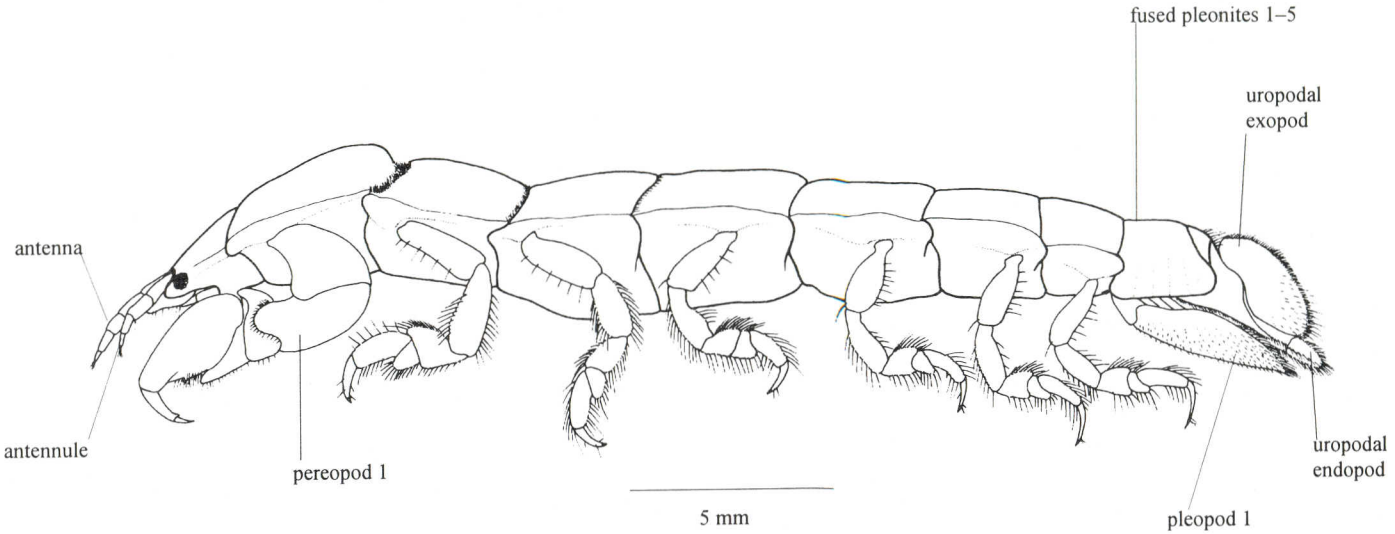

Fig 3.5. *Cyathura estuaria*, non-ovigerous female, lateral view.

or posterior sternal pockets, and invaginated internal pouches as part of the brood apparatus. There is often a marked sexual dimorphism in the structure of the pleon and telson, with the male being more ornamented, incised, or spinose than the female. The mouthparts of ovigerous females are often reduced and non-functional. The respiratory pleopods are tucked into the domed pleotelson, with the fourth and fifth pairs consisting either of two unpleated plates, or of one unpleated and one pleated plate, or with both rami pleated.

Most species are shallow marine dwellers, being detritivores and micrograzers in seagrass beds, on algal turfs and clumps, or on microbial films on submerged rocks. A few species are commensal in sponges, or are associated with molluscs. Species of the genus *Sphaeroma* are capable of burrowing into wood, including the growing tips of mangrove prop roots. In the latter case, this burrowing activity causes the root to divide, thereby increasing the number of prop roots that ultimately stabilize the mangrove plant.

'Pseudosphaeroma' barnardi Monod, 1931

Fig. 3.6

Characteristic features

Male 7.0 mm, ovigerous female 5.0–5.5 mm total length. Body strongly depressed, about 1.6 times longer than wide; capable of folding transversely in half ventrally. Plate-like and inverted V–shaped epistome apically subacute, fused posteriorly with clypeus and labrum (upper lip). Ovigerous female with mouthparts as in male. Two pairs of oostegites on pereonites 3–4, oostegites not reaching, or overlapping in, midline; eggs held in four pairs of internal pouches on pereonites 2–5. Pleotelson broadly triangular, apically rounded. Pleopods 4 and 5 with endopods having broad transverse branchial pleats. Uropodal sympod and endopod fused, not quite reaching apex of pleotelson; exopod short, ovate, articulating laterally on fused exopod and sympod.

Records

Western Cape in the following localities: Stream at Hout Bay; Palmiet River; stream at Hermanus; De Hoop Vlei, Bredasdorp; Storms River Mouth; Keurbooms River; Eiland Vlei, The Wilderness; Groenvlei; upper end of Knysna Estuary.

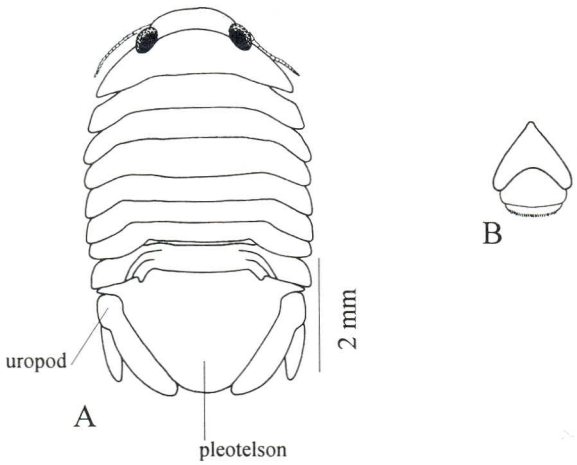

Fig. 3.6. A–B, *'Pseudosphaeroma' barnardi*: A, adult, dorsal view; B, epistome and labrum (upper lip) in frontal view (apex of epistome dorsal).

Remarks

'Pseudosphaeroma' barnardi would appear to be a brackish-water species that is also to some degree tolerant of fresh water.

The generic name *'Pseudosphaeroma'* is given here in quotation marks to signify an uncertain taxonomic position. True *Pseudosphaeroma* possess three pairs of oostegites overlapping the midline in the ovigerous female (Harrison 1984). Only three known genera of the sphaeromatids possess two pairs of non-overlapping oostegites, and all three are platy-branchiate, i.e. lacking branchial pleats on both endopod and exopod of pleopods 4 and 5, in contrast to *P. barnardi* which has hemibranchiate pleopods 4 and 5, i.e. only the endopods have branchial pleats. *'Pseudosphaeroma' barnardi* requires a new genus to accommodate it.

Suborder PHREATOICIDEA

Characteristic features

Eyes sessile, compound, or lacking. Antennules and antennae uniramous. Palp usually present on mandible. Maxilliped (first pereonal appendage) well developed, incorporated into mouthparts. First pereopods (sometimes referred to as gnathopods) subchelate, with propodus inflated. Posterior three pairs of pereopods directed posteriorly. Pereopodal coxae not developed into plates. Brood pouch formed by thoracic oostegites. Penes in male arising near base of seventh pereopods. Pleopod 2 in male, endopod having moderately broad copulatory stylet. Pleopods natatory and branchial in function. Uropods biramous. Telson fused with sixth pleonal somite to form pleotelson.

The Phreatoicidea form a relatively ancient group, with a fossil record stretching back to the Palaeozoic and Mesozoic. The group demonstrates the evolution from marine ancestors, through brackish-water forms, into fresh water, and the eventual invasion of groundwater habitats. The present-day distribution of the group, typically Gondwanan, includes Australia, New Zealand, India, and South Africa. The surface-dwelling forms, a few of which are blind, may be found in a variety of habitats: temporary headwaters, swamps, superficial lacustrine sediments, on stream and swamp vegetation, or under stones in swiftly flowing streams. Those forms that have invaded subterranean habitats are usually found in well water, pumped up from boreholes, or in the waters of caves. These forms are blind, white, and somewhat vermiform. About 50 species, arranged in seven families, have been recorded.

The South African phreatoicideans were first reported by Barnard (1914*a*), who placed them in the Australian genus *Phreatoicus*. At that time the group was poorly known, but with more collecting many more forms have become known. Nicholls (1943a, 1943b) established a firm taxonomic base for the suborder, and referred the South African species to a new genus *Mesamphisopus*. Barnard eventually described three varieties of the original *Phreatoicus capensis* (all reaching about 15 mm in total length), from mountain areas in the south-western Cape. Nicholls (1943a) recognized two of these varieties as full species. The third variety was described by Barnard in 1940; Nicholls probably did not see this reference. This variety is recognized as a full species here. Many questions still remain concerning the evolutionary history, geographical distribution, biology and ecology of the South African phreatoicideans, these being surface-dwelling forms showing no proclivity for entering the hypogean world. Inter- and intraspecific variation have not been studied, an essential

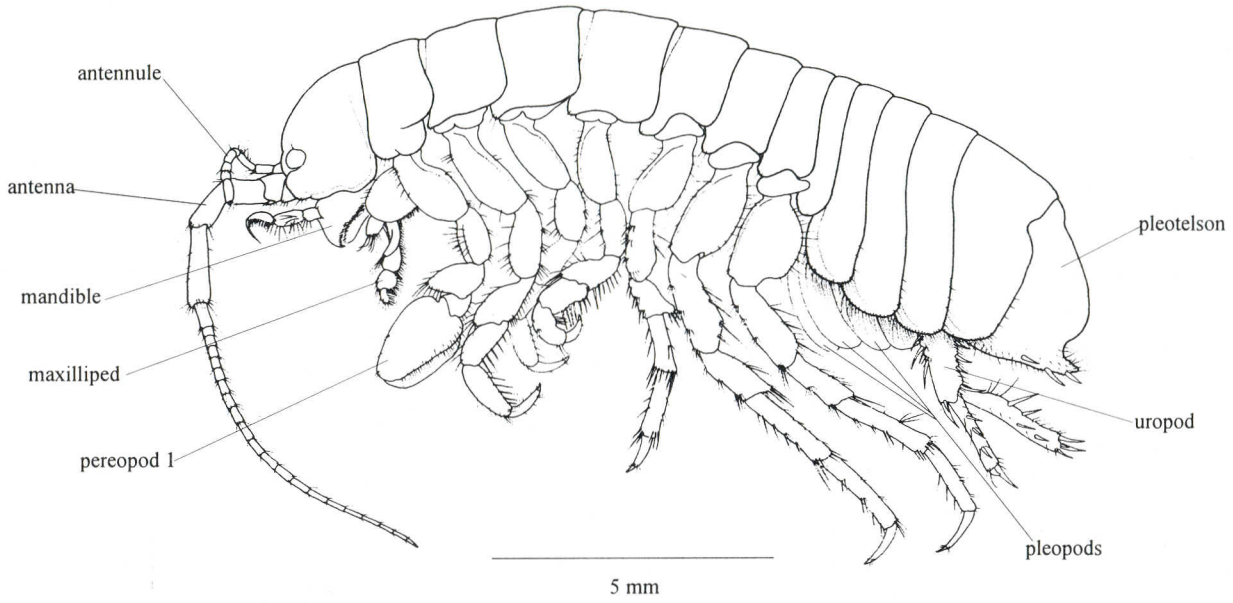

Fig 3.7. *Mesamphisopus capensis*, adult, lateral view.

requirement for an accurate interpretation of the distribution of the several currently accepted species. This is especially important given the very subtle characters that separate these supposed species. There is a real need for more fieldwork, to establish the range of species both in geographical areas and in terms of altitude. It is probable that considerable speciation has taken place on the relatively isolated mountain peaks of the Western Cape.

The southern African phreatoicideans appear to be able to withstand long dry periods. Barnard (1927: 154) observed this form of aestivation both in laboratory animals and in the field.

Family **Amphisopodidae**
Mesamphisopus Nicholls, 1943a

KEY TO THE SOUTH AFRICAN SPECIES OF *MESAMPHISOPUS*

1. Pleotelson having pair of subapical dorsal spines (Fig. 3.8A, E, G) 2
– Pleotelson lacking pair of subapical dorsal spines (Fig. 3.8C) ..... *M. capensis*

2. Cephalon and lateral pereon to some degree setose 3
– Cephalon and lateral pereon not setose ..... *M. abbreviatus*

3. Antennal peduncle sparsely setose; lateral pereon strongly setose ..... *M. depressus*
– Antennal peduncle strongly setose; lateral pereon sparsely setose ..... *M. penicillatus*

Mesamphisopus abbreviatus (Barnard, 1927)
Fig. 3.8A–B

Characteristic features

Pereopod 1 with three stubby spines on cutting edge of propodus. Spines on ventral margin of pleotelson slender. Cephalon and lateral pereonal segments lacking setae, or with very few short scattered setae. Female pleotelson and uropods with few elongate setae. Male pleotelson and uropods bearing dense elongate setae. Pleotelson with single pair of short subapical dorsal spines.

Records

Northern slopes of Kogelberg, Hottentots Holland Mountains (Western Cape).

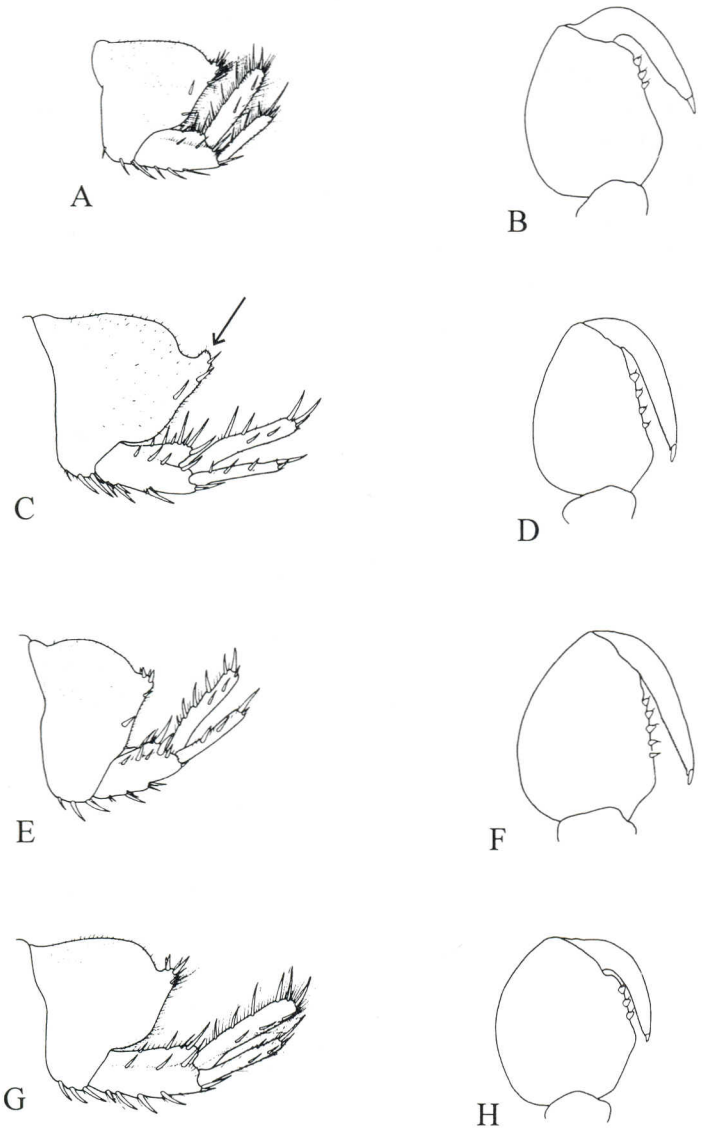

Fig. 3.8. A–B, *Mesamphisopus abbreviatus*: A, pleotelson and uropod, lateral view; B, pereopod 1. C–D, *M. capensis*: C, pleotelson and uropod, lateral view; D, pereopod 1. E–F, *M. depressus:* E, pleotelson and uropod, lateral view; F, Pereopod 1. G–H, *M. penicillatus*: G, pleotelson and uropod, lateral view; H, pereopod 1.

Mesamphisopus capensis (Barnard, 1914)
Figs 3.7, 3.8C–D

Characteristic features

Pereopod 1 with four stubby spines on cutting edge of propodus. Pleotelson with three stout spines on ventrolateral margin, but lacking a subapical dorsal pair. Cephalon and pereon with scattered setae. Middorsal length of pleotelson subequal to greatest lateral width. Uropodal sympod with mediodistal rounded lobe more pronounced and spinose than in other three species.

Records

Reservoir on Table Mountain, 915 m, Cape Peninsula (Western Cape).

Mesamphisopus depressus (Barnard, 1927)
Fig. 3.8E–F

Characteristic features

Pereopod 1 with five stubby spines on cutting edge of propodus. Body, and especially pereon, somewhat depressed; bearing moderately dense setae, especially on lateral pereon. Pleotelson with middorsal length distinctly less than greatest lateral width; short subapical dorsal pair of spines present.

Records

Steenbras Valley, Hottentots Holland Mountains (Western Cape).

Mesamphisopus penicillatus (Barnard, 1940)
Fig. 3.8G, H

Characteristic features

Antennular and antennal peduncles strongly setose, more marked in male. Cephalon and pereon lacking setae, but pleonal side-plates, ventral margin of pleotelson, and uropods bearing elongate dense setae, especially marked in male. Middorsal length of pleotelson slightly less than greatest lateral width; bearing pair of subapical dorsal spines. Pereopod 1 (gnathopod) in male subcircular, with propodal palm subequal in length to hind margin, three stubby spines on cutting edge of propodus; palm distinctly longer than hind margin in female and juvenile.

Records

Stream 18–21 m above sea-level, Hermanus (Western Cape).

ACKNOWLEDGMENTS

For the loan of material for this study, I thank Mr W. Haacke of the Transvaal Museum, Pretoria; Mrs M. van der Merwe, South African Museum, Cape Town; Dr B. Wilmot, formerly of the Albany Museum, Grahamstown; and Dr G. Wilson, Australian Museum, Sydney, Australia. I am grateful to Dr B. Knott of the University of Western Australia, Perth, for comments on the Phreatoicidea.

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CHAPTER 4

SPELAEOGRIPHACEA

by

B. Kensley

The Spelaeogriphacea are small (less than 10 mm in length), slender, transparent inhabitants of groundwater in caves and aquifers. They are thought to be detritivores, feeding on organic matter found in the groundwater. From 1957 to 1987, only one living species was known, viz. *Spelaeogriphus lepidops*, from a freshwater stream in Bats Cave, Table Mountain (Western Cape). A fossil form, *Acadiocaris novascotica* (Copeland, 1957) from marine Carboniferous sediments in Nova Scotia, Canada, was assigned to the Spelaeogriphacea by Schram (1974). A second living species, *Potiicoara brasiliensis* Pires, 1987, from a cave in the state of Mato Grosso do Sul, Brazil, was then added to the order in 1987. In 1998, as further confirmation of the Gondwanan affinities of the order, a third living species (*Mangkurtu mityula* Poore & Humphreys, 1998) was described from an aquifer in the Tertiary Dolomite of the Pilbara region of Western Australia.

Little of the biology of *Spelaeogriphus* has been published. It is assumed that the animal feeds on detritus, as the gut, visible through the almost transparent body, often appears dark and packed with tiny particles. Observation of live animals confirmed that the three anterior pereopodal exopods create a stream of water over the respiratory epipod of the maxilliped and over the respiratory exopods of the posterior four pairs of pereopods (Grindley & Hessler 1971). Grindley (1976) recorded that copulation was observed, with the male clasping the female with the aid of the antennular pads. Ovigerous females have been collected, with 10–12 eggs in the marsupium. Development of the egg is still undocumented.

Remarks

The presence of a lacinia mobilis in the mandible, and a ventral brood

pouch formed by thoracic oostegites, place the Spelaeogriphacea in the much-disputed superorder Peracarida, along with the Isopoda, Amphipoda, Tanaidacea, Mysidacea, Mictacea, and Cumacea (see Gordon 1960; Watling 1983). The real phylogenetic relationships within this group remain the subject of heated discussion.

The Brazilian *Potiicoara brasiliensis* differs from *S. lepidops* in having a shorter carapace; a non-sexually-dimorphic antennule, and antennal scale as broad and as long as the peduncle article 3; a mandibular palp of three articles; a row of thick distal spines on the maxillipedal endite; oostegites on pereopods 1-5; and a biramous pleopod 5.

The Australian *Mangkurtu mityula* has the following distinguishing characteristics: a non-sexually dimorphic antennule; the antennal scale shorter and narrower than peduncle article 3, a mandibular palp of three articles, maxillipedal palp articles 2 and 3 with few mesial setae, the epipod short and digitiform, pleopods 1–5 present, and the endopods with a basal, laterally-directed lobe. Pleopod 2 in the male has a biarticulate endopod and a narrow exopod. The oostegites are unknown.

Order SPELAEOGRIPHACEA Gordon, 1957
Family **Spelaeogriphidae** Gordon, 1957
Spelaeogriphus Gordon, 1957
Spelaeogriphus lepidops Gordon, 1957
Fig. 4.1

Characteristic features

Male and female, total length up to 7.5 mm. Body elongate, slightly depressed, entirely lacking pigmentation. Cephalothorax formed by fusion of pereonite 1 with cephalon. Pereon consisting of seven free pereonites. Pleon consisting of six free pleonites. Freely articulating telson consisting of single broad lobe bearing few setae on rounded posterior margin.

Cephalothorax bearing anterior pair of flattened, ovate, ocular lobes lacking in pigment or visual components; ocular lobes separated by broadly triangular rostrum. One pair of sexually dimorphic antennules consisting of peduncle of three articles, and two flagella; inner flagellum slightly longer than outer; peduncle article 2 in male having mesiodistal lobe bearing conical papillae. One pair of antennae, consisting of peduncle of four articles with articulating scale (exopod) distolaterally on article 2, and elongate flagellum reaching posteriorly almost to the 6th pleonal somite. Mandible having palp of one article, incisor of three to four cusps,

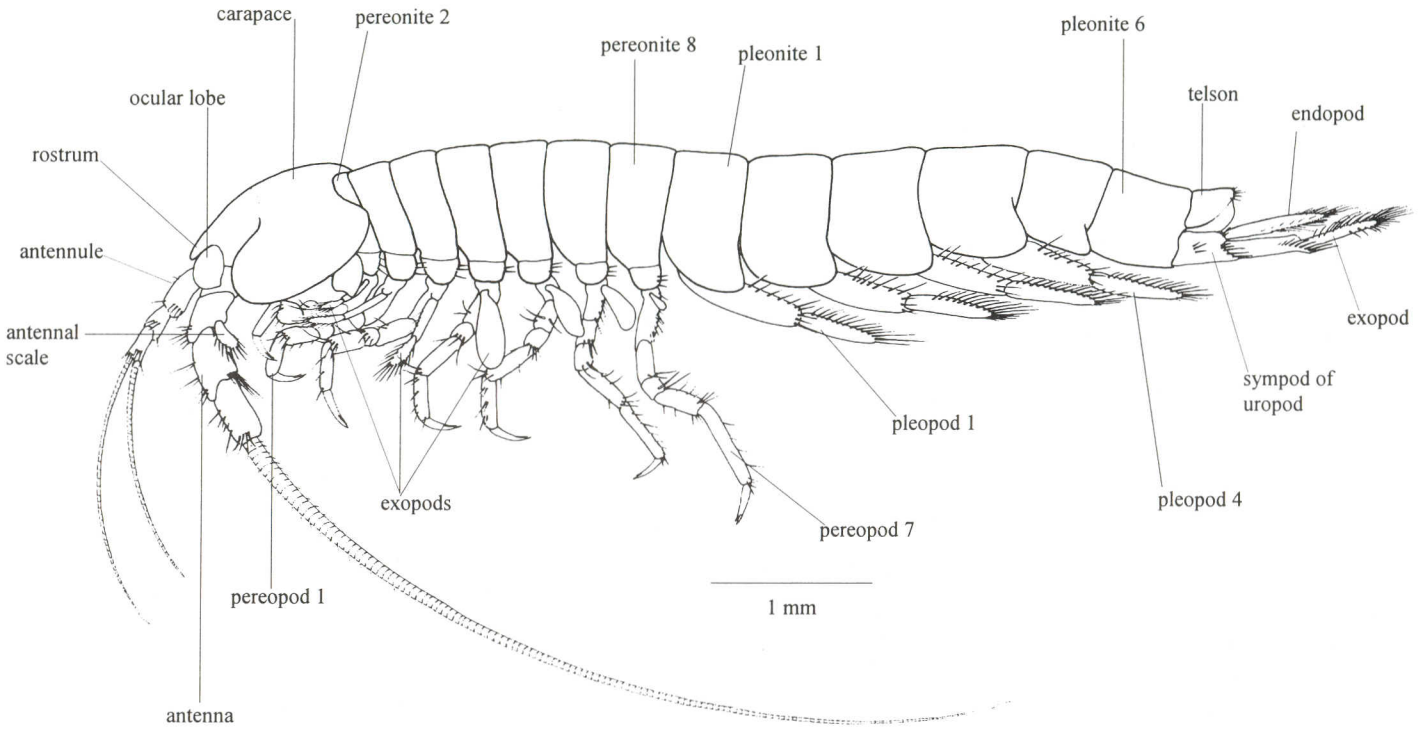

Fig. 4.1. *Spelaeogriphus lepidops*, adult in lateral view.

lacinia mobilis, spine row of 16–20 spines, and stout molar. Maxilla 1 having slender inner ramus bearing three terminal plumose papillae; outer ramus broad, with 16 distal spines. Maxilla 2 having inner ramus narrower than two lobes of outer ramus; latter broad, setose. Maxilliped having broad endite, distally setose; palp of five articles, articles 2 and 3 broad, setose on mesial margins; epipodite broad, cup-shaped, probably respiratory in function.

Short carapace present, partially covering second thoracic somite, broadening ventrolaterally into ovate lobe on each side, and obscuring mouthparts in lateral view. Seven pairs of pereopods ambulatory; coxae distinct. Anterior three pairs of pereopods each having biarticulate ventilatory exopod. Posterior four pairs of pereopods each having simple ovate respiratory exopod; exopods becoming smaller posteriorly. Brood pouch formed by four pairs of oostegites on pereopods 2–5 overlapping in midline.

Pleopod pairs 1–4 well developed, natatory, having broad protopod linked to its opposite member by two mesiodistal retinaculae (coupling hooks); endopod and exopod each consisting of single paddle-like and setose article. Pleopod 5 reduced, of single article concealed by epimeron of pleonite 5. Single pair of uropods, each consisting of sympod, endopod of single article, exopod of two articles; all margins heavily setose–spinose.

Records

Streams in Bat's Cave and several other caves on Table Mountain, Western Cape.

Remarks

The presence of a lacinia mobilis in the mandible, and a ventral brood pouch formed by thoracic oostegites, place the Spelaeogriphacea in the much-disputed superorder Peracarida, along with the Isopoda, Amphipoda, Tanaidacea, Mysidacea, Mictacea, and Cumacea (see Gordon 1960; Watling 1983). The real phylogenetic relationships within this group remain the subject of heated discussion.

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CHAPTER 5

TANAIDACEA

by

B. Kensley

The order Tanaidacea of the superorder Peracarida contains about 400 species, some superficially similar to the isopods. Their fossil history goes back to the Upper Permian. The great majority are marine in habit, and are found from the intertidal to the abyss. Many live in various types of sediments; some forms are commensal with sponges; others inhabit tubes spun from a mucous-like secretion into which faecal pellets or other detritus are embedded; a few forms live in empty mollusc or foraminiferan shells, rather like hermit crabs. A few species are estuarine in habit, and yet fewer have been found in fresh water.

Reproduction in some tanaidaceans shows a range of pathways involving hermaphroditism and protogyny. Males may develop from a neuter stage after moulting (primary males), or females may moult after brooding to become males (secondary males). Females may thus be either protogynous hermaphrodites, or gonochoristic, i.e. not having the ability to change to male.

The few South African freshwater tanaidacean species are clearly derived from marine stock; indeed, *Sinelobus stanfordi* has been recorded from fully marine to fully fresh water. Four species have been recorded from the freshwater coastal lakes of the east coast of South Africa; two of these, in the genera *Heterotanais* and *Leptochelia,* have not been identified and may represent undescribed species.

Characteristic features

Body usually cylindrical, occasionally slightly to strongly dorsoventrally depressed. Cephalon fused with first and second thoracic (pereonal) segments, and covered by carapace. The inner lateral surface of the carapace, along with maxillipedal epipods if present, functions as

a respiratory organ. Six free pereonal segments present. Sixth pleonal segment fused with telson to form pleotelson. Eyes, when present, often on ocular stalks. Antennules uni- or biramous. Antenna uni- or biramous. Mandibular palp present or absent. First maxilla having one or two endites. Second maxilla present or reduced. One pair of maxillipeds (thoracic appendages) forming part of mouthpart complex. Seven pairs of legs of which first pair chelate, referred to as chelipeds, often much larger in male than in female. Exopods occasionally present on cheliped and next pair of appendages. Five pairs of biramous pleopods, number occasionally reduced. Uropods slender, uni- or biramous. Genital aperture in males on eighth thoracic segment opening on single or on pair of genital cones. The female carries eggs and later mancas in a marsupium formed by four or fewer thoracic oostegites.

KEY TO THE SUBORDERS OF TANAIDACEA

1. Antennule having two flagella; antenna with scale-like exopod (Fig. 5.1); mandible with palp ..... **Monokonophora**
– Antennule having single flagellum; antenna lacking exopod (Fig. 5.2); mandible lacking palp .....**Dikonophora**

Each of the suborders is represented by a single identified species of freshwater tanaidacean in South Africa.

Order TANAIDACEA
Suborder MONOKONOPHORA
Family **Apseudidae**
Halmyrapseudes digitalis (Brown, 1956)
Synonym: *Apseudes digitalis* Stebbing
Fig. 5.1

Characteristic features

Adult male 6.0 mm, ovigerous female 5.8 mm total length. Body elongate, cylindrical. Eyes absent. Rostrum bluntly triangular. Free pereon segments subequal in length. Anterior five pleonites each with transverse row of plumose setae; pleotelson equal in length to posterior four pleonites together. Longer antennular flagellum of about nine articles; shorter accessory flagellum of three or four articles. Antennal flagellum of five articles. Cheliped in male robust, propodus expanded, with fixed finger having setose lobe interior to apical claw; dactylus reaching well beyond fixed propodal finger, with triangular tooth on inner margin near articulation. Cheliped in female subequal to succeeding leg, propodal finger acutely triangular, dactylus just overreaching propodus. Uropod biramous, endopod with 13–20 articles, shorter exopod of three articles.

Records

East coast river estuaries, including Mkomazi and Mzimkulu (KZ–N), Mbashe and Mzimvubu (Transkei) and Lake Sibaya (KZ–N)

Remarks

Boltt (1969) recorded densities of 100 to 1500 animals of *H. digitalis* per 0.0225 m^2 in depths of 20–40 m, on sandy substrata in Lake Sibaya, with lower densities at shallower depths. Although no ecological role was assigned to this species, it is probably one of the more important filter-feeding detritivores in the coastal lake systems.

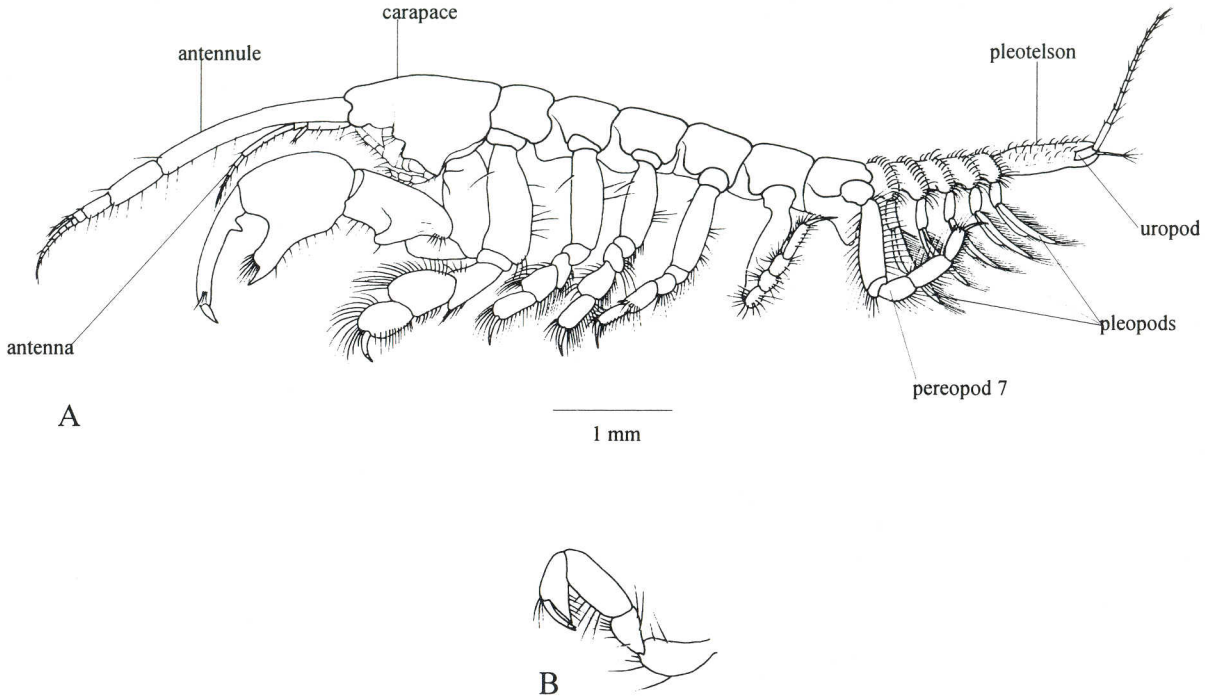

Fig. 5.1. *Halmyrapseudes digitalis*: A, male, lateral view; B, cheliped of female to same scale.

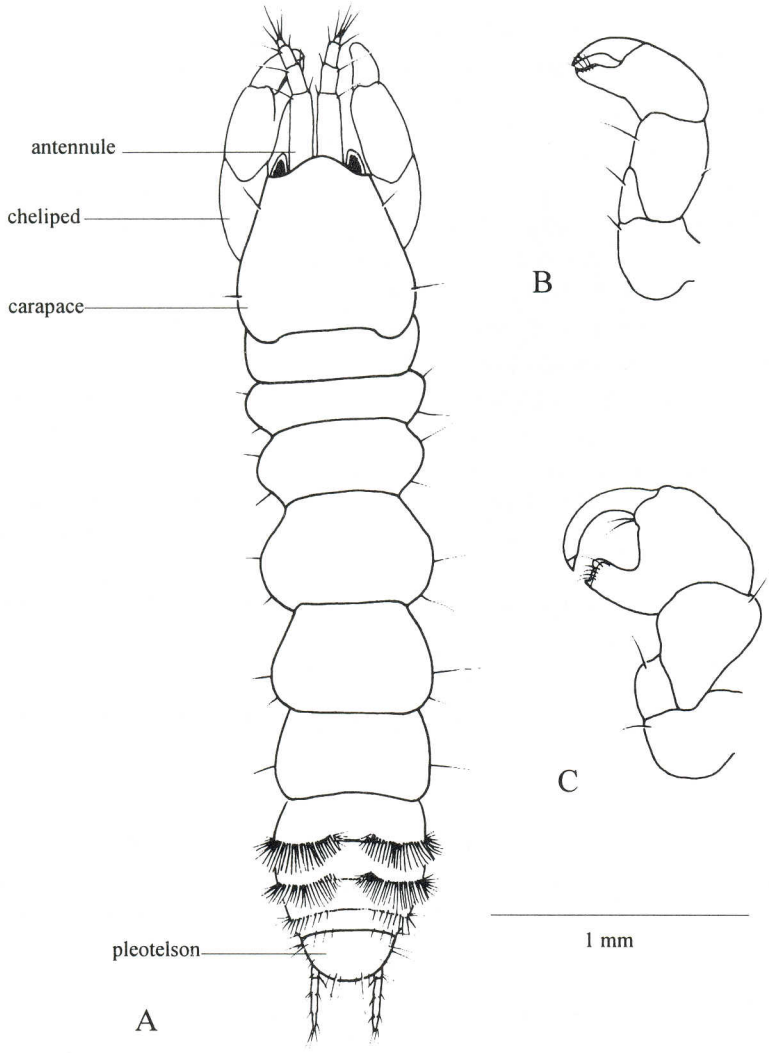

Fig. 5.2. *Sinelobus stanfordi*: A, adult female, dorsal view; B, cheliped of female; C, cheliped of male.

Suborder DIKONOPHORA
Family **Tanaidae**
Sinelobus stanfordi (Richardson, 1901)
Synonym: *Tanais philetaerus* Stebbing
Fig. 5.2

Characteristic features

Adult male 3.6 mm, ovigerous female 4.0 mm, total length. Body elongate, cylindrical. Eyes well pigmented, on short ocular lobes. Rostrum low, convex. First two free pereonites shorter than succeeding somites; pereonites 5–7 somewhat broader than long, subequal. Pleonites decreasing in length posteriorly; pleonites 1 and 2 each with distinctive pair of dense setal combs dorsally; pleotelson semicircular in outline. Antennular flagellum of single article bearing three aesthetascs in male, two in female. Antennal flagellum of single short article. Cheliped in male robust, propodus somewhat expanded, fixed propodal finger distally truncate, large gape between fixed finger and dactylus; latter strongly curved. Cheliped in female less robust than in male, with almost no gape between fingers.

Uropod uniramous, consisting of short sympod plus ramus of three poorly defined articles.

Records

Lake Nhlange, Kosi Lake complex (KZ–N); Lake Mpungwana (KZ–N); Saldanha Bay (WC).

Remarks

Originally referred to as *Tanais philetaerus* Stebbing in the South African literature, *S. stanfordi* has been shown to be a widely distributed species (Sieg 1980). It has been recorded from the southern United States, the Caribbean, Atlantic South America, California, the Galapagos, Pacific Central and South America, Polynesia, New Zealand, Australia, Japan, India, Sri Lanka, and the Red Sea. The species enters river mouths in Brazil and Argentina, and has also been taken from freshwater lakes in the Kuril Islands (Japan).

In South Africa, *S. stanfordi* has been taken from fully marine habitats, estuaries, and coastal lagoons and lakes. Brown (1957) reported this species as being commensal in the sponge *Hymeniacidon perlevis* from Saldanha Bay.

ACKNOWLEDGMENTS

I am grateful to the late Dr Jürgen Sieg of the University of Osnabrück for assistance with the systematics of the tanaidaceans.

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