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ANTARCTIC ROTIFERS

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ABSTRACT

This report describes 42 species of freshwater rotifer and reviews all previous studies on Antarctic rotifers. Thirty-eight of the species were found during a two-year study at Signy Island, South Orkney Islands. Twenty-nine of them were Monogononta including one new species, four new sub-species and twenty new records for the Antarctic. The other nine were Bdelloidea, all of which have been reported from the Antarctic before. In addition, fifteen species (thirteen Monogononta and two Bdelloidea) were obtained from South Georgia and all are new records for the sub-Antarctic. The results clearly show that, contrary to previous studies, Monogononta, not Bdelloidea, are the predominant group. An attempt is made to integrate the present and previous observations into a coherent ecological picture, as a result of which, areas for future study are indicated.

CONTENTS

I. INTRODUCTION

This report describes the results of a continuous, two-year, taxonomic study of freshwater rotifers at Signy Island. It includes additional information obtained from other places, notably South Georgia, and reviews the results of all previous Antarctic expeditions.

1. *Signy Island*

Signy Island (60° 43′ S, 45° 38′ W) is one of the South Orkney Islands, a small group that lies on the northern edge of the Weddell Sea and forms part of the Scotia arc, which links the tip of South America with the Antarctic Peninsula (Fig. 1).

Signy Island is small, roughly triangular in shape (about 7 km by 5 km, with an area of 19.9 km^2) and composed of heavily-folded, metamorphosed sediments, mainly quartz-mica-schists, with some amphibolites and marbles (Matthews and Maling, 1967). The climate is severe and during 1974 and 1975 (the period of fieldwork of this study) the annual mean temperature was −4.3°C with extremes of −32.5°C and +16.2°C. The annual mean wind speed was 12.5 knots. Only 610 hours of sunshine were recorded each year (16.5% of the maximum possible) and it rained or snowed 335 days each year (Limbert, 1977, 1979).

2. *The study sites*

Scattered around the ice-free coastal area of Signy Island are 16 freshwater lakes (Fig. 2). They are all small and shallow. Emerald Lake the deepest at 15 m, Heywood Lake the largest in area (4.5×10^4 m^2) and Sombre Lake the greatest in volume (1.33×10^5 m^3). Lake temperatures lie within the range 0–6°C and they are frozen to a depth of about 1 m for 9–12 months of each year. Priddle and Heywood (1980) divided the Signy Island lakes into two groups: nutrient poor upland lakes and nutrient rich (relatively) coastal lakes. Within these two categories lies a whole spectrum of lake types. At one extreme is Gneiss Lake, an upland ultra-oligotrophic system, almost permanently ice covered, with a negligible phytoplankton, essentially inorganic sediments and a poorly-developed benthic vegetation. At the other extreme are the more turbid coastal lakes that have been enriched by seal or bird excrement to the point of pollution, namely Bothy Lake, Amos Lake and Heywood Lake. These systems have a highly seasonal phytoplankton, relatively organic sediments and virtually no benthic vegetation. Between the extremes are the oligotrophic lakes (Moss Lake, Emerald Lake, Tranquil Lake and Sombre Lake), which are very clear and have well-developed benthic vegetation (usually cyanobacterial mats but sometimes also including mosses), and the remaining lakes (Light Lake, Pumphouse Lake, Twisted Lake, Knob Lake, Spirogyra Lake), which are devoid of mosses and exhibit a gradation of decreasing benthic vegetation and increasing phytoplankton. Full descriptions of all these lakes are given by Heywood and others (1979).

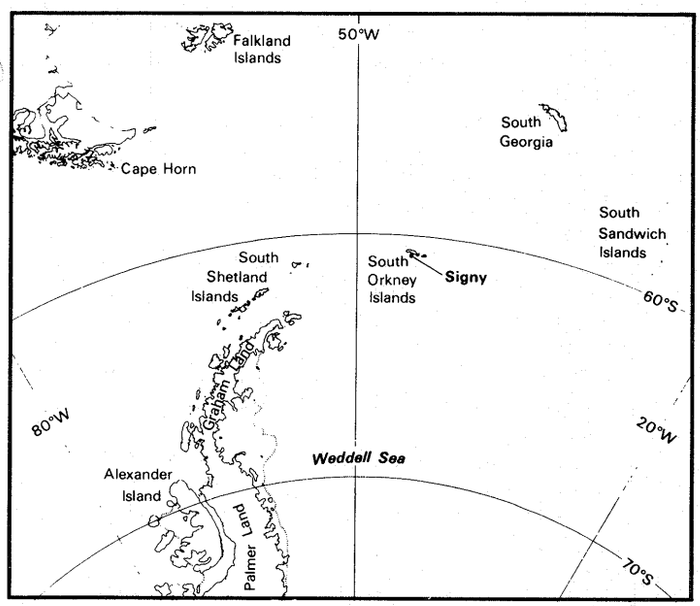

Fig. 1. Map of the Scotia Arc showing the locations of Signy Island and South Georgia.

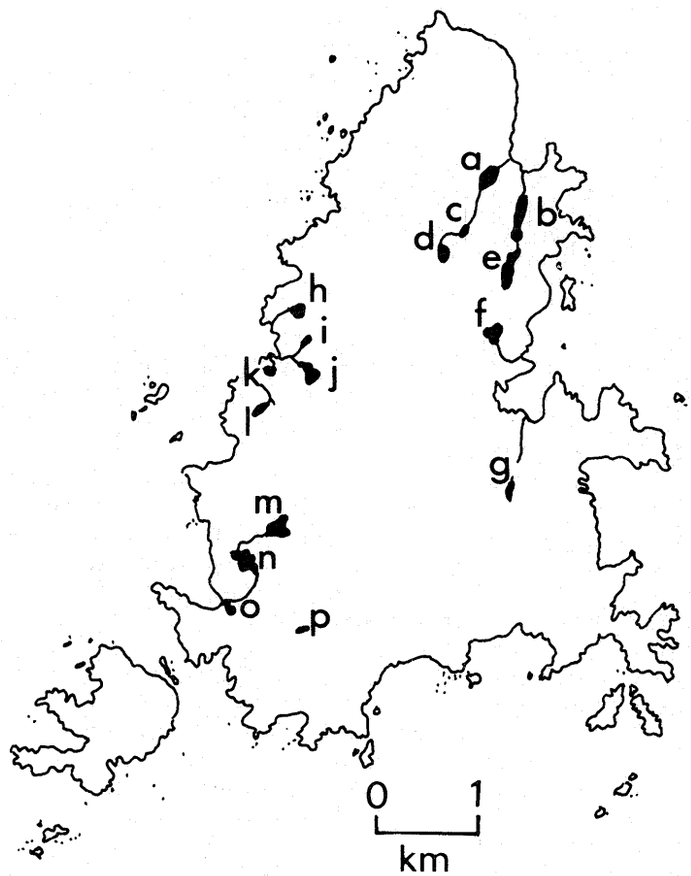

Fig. 2. Map of Signy Island showing the locations of the lakes. a – Sombre Lake; b – Heywood Lake; c – Changing Lake; d – Moss Lake; e – Knob Lake; f – Pumphouse Lake; g – Orwell Lake; h – Light Lake; i – Spirogyra Lake; j – Tranquil Lake; k – Amos Lake; l – Tioga Lake; m – Emerald Lake; n – Twisted Lake; o – Bothy Lake; p – Gneiss Lake.

Fig. 3. Map of Signy Island showing the locations of the pools. a – Seal scrapes by Amos Lake; b – The Wallows Pool; c – Rock pools at Polynesia Point; d – Rock pools at Paal Harbour; e – SIRS Pool; f – Gourlay Pool.

In addition to the lakes, there are many pools, here defined as bodies of water that, unlike lakes, freeze solid in the winter (Røen, 1962). The pools are frozen for at least 9 months each year. During the summer, however, they thaw and may reach temperatures as high as 12°C but, because of their shallowness, they are subject to rapid refreezing. Many of the pools receive sea-spray and may, in addition, be enriched by seals and penguins. Antarctic pools can be conveniently divided between two categories, intermittent pools, present for only part of the summer when the air temperature is high enough for melt water to fill the basins, and seasonal pools, present throughout the summer and recognizable even during the winter (Dartnall, 1980). Many examples of both types are found at Signy Island.

Six pools were examined in the present study (Fig. 3) and are briefly described here. Site no. 1, near Amos Lake, consists of a number of intermittent pools formed in seal scrapes. Over the years, this area has been heavily contaminated by elephant seals (*Mirounga leonina*), though numbers were relatively low during the period of this study. Site no. 2, the Wallows Pool, alongside Heywood Lake, is a large seasonal pool about 110 m by 50 m, but less than 1 m deep. As its name implies, it is a place where seals congregate. Site no. 3 is a series of small (less than 2 m^2) rock pools at Polynesia Point. These seasonal pools are drenched by sea-spray and contaminated by the guano of penguins (mainly chinstrap *Pygoscelis antarctica* and Adélie *P. adeliae*). Site no. 4, at Paal Harbour, is similar though less contaminated by seals and penguins. The fauna and chemistry of Paal Harbour pools is described by Goodman (1969). The 5th site, a flooded moss carpet, is in the wet part of one of the Signy Island Reference Sites (SIRS), an area that was formerly maintained and investigated by the British Antarctic Survey. (See Tilbrook (1973) for a detailed description of the area.) A pool was present at this site throughout the three summers of this study but both earlier and subsequent records show that it is normally an intermittent rather than a seasonal pool. The 6th site, Gourlay Pool, is a small (30 m by 10 m by 0.3 m) seasonal pool, just below the field hut on Pageant Point. This pool, which is contaminated by seals (fur seals *Arctocephalus gazella* and elephant seals), penguins and skuas (*Catharacta skua*) and receives some sea-spray, was the subject of a detailed ecological study (Dartnall, unpublished).

3. *Other locations*

In addition to the Signy samples collected by one of us (HJGD), specimens were obtained from three other locations by members of the British Antarctic Survey. Locations from which samples were taken include the lake at Cape Hansen on Coronation Island, the Maiviken Lakes and Gull Lake at South Georgia and a number of pools at Rothera Point, Adelaide Island.

Coronation Island, though only 2 km to the north of Signy Island, is much more mountainous, heavily glaciated and permanently covered with snow and ice. The lake there is a proglacial lake, similar to Gneiss Lake at Signy Island, but considerably smaller.

South Georgia (Fig. 4) is a crescent-shaped island, 160 km long and 5–30 km wide. It lies within the Antarctic convergence, almost 2000 km due east from the southern tip of South America (Fig. 1). The island is extremely rugged and heavily glaciated with a central spine of snow-capped mountains, rising to 2800 m. The climate, though not as extreme as at Signy, is nevertheless harsh, being particularly cold and damp (Limbert, 1979). The vegetation is sparse in many areas with mosses and lichens predominating. Tussock grass grows in swampy ground near the sea. Further inland, there is a tundra-like region with various grasses, burnets and tiny flowering plants. Rivers and lakes are fairly common, particularly in the northern coastal lowlands. Collections were made from four sites, all of which are fairly close to the British Antarctic Survey's station at King Edward Point (54° 16′ S, 36° 30′ W) (Fig. 4). Rotifers were present in the samples from Gull Lake and from the lakes at Maiviken. These lakes are considerably larger than those at Signy. The largest lake at Maiviken has a surface area of 2.3×10^5 m^3 and was 40 m deep. Moss (*Bryum* sp.) grows in these lakes below 10 m (Light and Heywood, 1973; Priddle and Dartnall, 1978). A preliminary note on the fauna of South Georgia has been published by Dartnall and Heywood (1980).

Collections were also made from a number of pools at Rothera Point, Adelaide Island (67° 34′ S, 68° 07′ W) (Fig. 1). Descriptions of the rotifers found there have already been published (Dartnall, 1980).

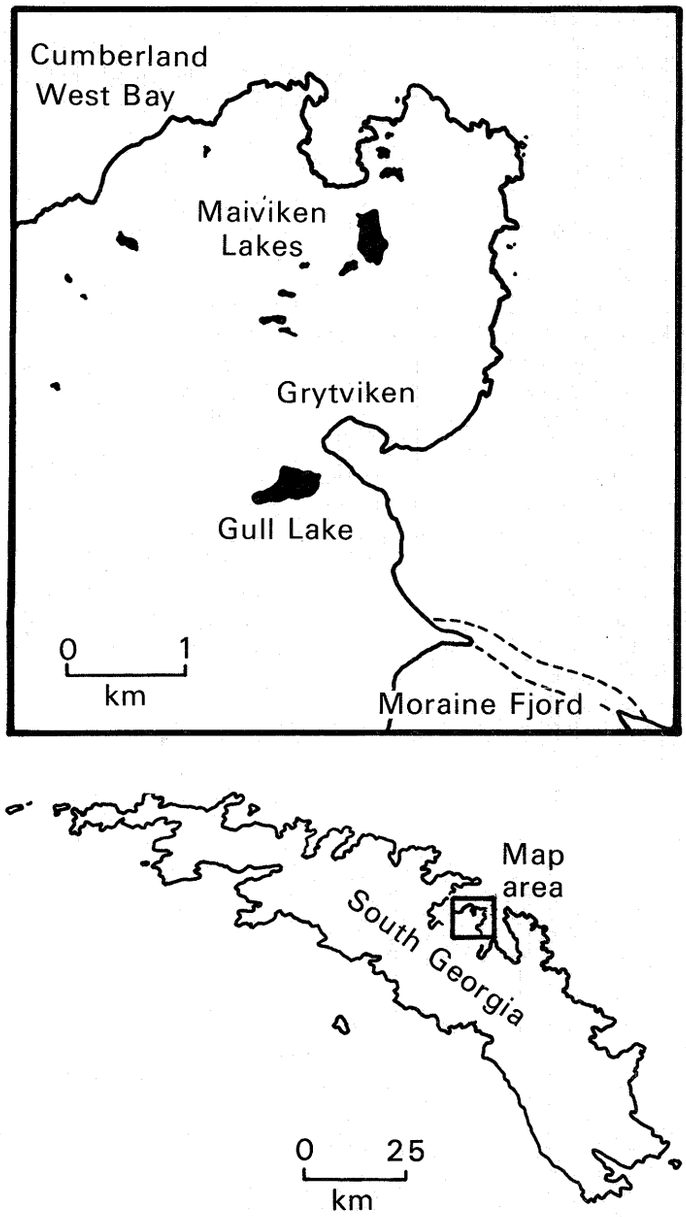

Fig. 4. Map of South Georgia showing the locations of Gull Lake and the Maiviken Lakes.

4. *Materials and methods*

Rotifers were collected in a number of ways. Generally, lake samples were obtained by means of a hand-operated baling pump (Whale Gusher 8, Munster and Simms, Bangor, Northern Ireland) and rigid plastic piping (Durapipe, ABS Class E 1″ (25 mm) internal diameter). The piping was connected to the pump by clear PVC tubing and the water was conducted to the collecting vessels by a flexible rubber hose. The rotifers were almost always found on the lake bottom. This appears to be a characteristic of Antarctic rotifers (Armitage and House, 1962; Opalinski, 1972*b*; Dartnall 1977). In Light Lake, one of the most rotifer-productive lakes on Signy, the average number of rotifers per litre was 1, 3 and 1000 for the surface, mid-water and bottom samples respectively. When taking surface and mid-water samples, large volumes had to be taken and filtered. With bottom samples, one or two litres was generally sufficient. The bottom end of the collecting tube was upturned to prevent sediment contaminating the sample. During the summer, the sampling apparatus was hung over the side on an inflatable rubber boat that had been rowed into the middle of the lake. In winter, the samples were obtained through holes cut in the ice. Depending on ice thickness, the holes were cut with an ice chisel, axe or a petrol-driven ice drill. Samples from deep water were occasionally obtained by SCUBA divers, who brought up handfuls of the benthic vegetation. Samples from pools and lake shallows were taken from the water's edge as scoops of benthic vegetation and bucketfuls of water. Collecting by phytoplankton net was unsatisfactory because the net was damaged on the rocks and boulders of the lake shallows.

The samples were examined in the laboratory using a binocular dissecting microscope and a high-powered compound microscope. Drawings were made, with the aid of a drawing tube and squared graticule, from living specimens kept under slight compression by means of a coverslip mounted on vaseline, from specimens relaxed and narcotized with tetra-sodium pyrophosphate (Robotti and Lovisolo, 1972) and from permanent slides. As a relaxant, tetra-sodium pyrophosphate proved satisfactory and it was possible, with a little practice, to extend most species fully. *Collotheca gracilipes, C. ornata cornuta, Ptygura crystallina* and *P. melicerta* were notable exceptions, however, and the drawings of these were built up from a series of photomicrographs of the living animals. Permanent slides made by the glycerine jelly method (Russell, 1961*b*) proved the most satisfactory.

Trophi were mounted in polyvinyl-lactophenol (PVL) (Russell, 1961*a*). They could be examined *in situ* or, alternatively, released from the animal by dissolving the rest of the body in a weak solution of sodium hydroxide. When the trophi were dissolved out, extreme care had to be taken because they sometimes shot out a considerable distance. Immediately after, a small drop of PVL and a coverslip were applied. The positions of the trophi were marked on the coverslip since they became increasingly difficult to find as the PVL cleared.

Loricas were also mounted in PVL but this is not generally recommended because they are not as dense as trophi and some detail is lost as the PVL clears and hardens. Nevertheless, these slides proved to be of some use if they were examined fairly soon after they had been made.

II. TAXONOMY

In this section, descriptions of the 42 species found at Signy Island and South Georgia are given. Here, the term 'common' is used to mean 'common on Signy Island' and is used without prejudice to the occurrence of that species elsewhere in the world. When dealing with well-known species, only brief descriptions are given and reliance is placed on the figures. In general, all the drawings in any one figure are to the same scale, that given by the horizontal scale bar. Exceptions are individually noted by vertical scale bars immediately to the left of the relevant drawing.

Type specimens have been deposited with the British Museum (Natural History). Duplicates are kept by the British Antarctic Survey.

Class: **MONOGONONTA**

Order: PLOIMA

Family: BRACHIONIDAE

Genus ***Epiphanes*** Ehrenberg

Large, illoricate rotifers with a conical, cylindrical or sack-shaped body. The corona bears several tufts of strong cilia. The foot bears two small toes. The mastax has malleate trophi. One species was found at Signy Island.

Epiphanes senta (O. F. Müller)
Fig. 5

This species is very common in the pools (Table VI, p. 36). It is large, with a maximum length in excess of 500 μm. Males are approximately half this size. The eggs are circular (180 μm in diameter) and brown. The Signy specimens agree closely with the published descriptions and measurements for this species (Koste 1978).

Epiphanes senta is normally found in small pools that are enriched with the excreta of domestic fowls and cattle and has a world-wide distribution. It has been reported from the Antarctic several times: from the McMurdo Sound area (Murray, 1910; Armitage and House, 1962; Dougherty and Harris, 1963), from fresh and brackish habitats in the Bunger Hills (Korotkevich, 1958) and at Haswell Island (Kutikova, 1958*b*; Donner, 1972), and at King George Island, South Shetland Islands (de Paggi, 1982).

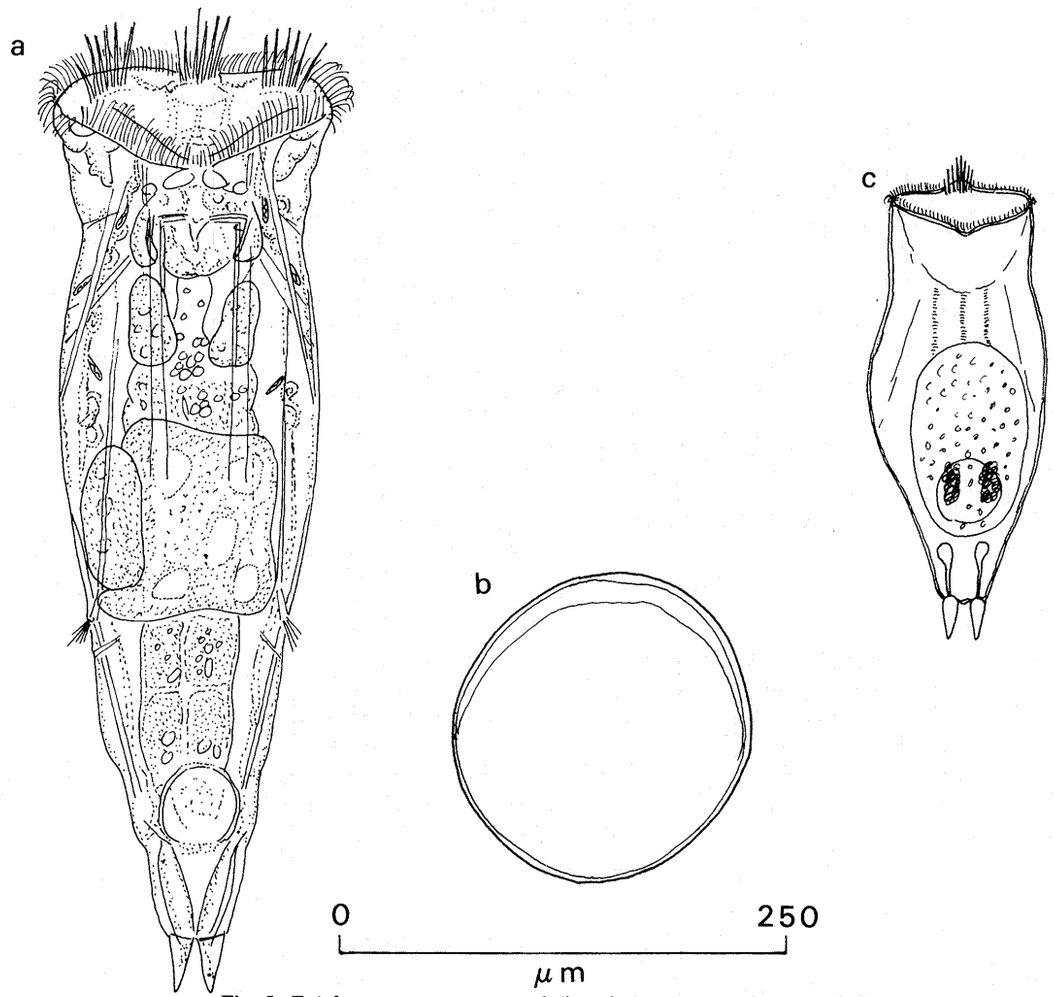

Fig. 5. *Epiphanes senta*: a – ventral view; b – egg; c – male; ventral view.

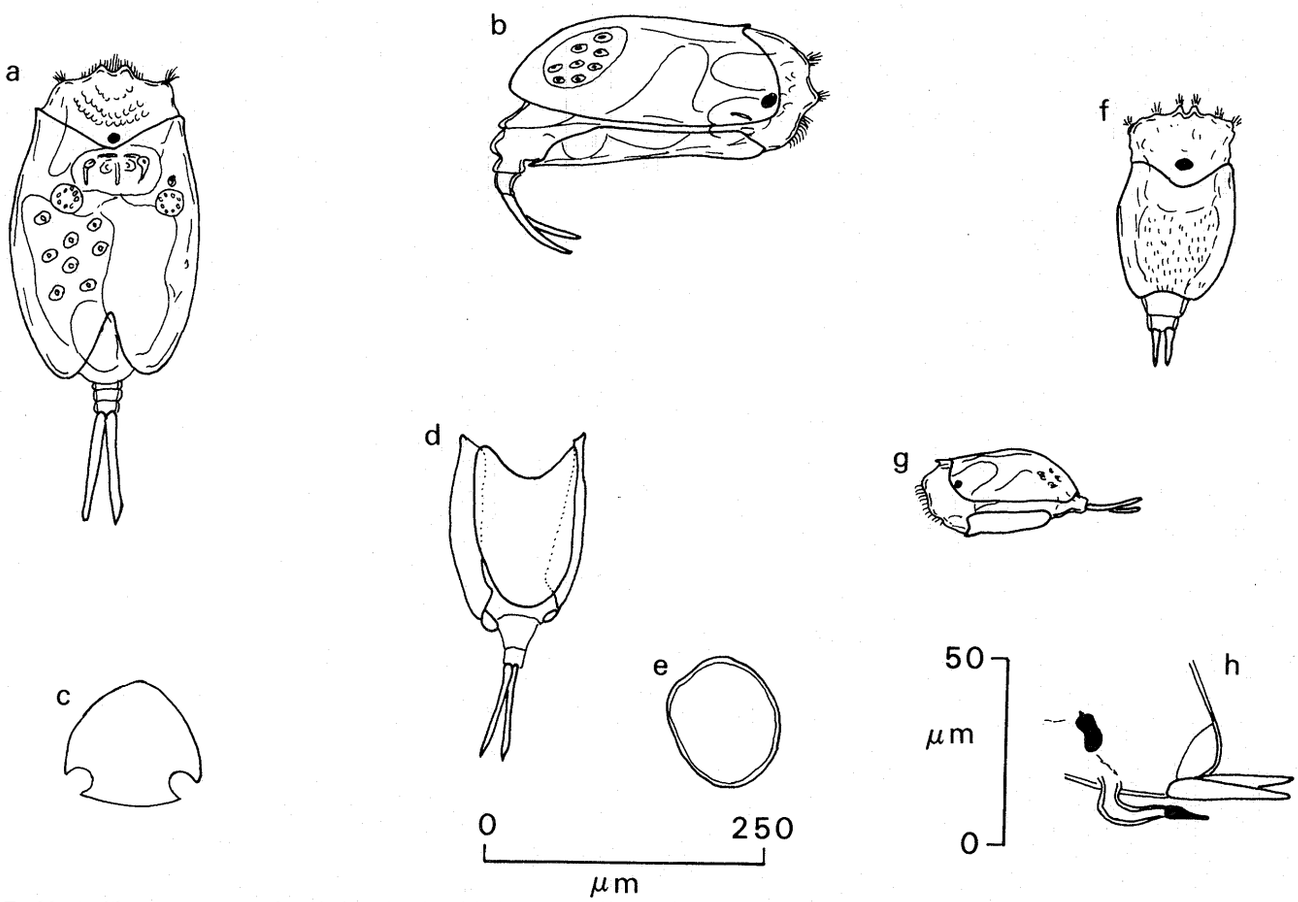

Fig. 6. *Euchlanis dilatata parva*: a – dorsal view; b – lateral view; c – lorica, cross-section; d – lorica, ventral view; e – egg; f – male, dorsal view; g – male, lateral view; h – male, penis.

Genus ***Euchlanis*** Ehrenberg

In this genus, the lorica consists of two plates, which, in most species, is separated by a flexible membrane that forms lateral sulci. The lorica lacks spines and other forms of ornamentation. The dorsal plate is arched and wider than the ventral plate. The foot projects between these plates at the posterior end. Although the two toes are long and strong, the foot and toes together are shorter than the lorica. The mastax has malleate trophi. Only one species was found. It was present at both South Georgia and Signy Island.

Euchlanis dilatata parva Rousselet
Fig. 6

This very common species was found in eleven of the Signy Island lakes (Table VII, p. 37). Very small specimens were also found at South Georgia, from Gull Lake and the Maiviken Lakes. The smallest specimens, from South Georgia, were only 220 μm long while the largest specimens found at Signy during this study were nearly 500 μm. The dorsal plate of the lorica was found to range from 144 to 264 μm* and the toes from 61 to 108 μm. The toes, which are long and slender, were always more than one-third the length of the lorica.

*The first mention of *E. dilatata* at Signy is by Green (1972) and in a personal communication he remarked that the lorica length of his largest specimen was 276 μm. This is slightly larger than the largest we observed.

The identification of this species proved to be most debatable. Without benefit of the Signy specimens we would have identified all the specimens from South Georgia as *E. parva* since they fitted Rousselet's (1892) original description perfectly. Rousselet separated *E. parva* from *E. dilatata* on the basis of its small size, greater length and slenderness of the toes and its conspicuous lateral antennae.

The Signy specimens showed a considerable variation in size. The smallest, though fractionally larger than the South Georgia specimens, were well within Rousselet's range for *E. parva*. The largest, while satisfying Rousselet's second and third condition for *E. parva*, were outside the generally accepted size range for that species and in isolation we should have identified them as *E. dilatata*. It is worth noting that Liebers (1937) has shown that *E. dilatata* grows considerably in the 24 hours following hatching.

Although the original separation of *E. parva* from *E. dilatata* on size grounds was apparently valid, Carlin-Nilsson (1934) has described as *E. parva* specimens with a lorica as long as 260 μm and toes of 105 μm, while Myers (1930) has identified as *E. dilatata* specimens with a lorica length of only 200 μm and toes of 70 μm. Finally, Koste (1978), while retaining *E. parva* as a separate species, remarks that it resembles a small form of *E. dilatata*. We believe that the Signy Island and South Georgia specimens belong to the same species and have provisionally named it *E. dilatata parva*.

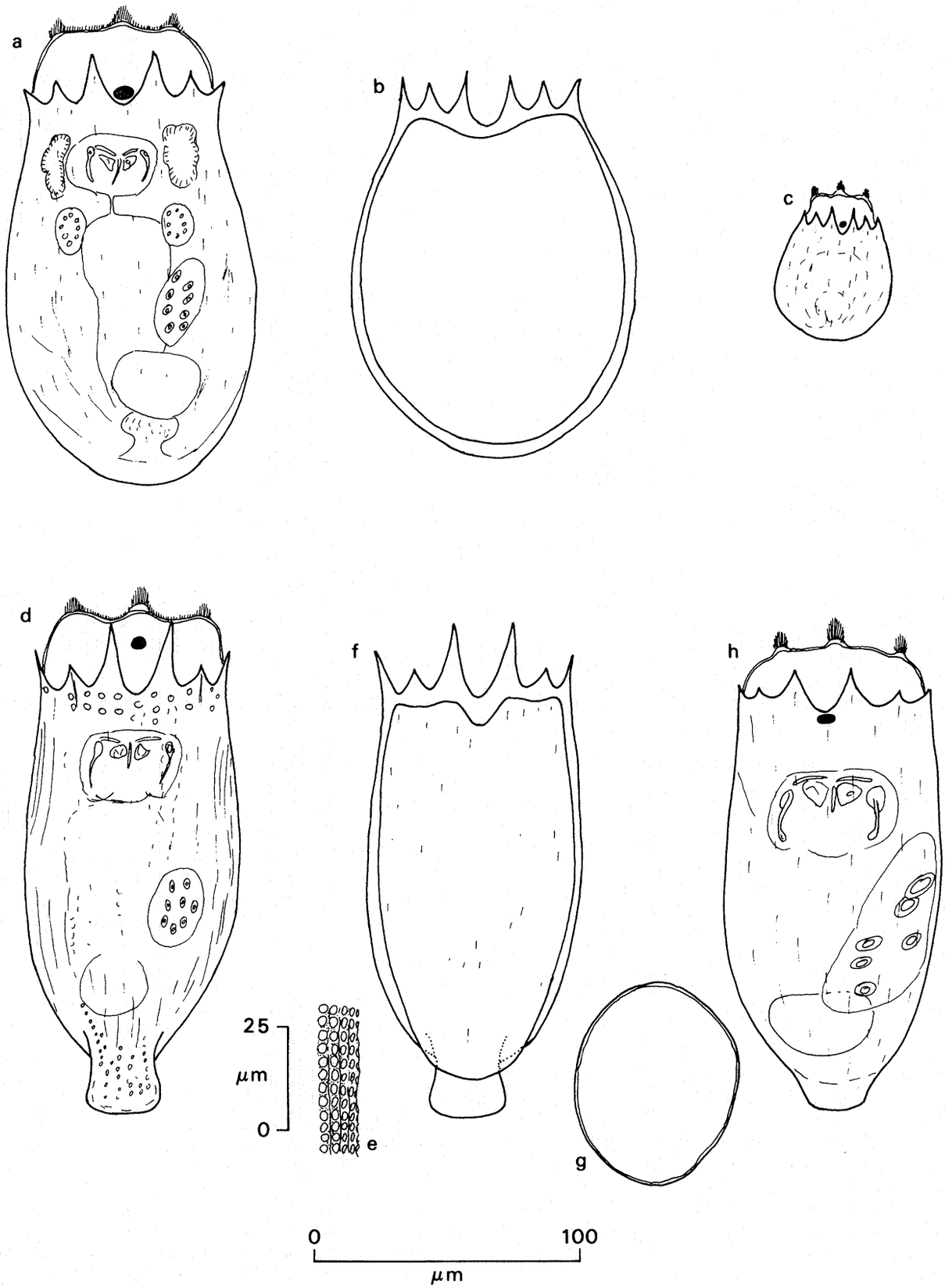

Fig. 7. *Notholca salina*: a – dorsal view; b – lorica, ventral view; c – male, dorsal view. *Notholca walterkostei*: d – dorsal view; e – lorica, detail; f – lorica ventral view; g – egg. *Notholca walterkostei reducta*: h – dorsal view.

Genus ***Notholca*** Gosse

In this genus the lorica is a box-like structure of two plates. Two or three pairs of spines of differing lengths are symmetrically arranged on the anterodorsal margin of the lorica. The members of this genus are free swimming. They lack a foot or ventral attachment disc. The mastax has malleate trophi. Two species were found at Signy Island. One of these was also found at South Georgia.

Notholca salina Focke
Fig. 7a–c

This species was found at three pool sites (Table VI, p. 36). It is a medium-sized rotifer with a lorica length of 175 μm and width of 95 μm, but it is very flexible, being elongated when the head is fully extended and considerably widened when the animal is fully retracted. The dorsal surface, which in British specimens is usually furrowed with numerous longitudinal striae, was much smoother and in some cases these were scarcely visible, except immediately below the anterodorsal spines. Diatoms were observed in the stomachs of some specimens. Eggs were not seen. A single male was found during this study and, from the literature, it would appear to be the first record. It was approximately one-third the size of the female at 50 μm and had a rudimentary lorica complete with anterodorsal spines. In common with most male rotifers, it lacks a digestive system. No protrusible foot or penis was seen.

N. salina has only recently been recognized as a separate species. Originally, it was identified as *N. squamula*, a species with a world-wide distribution that can tolerate a wide range of temperatures and salinities (de Ridder, 1972; Ruttner-Kolisko, 1974). However, Focke (1961) separated the freshwater and brackish specimens into subspecies (*N. s. mulleri* and *N. s. salina*) on morphological grounds. Subsequently, Björklund (1972*b*) has considered them as separate species. *N. salina* has been reported previously from the Antarctic, from the South Shetland Islands (de Paggi, 1982).

Notholca walterkostei de Paggi
Fig. 7d–g

This species (reported as *N. verae* by Priddle and Dartnall (1978) and as a new species by Dartnall (1983)) was found in most of the Signy lakes (Table VII, p. 37). We also found it in Gull Lake and the Maiviken Lakes, South Georgia (reported as *Notholca* sp. by Dartnall and Heywood, 1980) and in the samples collected from Ablation Point, Alexander Island (reported as *N. verae* by Heywood, 1977). *N. walterkostei* was first described by Paggi (1982) from the South Shetland Islands. It is a medium-sized rotifer with a total length of 200 μm and greatest width of 75 μm. The dorsal plate of the lorica (190 μm) has handle-like posterodorsal elongation. Both lorica plates appear to be covered in discontinuous striae when viewed at low power. Closer examination shows that the striae are, in fact, the edges of longitudinal rows of cup-like depressions. In some places, especially below the anterio-median spines, these hollows appear to overlap or merge into each other in a crater-like fashion. Viewed edge-on, the rows of cuplike depressions have the appearance of a serrated surface. The lorica crumples very easily in preserved specimens, which further accentuates the appearance of false striae. Eggs are brown and circular to oval in shape (75 μm by 60 μm). Males were not seen.

In its various locations, *N. walterkostei* showed considerable variation in both size and shape. The specimens from South Georgia were smaller (length of lorica 160 μm, width 56 μm), though in all other respects were identical with the Signy specimens. The specimens from Ablation Point, Alexander Island, though similar in size, had an even more pronounced caudal process and longer anterior spines.

N. walterkostei is obviously closely related to *N. verae*, first described by Kutikova (1958*a*) from plankton collected in the Bunger Hills and subsequently reported from there by Korotkevich (1958) and Kutikova (1958*b*), and from Deep Lake Tarn in the Vestfold Hills (Everitt, 1981).

Notholca walterkostei reducta spp. nov.
Fig. 7h

This new subspecies of *N. walterkostei* was found only in Tioga Lake and in the lake at Cape Hansen, Coronation Island. While this species is somewhat smaller than the *sensu stricto N. walterkostei* from the South Shetlands, Signy Island and Alexander Island, it is similar in size to those from South Georgia with a lorica length of 160 μm and maximum width of 65 μm. The posterocaudal process and the anterodorsal spines are considerably reduced when compared with that species. The cup-like depressions are restricted to the area just below the frontal spines and in this respect it shows an affinity with *N. foliacea*.

N. walterkostei reducta is of considerable interest, not only because of its restricted distribution on Signy, but because it appears to be intermediate between *N. verae* and *N. walterkostei*.

Family: MYTILINIDAE

Genus ***Mytilina*** Bory de St Vincent

The members of this genus have a well-developed lorica, which is slightly flattened laterally. The dorsal surface has two central ridges separated by a median groove. The anterior and posterior region are, in about half the species, decorated by a number of spines. The foot is short and composed of one or two segments with two long, strong toes. The mastax has malleate trophi. Only one species was found, at South Georgia.

Mytilina mucronata longicauda forma nov.
Fig. 8

This species was not found at Signy Island but a number of specimens were found in the Maiviken Lakes, South Georgia, and these would appear to be a hitherto undescribed form of *Mytilina mucronata* (O. F. Müller). It is a medium-sized rotifer with a lorica length of 234–248 μm and toes of 61–68 μm. Eggs were not seen, neither were males. While resembling *M. mucronata* in many respects (it bears a similar pustulated band or collar and the lorica size lies within the recognized limits (Koste, 1978), though the toes are about 8 μm longer), the posterodorsal margin of the

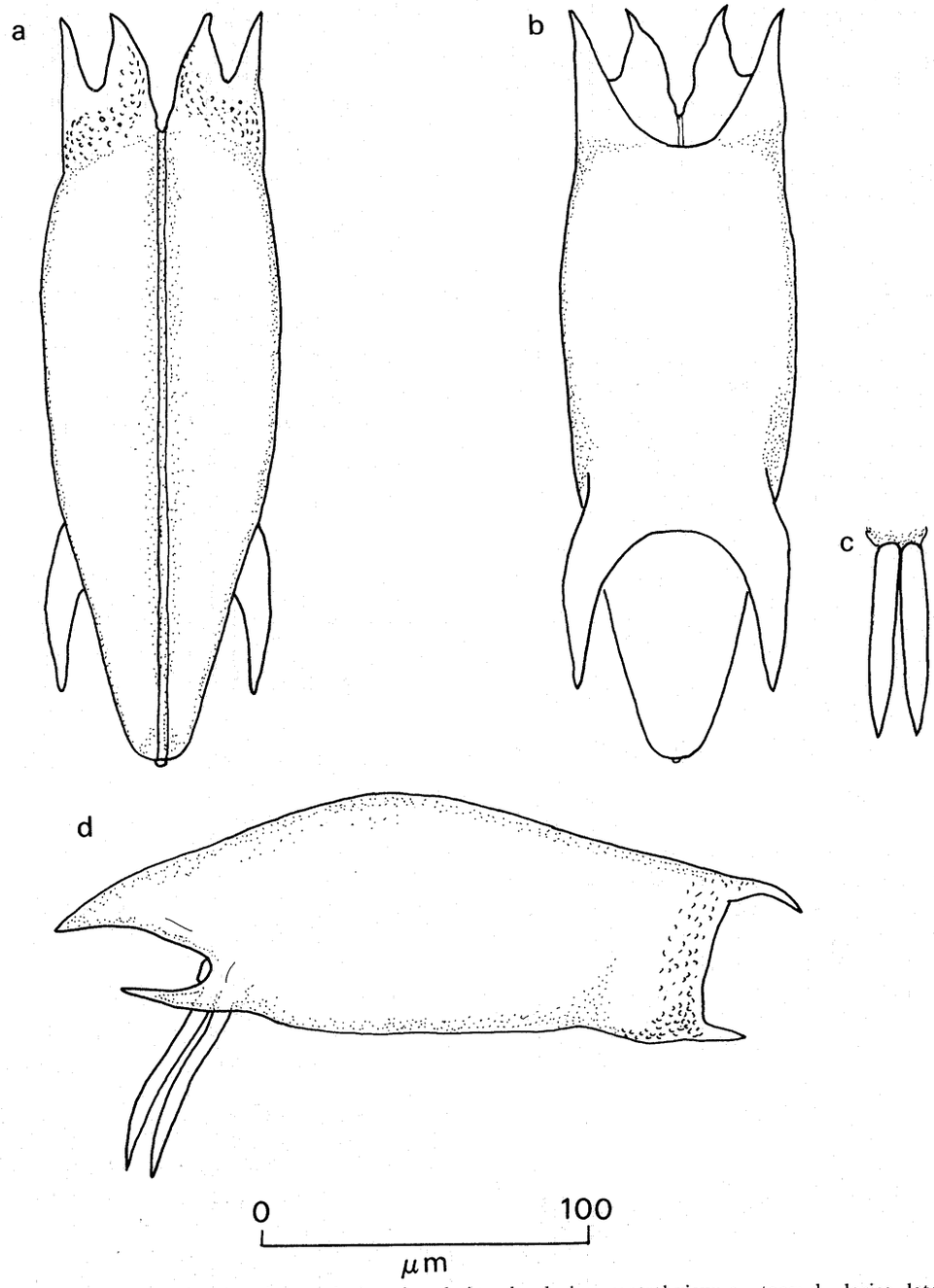

Fig. 8. *Mytilina mucronata longicauda*: a – lorica, dorsal view; b – lorica, ventral view; c – toes; d – lorica, lateral view.

South Georgia specimens is extended to almost twice the length of the posterior ventro-lateral spines. From a lateral aspect, there is some resemblance to *M. mucronata spinigera* (Ehrenberg) but when viewed from a dorsal or ventral position, the posterodorsal median projection is seen to be bluntly rounded (like *M. mucronata*), whereas *M. spinigera* is produced into a sharp point.

Genus ***Colurella*** Bory de St Vincent

In this genus the lorica is flattened laterally so that it appears mussel-shaped in side view. The head carries a small, retractable, semi-circular shield dorsal to the corona. The foot consists of three or four segments and two slender toes, which are normally longer than the foot. There are usually two lateral eyes. The mastax has malleate trophi. One species was found at Signy.

Colurella colurus compressa? Lucks
Fig. 9

This species was only found in the Paal Harbour pools, where it was very abundant. It is a small rotifer, with a lorica length of 108 μm and a depth of 54 μm. The foot has

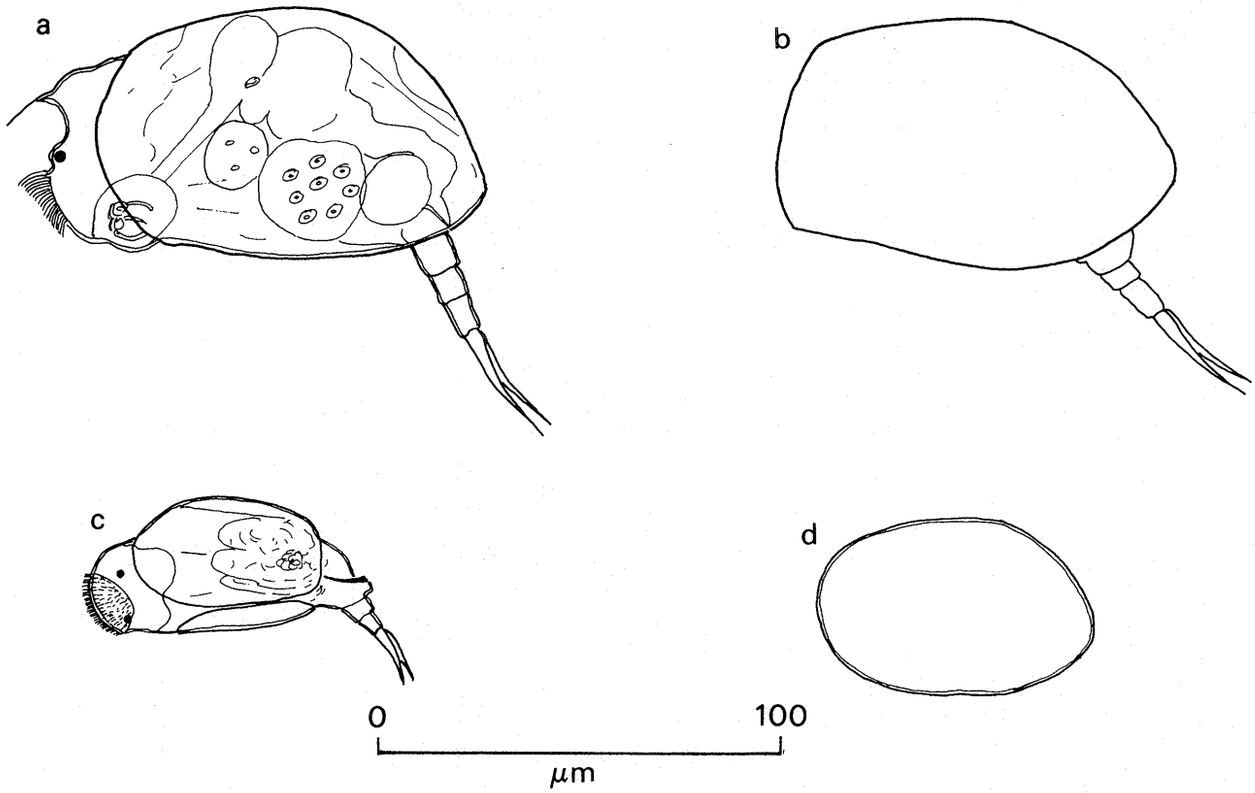

Fig. 9. *Colurella colurus compressa*: a – lateral view; b – lorica, lateral view; c – male, ventro-lateral view; d – egg.

three segments and two slightly curved toes, which are the same length as the foot (36 μm). The male, which lacks both trophi and a digestive system, is half the size of the female. The eggs are brown and oval (70 μm by 45 μm).

Some confusion exists in the literature as regards the status of *compressa*. Björklund (1972*a*) regards it as a separate species, Kutikova (1970) as a variety, while Koste (1978) regards it merely as a form of *Colurella colurus*. We are inclined to support Koste's view; however, our identification of the Signy specimens with the form *compressa* must remain tentative because we were unable to examine the ventral aspects of the lorica in sufficient detail.

The distribution of *C. colurus compressa* is difficult to determine because many authors have not differentiated it from *C. colurus*. *C. colurus* is a widely distributed species, which has been reported from the Antarctic before: from Jenny Island, Marguerite Bay (reported as *C. amblytela* by Beauchamp (1913) and from the sub-Antarctic Îles Kerguelen (Russell, 1959). The *C. colurus* reported from Rothera Point, Adelaide Island (Dartnall, 1980) and the *Colurella* sp. found at Ablation Point, Alexander Island (Heywood, 1977) are now both thought to be the form *compressa*.

Genus ***Lepadella*** Bory de St Vincent

In this genus the single-piece lorica that completely encircles the body is compressed dorso-ventrally. The foot opening is large and is situated between the middle and the posterior end of the ventral surface. The foot has three or four segments and two long and slender toes. The head has a pair of lateral eyes. The mastax has malleate trophi. Five species were found at Signy. Two of these were also found at South Georgia.

Lepadella intermedia sp. nov.
Fig. 10a–c

This species was found in five of the lakes (Table VII, p. 37). In Light Lake, densities in excess of 6500 individuals per litre of benthic water were recorded. This species was also found in the Maiviken Lakes, South Georgia. It is a small species, with a total length of 110 μm. The lorica is 70 μm long, 30 μm high and 55 μm broad. The anterior margin of the lorica is 22 μm long, while the foot aperture is just 15 μm. The foot has three segments, each 6 μm long, and two toes of 18 μm. In outline, the lorica is oval, the greatest breadth varying from five-eighths to three-quarters of the greatest length. The anterior dorsal margin is almost straight or only slightly concave, while the ventral margin is deeply scooped and almost semi-circular in outline. The dorsal surface of the lorica is produced into a very wide crest running the whole length of the lorica. The base of the dorsal keel is, at its widest point, at least one-third the maximum breadth. The summit of the keel is further produced into a very narrow ridge. The foot aperture on the posteroventral surface is in the shape of an inverted U, the anterior end of which is rounded and very slightly narrower than the posterior end. The foot is fairly stout and the three foot segments are approximately equal in length. The two toes are slender and sharply pointed. Eggs were not found, neither were males.

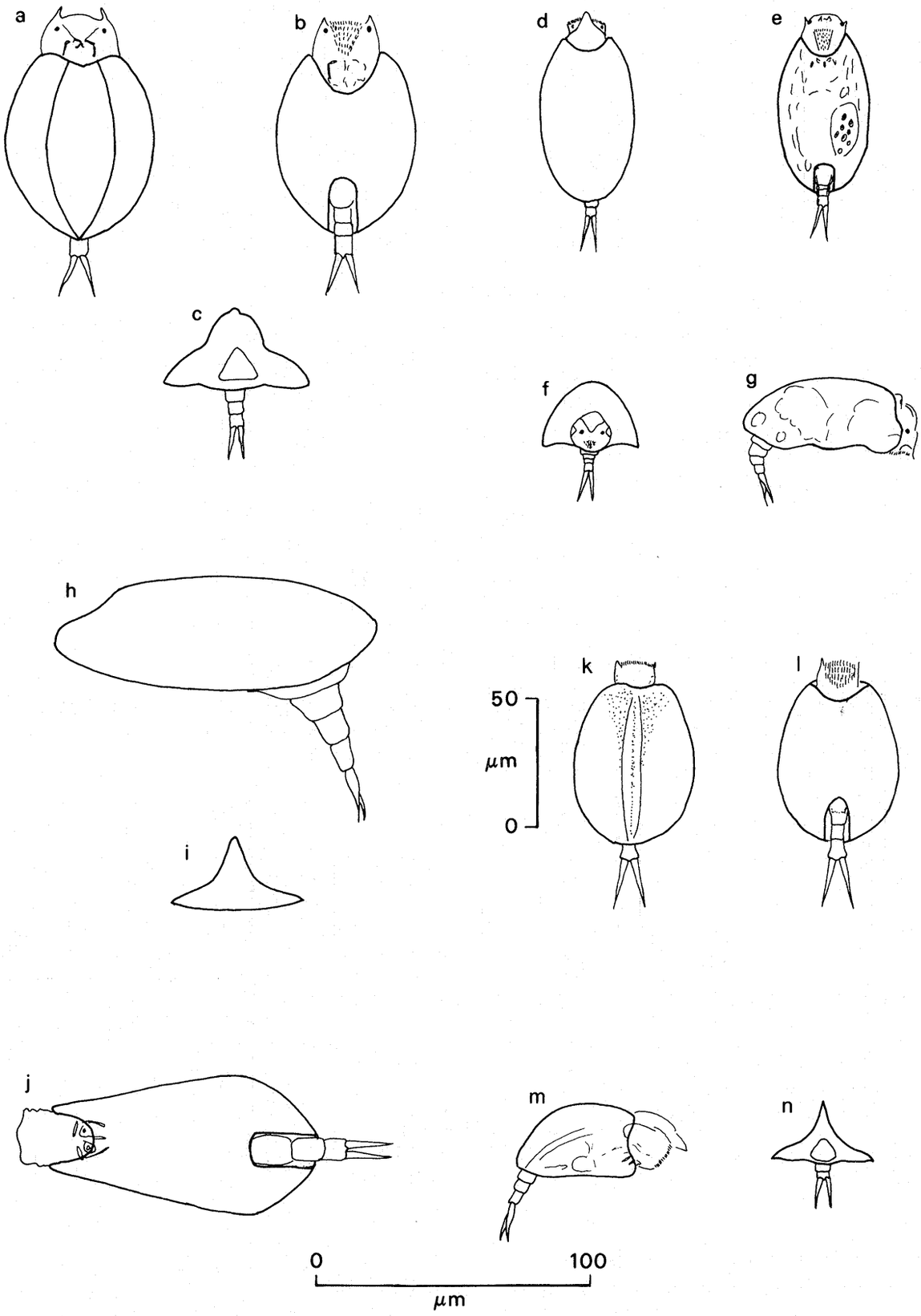

Fig. 10. *Lepadella intermedia*: a – dorsal view; b – ventral view; c – lorica, anterior cross section. *Lepadella patella oblonga*: d – dorsal view; e – ventral view; f – anterior cross section; g – lateral view. *Lepadella rhomboides signiensis*: h – lateral view; i – lorica, cross-section; j – lorica, ventral view. *Lepadella triptera*: k – dorsal view; l – ventral view; m – lateral view; n – lorica, anterior cross-section.

Table I. Comparative measurements (all in μm) of *Lepadella patella* f. *oblonga* from Signy Island, Russia and Southern Finland.

	Signy I.	*Russia (Kutikova 1970)*	*S. Finland (Björklund, 1972)*
Length of lorica	68	80–110	88–104
Greatest width	30	50–70	59–70
Length of toes	12	20–25	21–25

This species resembles both *L. triptera* Ehrenberg and *L. pejleri* Eriksen in overall size and in general outline, when viewed from the dorsal or ventral aspect, while in cross-section, it more nearly resembles *L. imbricata* Harring and *L. rhomboides* (Gosse). *L. intermedia* would therefore appear to be intermediate between *L. triptera* and *L. pejleri* on one hand, and *L. imbricata* and *L. rhomboides* on the other. It is probably closer to *L. triptera* and *L. pejleri* on account of the similarity of the foot segments and the anterodorsal and ventral margins of the lorica.

Bērziņš (1976) has described a new species (*L. gelida*) from Aneboda, Sweden, which is similar to *L. intermedia* in general shape, though it has a somewhat narrower dorsal keel and a different foot opening.

Lepadella patella f. *oblonga* (Ehrenberg)
Fig. 10d–g

This species was found in eight Signy Island lakes (Table VII, p. 37) and in the Maiviken Lakes, South Georgia. The specimens from these locations were considerably smaller than those reported elsewhere (Table I). Eggs were not seen, neither were males.

This species, originally described by Ehrenberg (1834) as *Squamella oblonga*, was repeatedly described and renamed over a period of almost 80 years. Then, in 1913, Harring reinstated it under Ehrenberg's specific name but in the genus *Lepadella*. Three years later, in a monograph on this genus (Harring, 1916), he reduced it to a synonym of *L. ovalis* (Müller), a decision supported by Voigt (1957). The status of this rotifer, however, continues to be challenged. Björklund (1972*a*) considers it to be a separate species, Wulfert (1960) and Kutikova (1970) as a variety of *L. patella* and Koste (1978) merely as a form of *L. patella*. We concur with the last view. Since what we are referring to as *L. patella oblonga* has for so long (1916–1960) been regarded as a synonym of the extremely common *L. ovalis*, it is difficult to give an exact picture of the distribution of this species. *L. patella* has been reported from the Antarctic: from the Obruchev and Bunger hills by Kutikova (1958*b*) and Korotkevich (1958), the Thalla Hills by Opalinski (1972*b*) and from Langhovde by Sudzuki (1964); and from the sub-Antarctic Macquarie Island and Îles Kerguelen (Russell, 1959).

Lepadella rhomboides signiensis ssp. nov.
Fig. 10h–j

This new subspecies of *L. rhomboides* (Gosse) was found only in Moss Lake and Twisted Lake. Only 30 examples were found and 23 of these were obtained on one occasion (January 1975) from Moss Lake. Although the Signy specimens differ quite considerably from *L. rhomboides*, and so merit consideration as a separate species, we prefer, at this time, to present it as a subspecies because of the small number of specimens obtained. The shape of the lorica is different. In the Signy specimens, the greatest width is posterior to the transverse median line, being located some three-quarters of the distance from the anterior to posterior end of the lorica, whereas in the *sensu stricto* species, the greatest width is approximately at the transverse median point. The anterodorsal and ventral sinuses of the Signy specimens are deeply scooped and have gently rounded margins resembling those of *L. quinquecostata* (Lucks) and *L. acuminata* (Ehrenberg), whereas *L. rhomboides* has a V-shaped ventral sinus and the dorsal sinus has a median notch (Harring, 1916). In cross-section, the Signy specimens have a more acutely pointed keel resembling that of *L. triptera* Ehrenberg and *L. rhomboidula* Bryce. When viewed in lateral aspect, the posterodorsal profile of the lorica appears deeply concave above the base of the foot, which reminds one of the lorica of *Brachionus urceolaris* Müller. The Signy specimens did not have eyespots. Small, lateral eyespots are figured in Hudson and Gosse (1886) but they are not mentioned in the text. Comparative measurements of *L. rhomboides* and the Signy specimens are given in Table II.

Table II. Comparative measurements (all in μm) of *Lepadella rhomboides sensu stricto* and the Signy specimens.

	L. rhomboides (after Harring (1916))	*signiensis*
Length of lorica	120	126
Depth of dorsal sinus	11	12
Depth of ventral sinus	20	14
Greatest width of lorica	80	65
Width of anterior margin	29	29
Length of foot groove	37	?
Width of foot groove	19	?
Length of foot	35	46
Length of terminal joint	19	18
Length of toes	25	26

Lepadella triptera Ehrenberg
Fig. 10k–n

This species was only found in Moss Lake and Light Lake, where it was very rare. Eggs were not seen, neither were the males. The dimensions of the Signy specimens, while considerably smaller than those quoted by Harring (1916) and Kutikova (1970), were in close agreement with those reported by Björklund (1972*a*) and de Ridder (1972) (see Table III).

Among the material collected and provisionally identified in the field as *L. triptera* is an extremely small specimen. This rotifer was only 37 μm long and 20 μm at its greatest width, yet the trophi appear to be of normal size and measure 13 μm from the tip of the unci to the lower end of the manubrium. There are three foot segments but only the terminal one can be measured accurately (5 μm). The toes are extremely long, being slightly more than half the length of the lorica (19 μm). Details of the anterodorsal and ventral margins of the lorica and of the foot aperture were impossible to determine. Further specimens, preferably living, must be examined to decide whether this small rotifer is a young *L. triptera* or a new species.

Table III. Comparative measurements (all in μm) of *Lepadella triptera* from Signy Island and elsewhere.

	Signy I.	*USA (Harring, 1916)*	*Russia (Kutikova, 1970)*	*S. Finland (Björklund, 1972)*	*Iceland (de Ridder, 1972)*
Lorica length	54–64	75	65–100	49–67	58–65
Lorica width	43–50	64	53–64	42–56	50–55
Length of toes	18	20	15–20	13–19	15–22

Family: LECANIDAE

Genus ***Lecane*** Nitzsch

The members of this genus have a well-developed lorica consisting of a dorsal and a smaller ventral plate, joined by a flexible membrane. The foot projects through a hole in the ventral plate. The foot is short, of one or two segments, and the toes long. The mastax has malleate trophi. Two species were found at South Georgia, one of which was also found at Signy.

Lecane closterocerca (Schmarda)
Fig. 11a

This species was only found at South Georgia, from the Maiviken Lakes. It is a small rotifer, with dorsal plate 93 μm long and 82 μm wide and ventral plate 96 μm long. The anterior margin, which is straight, was 46 μm wide. The toe, which is single and fused, was 32 μm long. Eggs were not seen. Males were not found. Although the lorica is slightly larger than the published measurement for this species, the foot and toe are within the range quoted by Koste (1978). *L. closterocerca* is a cosmopolitan species, with a wide pH and thermal tolerance and has also been found in brackish water (de Ridder, 1972).

Lecane lunaris (Ehrenberg)
Fig. 11b–e

This species was found in nine Signy Island lakes (Table VII, p. 37), where it was very abundant. It was also found in the Maiviken lakes, South Georgia and is one of the two *Lecane* species reported from there by Dartnall and Heywood (1980). The dorsal plate was 128–140 μm long and 86–108 μm wide; the ventral plate was 130–147 μm long and 64–95 μm wide. The toe (without the claw) was 46–54 μm and the claw was 7–14 μm. The claw is quite clearly double, which agrees with von Hofsten (1909) though most authorities infer a single undivided claw. Eggs were not found and neither was the male.

The Signy and South Georgia specimens conform closely to the published descriptions. They differ in having a slightly larger lorica, though the foot and claws are within the range quoted by various authors (see Koste, 1978). One of the commonest of rotifers, *L. lunaris* has a world-wide distribution (de Ridder, 1972).

Family: PROALIDAE

Genus ***Wulfertia*** Donner

The members of this genus are illoricate. The corona is a simple, wide circumapical ring with a mouth set some distance posteriorly. The mastax has malleate trophi; the manubria are not expanded. The body is not annulated and the posterior part is widened. The foot and toes are shorter than the rest of the body. One species was found at Signy.

Wulfertia sp.
Fig. 12

This species was only found in Moss Lake and Light Lake, where it was very rare. It is a small rotifer with a total length of 130 μm. The body, which is not annulated, is roughly cylindrical in shape and the head and foot merge into it. The trophi, which are 28 μm long, appear to have three teeth on each uncus. The ventrally-situated epipharyngeal plates each appear to have ten teeth. A large red eyespot is present on the brain. The toes are small and stubby (15 μm) and the pedal glands large. Eggs were not seen, neither was the male.

Only one species of *Wulfertia* is known – *W. ornata* Donner (1943). The Signy specimens lack the posterior widening of the body so characteristic of that species. However, with so few specimens and without details of the side view of the trophi, we are unable to identify our species further.

Family: NOTOMMATIDAE

Genus ***Cephalodella*** Bory de St Vincent

In this genus the lorica, which is delicate, is made up of four trunk plates. The body is compressed laterally and curved towards the ventral side. The foot is short, consists of one segment and bears two curved toes. The mastax has virgate trophi. A large genus, five species were found at Signy, two of which were also found at South Georgia.

Cephalodella auriculata (O. F. Müller)
Fig. 13a–d

This species was found in eight Signy Island lakes (Table VII, p. 37) and in the Maiviken Lakes, South Georgia, where it was very common. It is a small rotifer with a total length of 160 μm. The toes are 24–30 μm long. Eggs were not seen, neither was the male. The Signy specimens agree closely with the published descriptions (Koste, 1978). This species has a world-wide distribution.

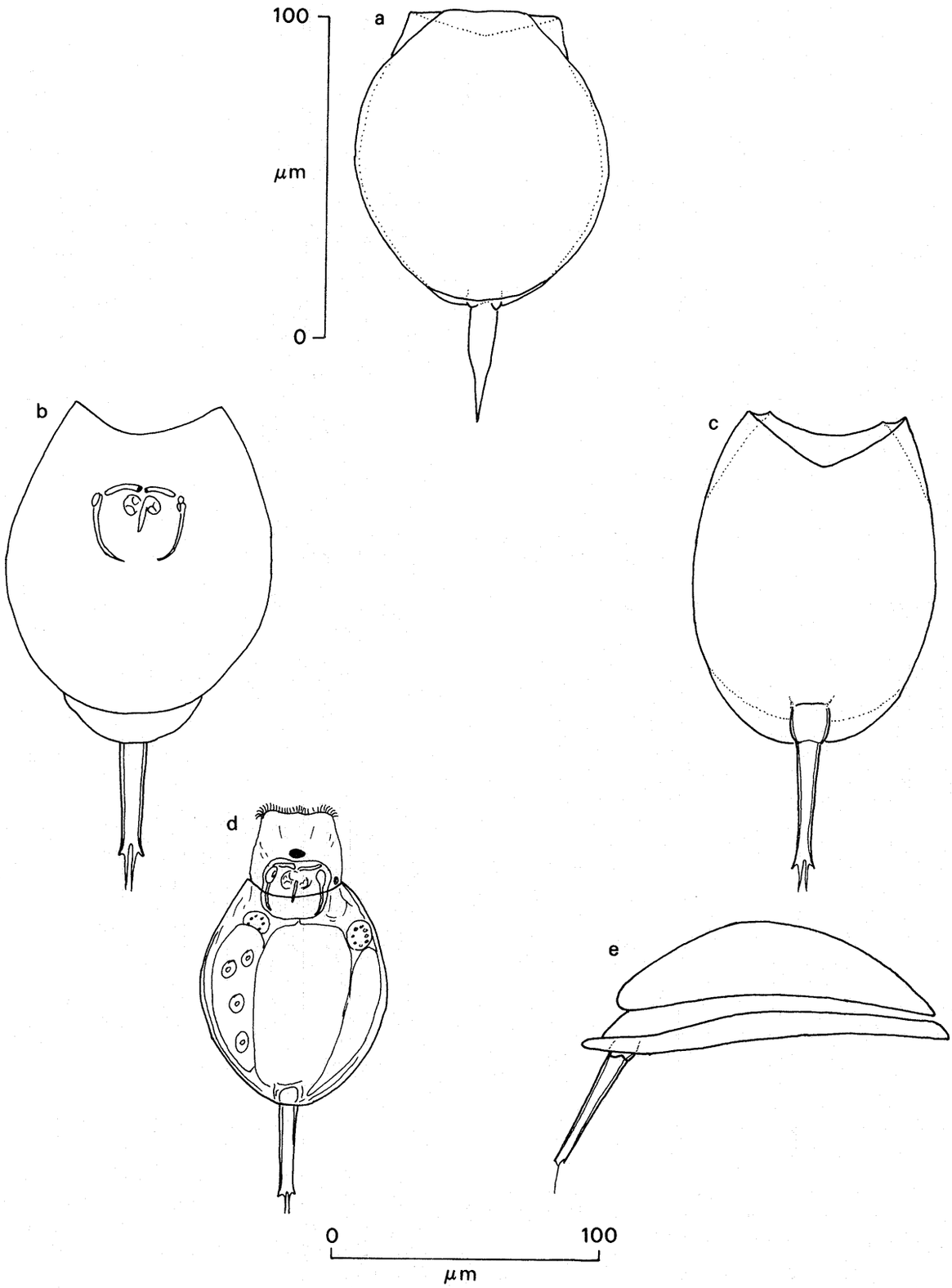

Fig. 11. *Lecane closterocerca*: a – lorica, dorsal view. *Lecane lunaris*: b – lorica, dorsal view; c – lorica, ventral view; d – dorsal view; e – lorica, lateral view.

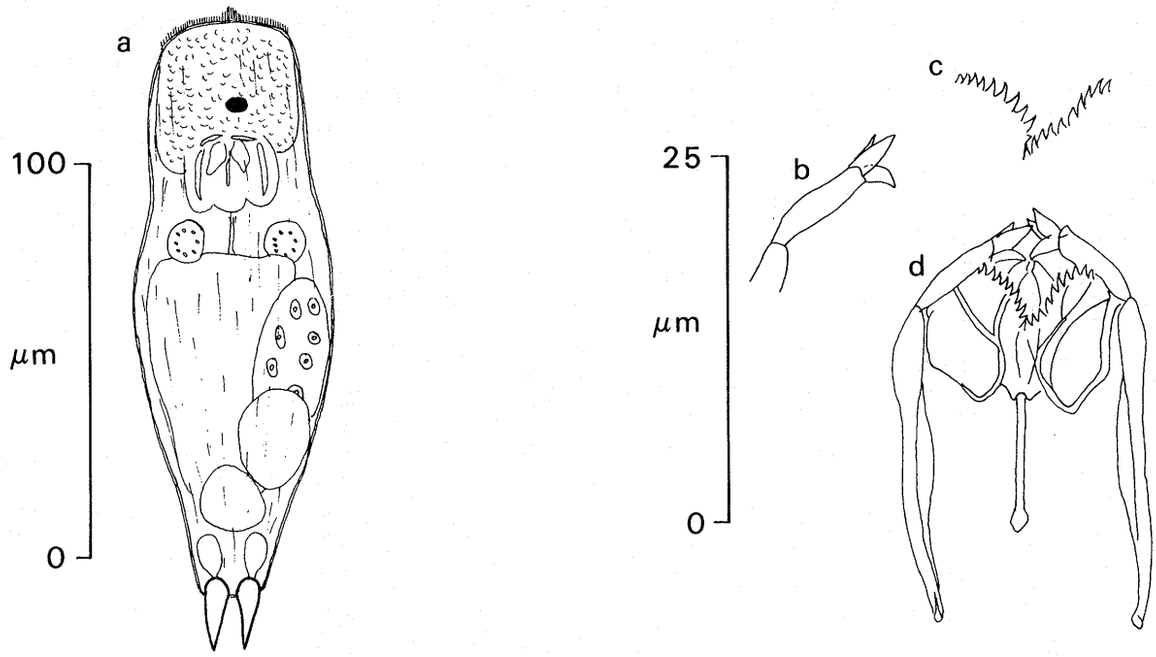

Fig. 12. *Wulfertia* sp. a – ventral view; b – trophi, uncus; c – trophi, edge of epipharyngeal plates; d – trophi.

Cephalodella catellina (O. F. Müller)
Fig. 13e, f

This species was only found in the Paal Harbour pools, where it was very abundant. It is a small rotifer with a length of 125 μm. The male (75 μm) is about three-fifths the size of the female. In the male, the two frontal eyespots are widely separated. Eggs were not seen. Although the Signy female specimens agree closely with the published descriptions and measurements for this species (Kutikova, 1970; Koste, 1978), the Signy male is only half the size of the single measurement quoted by Voigt (1957).

Cephalodella catellina has a world-wide distribution (de Ridder, 1972) and it has been reported from the sub-Antarctic (Russell, 1959). It has also been reported from the McMurdo Sound area of Antarctic if, as we believe, Murray (1910) was mistaken in his identification of *Cephalodella tenuior* (reported as *Diaschiza tenuior*). The illustration given by Murray shows a *Cephalodella* with foot emerging from the ventral surface (cf. *C. catellina*). In *C. tenuior* the foot emerges from the posterior end (see Kutikova, 1970; Koste, 1978). Russell (1956) apparently supports this view as he includes, without comment, only *C. catellina* in the checklist of rotifers collected by Murray. If this assumption is correct, then it is highly probable that the *C. tenuior* of Dougherty and Harris (1963) and the *Cephalodella* sp. of Armitage and House (1962), Spurr (1975) (reported as *Diaschiza* sp.) and Cathey and others (1981) are also *Cephalodella catellina* since all these authors sampled the same area as Murray.

Cephalodella forficata (Ehrenberg)
Fig. 13g–i

This species was only found in Light Lake, where it was rare. It is a small rotifer, with maximum length of 153 μm of which the body is 108 μm and the toes 45 μm. The mastax has a length of 20 μm. Eggs were not seen, neither was the male. The Signy specimens, though small, fall within the dimensions quoted by Koste (1978) for this species. *Cephalodella forficata* has a fairly wide, if somewhat patchy, distribution (de Ridder, 1972).

Cephalodella gibba (Ehrenberg)
Fig. 14a, b

This species was found amongst the benthic vegetation of several Signy Island lakes (Table VII, p. 37) where it was very common. It is a medium-sized rotifer, with a total length of 270–282 μm. The maximum length of the body was 198 μm with toes 72–85 μm. The mastax was 54 μm. Eggs were not seen. The male was found only on one occasion; it had a length of 175 μm. The Signy specimens agree closely with the published descriptions. *C. gibba* has a world-wide distribution (de Ridder, 1972) and has been recorded from King George Island, South Shetland Islands (de Paggi, 1982) and from the Maiviken Lakes, South Georgia (Dartnall and Heywood, 1980).

Cephalodella megalocephala (Glassott)
Fig. 14c–f

This species was found in eight lakes (Table VII, p. 37). It is a medium-sized rotifer with a total length of 230 μm. The toes were 36 μm long. The male was fractionally more than three-fifths the size of the female at 150 μm. Eggs were not seen.

Although *Cephalodella megalocephala* may be predatory (J. V. Reed, pers. comm.), it was also observed to be preyed upon by *Dicranophorus permollis giganthea*. The Signy specimens agree closely with the published description, being fractionally larger but otherwise requiring no special comment.

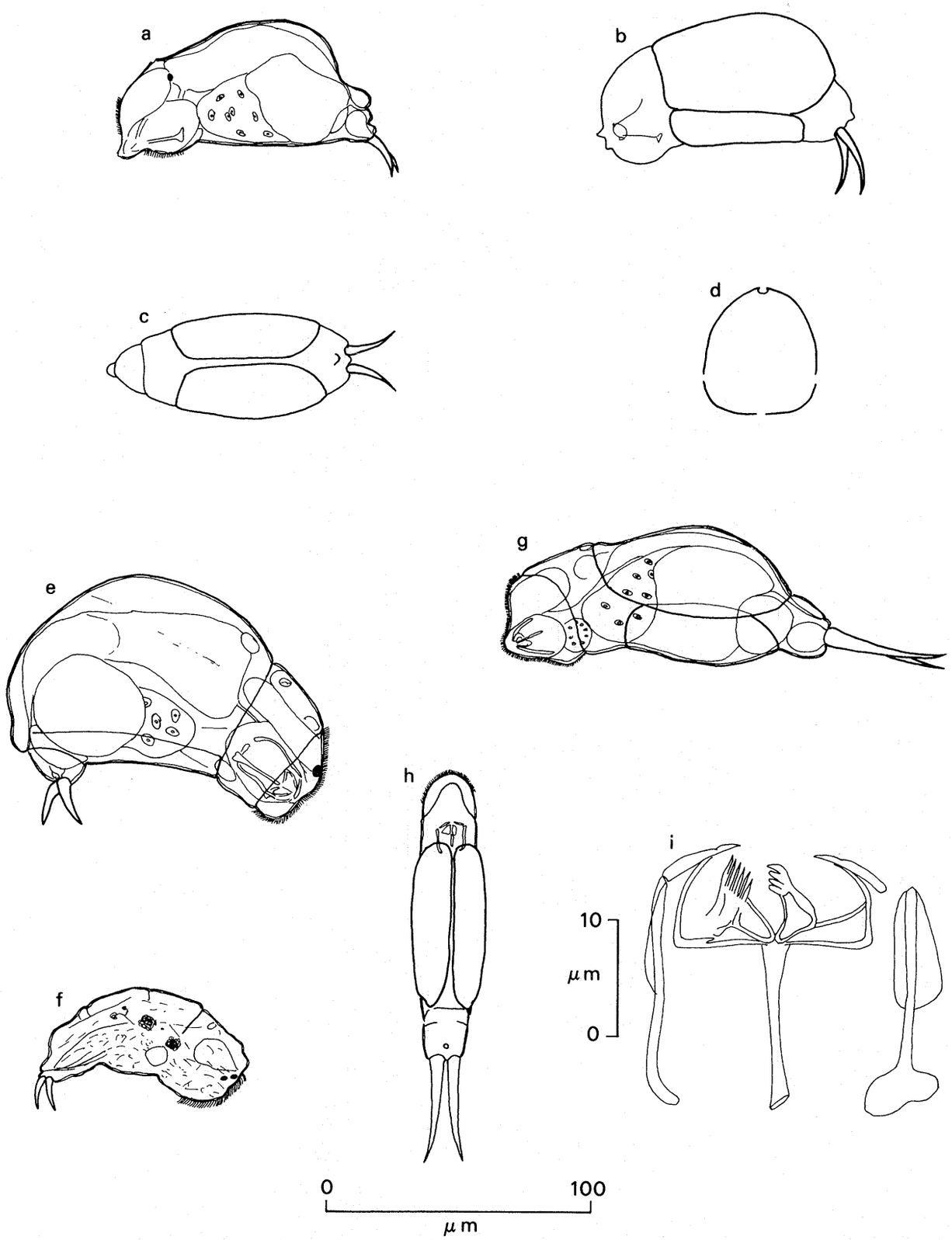

Fig. 13. *Cephalodella auriculata*: a – lateral view; b – lorica, lateral view; c – lorica, dorsal view; d – lorica, cross-section. *Cephalodella catellina*: e – lateral view; f – male, lateral view. *Cephalodella forficata*: g – latero-ventral view; h – dorsal view; i – trophi, courtesy of J. Vaughan-Reed.

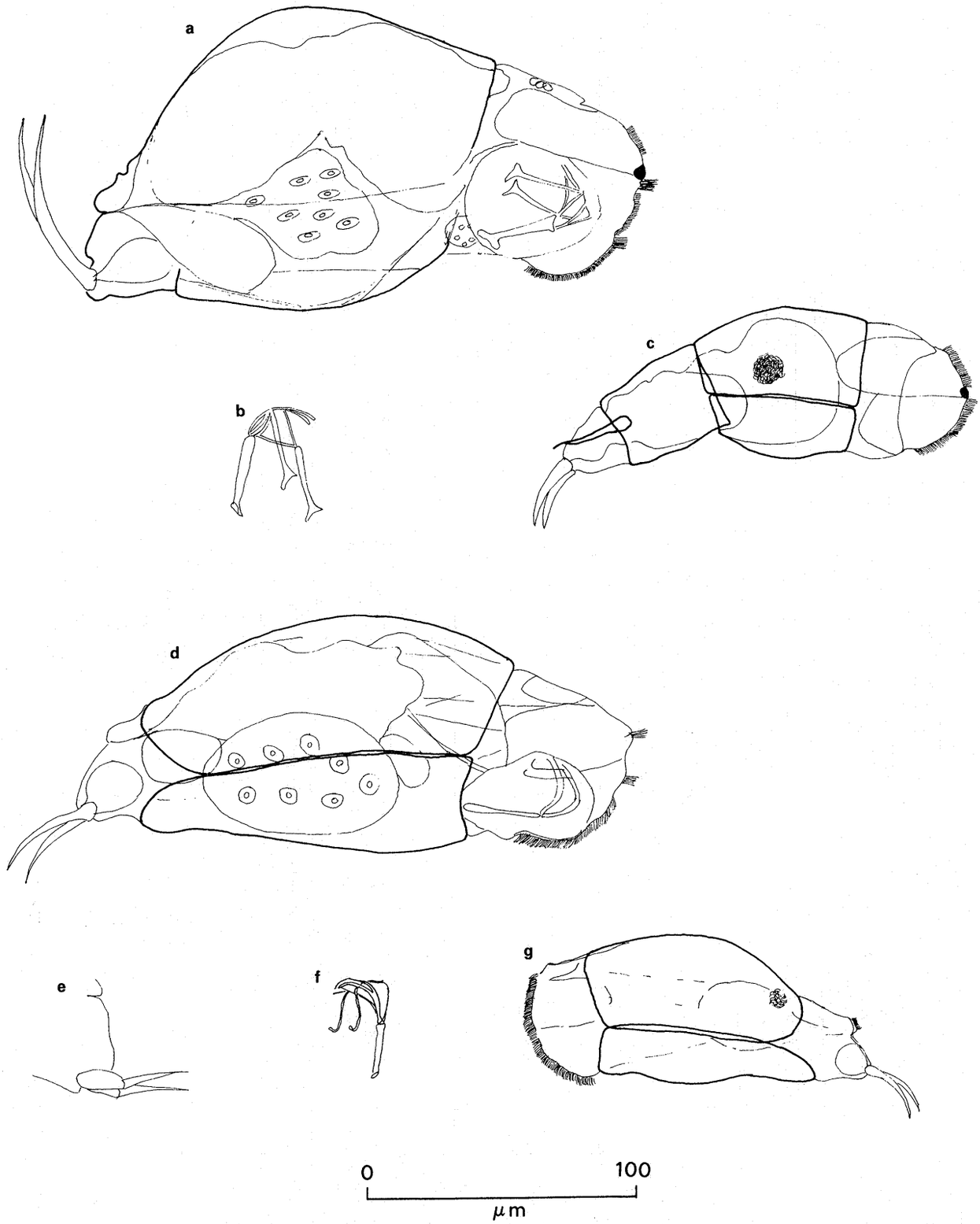

Fig. 14. *Cephalodella gibba*: a – lateral view; b – trophi; c – male, lateral view. *Cephalodella megalocephala*: d – lateral view; e – toes; f – trophi; g – male, lateral view.

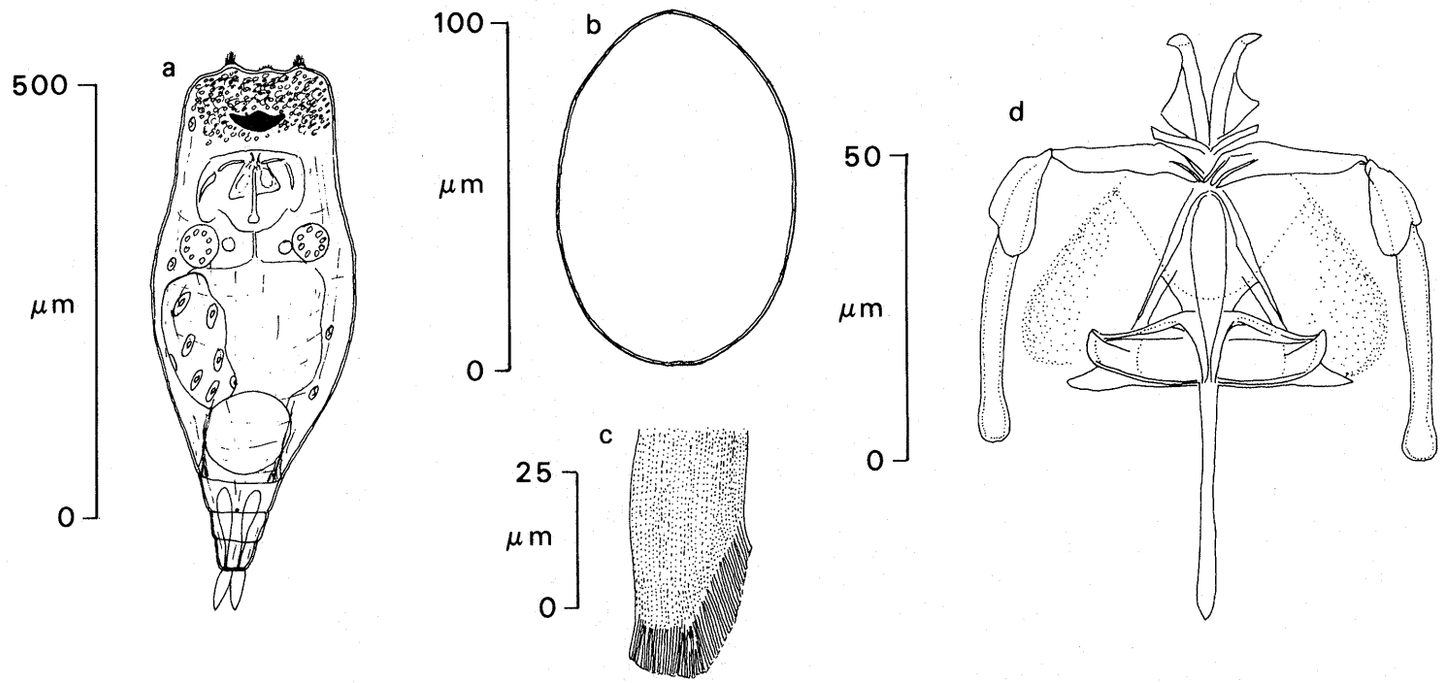

Fig. 15. *Eosphora najas*: a – dorsal view; b – egg; c – trophi, fulcrum, lateral view; d – trophi, ventral view.

Genus ***Eosphora*** Ehrenberg

A small genus of illoricate notommatid rotifers in which the mastax is not removed from the corona. The rectrocerebral organ has both a sac and glands (cf. *Resticula*). The mastax has modified virgate trophi. The unci usually have one principal tooth. *E. najas* has at least two. The foot is well-developed and carries two short, strong toes. One species was present at both Signy and South Georgia.

Eosphora najas Ehrenberg
Fig. 15

This species was found in several of the Signy Island lakes and in the Maiviken Lakes, South Georgia. It is a very large rotifer (in excess of 600 μm) though it was very difficult to measure accurately. Living specimens tended to be elongated when held in compression, while mounted specimens tended to be foreshortened. Typical measurements were: body length – 342 μm, foot length – 79 μm, toe length – 50 μm, total length – 471 μm. The foot is composed of three segments. *E. najas* is predatory and the trophi are modified for seizing its prey. Specimens were observed (several times) to seize hold of an individual *Euchlanis* by the neck and to suck out the internal contents within a minute. Specimens of *Eosphora najas* collected at South Georgia contained the trophi of *Cephalodella gibba, Trichocerca rattus globosa* and bdelloids in their stomachs. From the upper surface of the unci to the tip of the fulcrum the trophi measured 82 μm. The rami measured 39 μm, manubria 49 μm and fulcrum 43 μm. A single, large, red, cerebral eyespot is present. The eggs are large, brown and oval (90 μm by 65 μm). The male was not seen.

Although the Signy specimens fall within the overall size range quoted by Koste (1978), the trophi, at 82 μm, are 10–15 μm larger than the sizes quoted by Harring and Myers (1922), Voigt (1957) and Kutikova (1970). This difference could, however, be due to displacement in the mounting process. *E. najas* has a world-wide distribution.

Genus ***Scaridium*** Ehrenberg

In this genus, the foot and toes are longer than the lorica. The foot and toes are highly mobile with strong striated muscles running through them. The lorica, which is thin and flexible, is cylindrical in shape. The corona is simple. The mastax has modified virgate trophi. Only two species are known, one of which was found at Signy.

Scaridium bostjani Daems and Dumont
Fig. 16

This species was locally abundant amongst the mosses and benthic algae of Sombre Lake, Moss Lake, Light Lake and Tranquil Lake. It is a medium-sized rotifer, up to 352 μm long. The two-segmented foot is long and bears even longer toes that enable this species to swim with a flicking movement. There is a single, red eyespot. Only one large, brown, circular/oval egg, covered in papillae, was seen. The male was not seen.

Originally we thought that our specimens were a small form of *S. longicaudum* (O. F. Müller), a long-established species with a world-wide distribution (de Ridder, 1972). Indeed, the Signy specimens had been tentatively identified as this species (Dartnall, 1977; Priddle and Dartnall, 1978). However, since we first found the Signy specimens, Daems and Dumont (1974) have described a new species, *S. bostjani*, from Kathmandu-Tal, in Nepal.

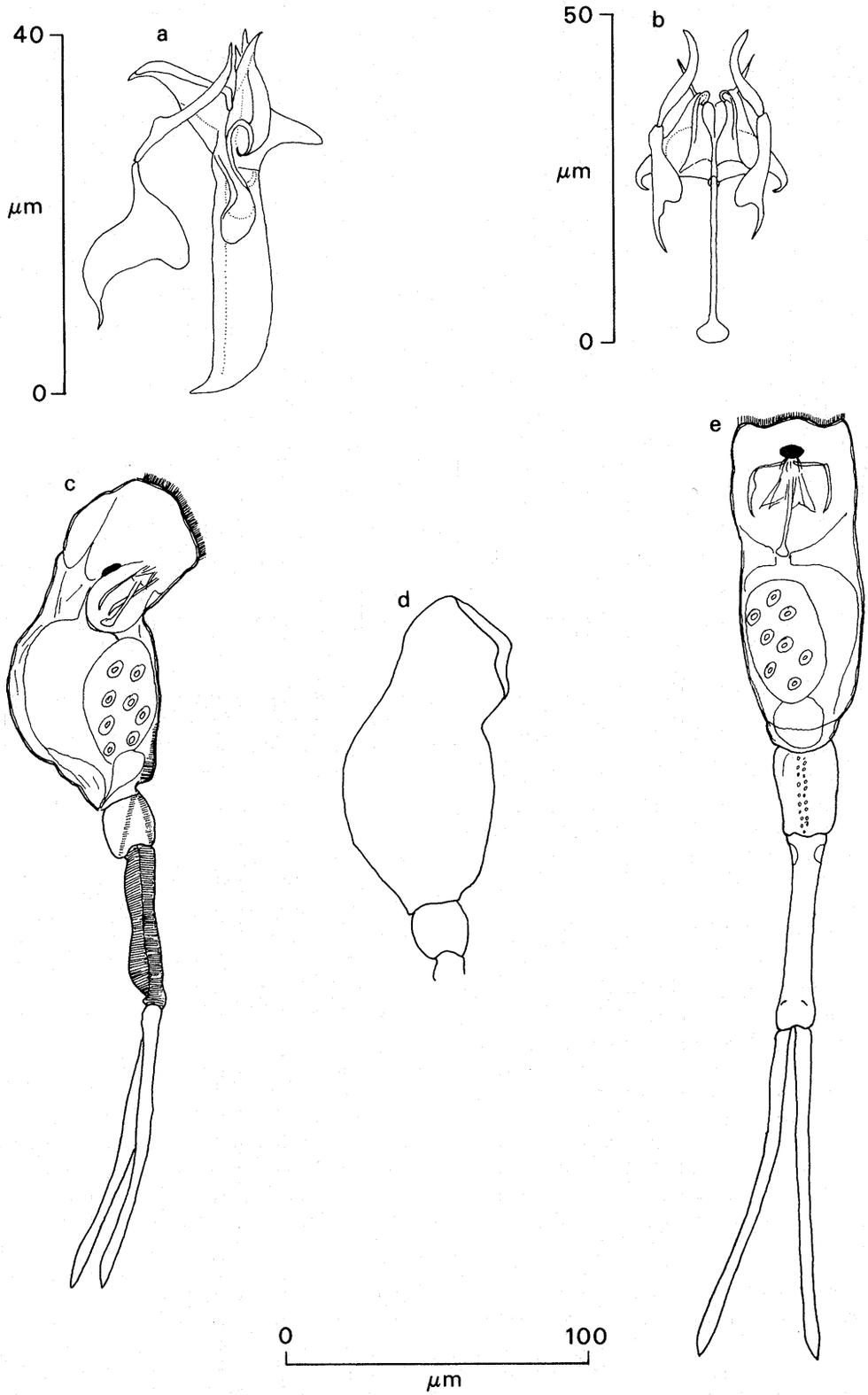

Fig. 16. *Scaridium bostjani*: a – trophi, lateral view; b – trophi, ventral view; c – lateral view; d – lorica, lateral view; e – ventral view.

Table IV. Measurements of *S. bostjani* from Signy Island and Nepal (Daems and Dumont, 1974) and *S. longicaudum* (O. F. Müller) (all in μm).

	S. bostjani		*S. longicaudum*
	Signy I.	*Nepal*	
Total length	266–352	281–288	360–450
Length of body	72–108	86	120–155
Length of foot	79–100	91–96	118–150
Length of toes	115–144	104–106	122–145
Length of trophi	40–48	40	48

S. bostjani differs from *S. longicaudum* in the form of the manubrium. In general shape, the manubria of these species are similar but *S. bostjani* has a characteristic narrow neck to the upper part (see Fig. 16a) and close examination has shown that our specimens are identical with this new species. As can be seen in Table IV, the Signy Island specimens show greater variation in size than the Nepalese specimens of Daems and Dumont (1974). While most of the Signy specimens were slightly smaller than, or approximately equal in size to those of Daems and Dumont, a few were considerably longer and almost came within the lower size range of *S. longicaudum*. The toes of the Signy specimens were considerably longer than the *sensu stricto S. bostjani* and more comparable with *S. longicaudum*.

Genus ***Resticula*** Harring and Myers

A small genus of illoricate notommatid rotifers. The mastax is not removed from the corona. The retrocerebral organ lacks glands and consists of just a sac. The mastax has modified virgate trophi. The uncus has one principal and between one and five preuncial teeth. The foot is well-developed and carries two short, strong toes. One species was found at Signy.

Resticula gelida (Harring and Myers)

Fig. 17

This species was found in several of the pools. In Gourlay Pool it was very abundant. It is a large species, up to 400 μm long. The trophi range from 57 to 60 μm in length. A large, red eyespot is present on the brain. The male was not seen. Eggs are large, brown and circular (90 μm in diameter).

The Signy specimens agree closely with the published descriptions, being the maximum size specified by Harring

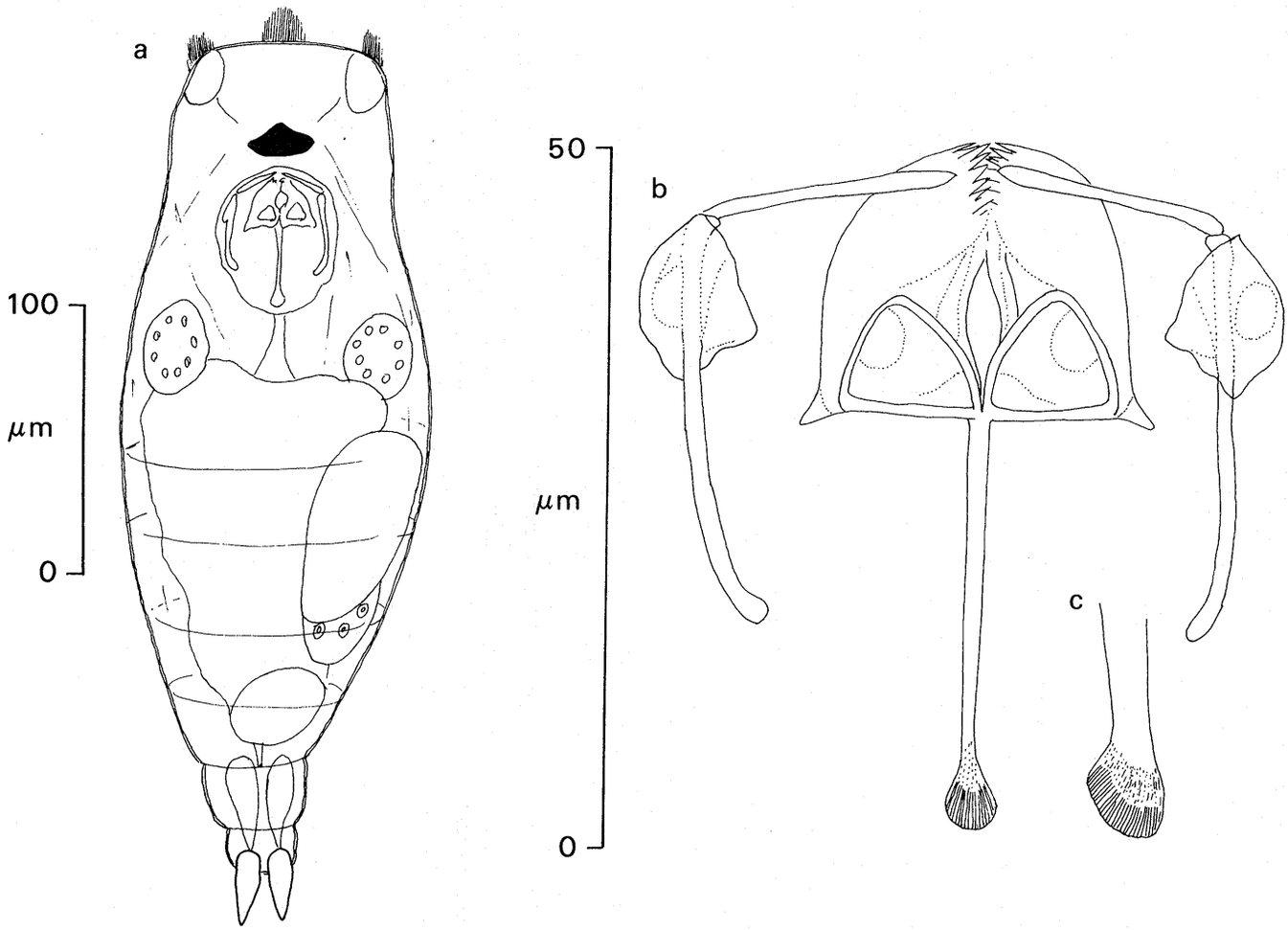

Fig. 17. *Resticula gelida*: a – dorsal view; b – trophi, ventral view; c – trophi, fulcrum, lateral view.

and Myers (1922). The trophi are slightly larger than those of the original specification but compare favourably with Koste (1978), who recorded trophi of 60 μm in specimens 384 μm long. Wulfert (1936) recorded specimens that were 600 μm with trophi of 75 μm. *Resticula gelida* has a world-wide distribution and has been reported from Rothera Point, Adelaide Island (Dartnall, 1980).

Family: TRICHOCERCIDAE

Genus: ***Trichocerca*** Lamarck

The members of this genus are all very asymmetrical. The trunk is usually cylindrical and is often arched. The foot is short and ends in one or two toes. If there are two toes, then they are usually of unequal length, with the left longer than the right. The mastax has virgate trophi that are also asymmetrical. Three species were found at South Georgia, two of which were also found at Signy Island.

Trichocerca brachyura (Gosse)
Fig. 18

This species was found in several of the Signy Island lakes (Table VII, p. 37) and in the Maiviken Lakes, South Georgia, where it was very rare.

It is a small species with a kidney-shaped lorica (126 μm) that lacks anterior spines and protuberances. The toes are very variable; in some specimens they are of almost equal length while in others the left (39 μm) was considerably larger than the right (27 μm). Some specimens were found with five small sub-styles at the base of the toes, though only two are present in the mounted slides. The mastax is large (35 μm) and the trophi are very asymmetric. The left manubrium is 26 μm long and crutch-shaped. The right manubrium is greatly reduced, being almost vestigial. The fulcrum is long (27 μm) and crutch-shaped at its base.

T. brachyura is very closely related to *T. cavia* (Gosse), *T. relicta* Donner, *T. vernalis* Hauer and *T. intermedia* Stenroos. The trophi of *T. brachyura* resemble those of all this group in having a greatly reduced, almost vestigial right manubrium. Koste (1978) suggests that *T. vernalis* may be a synonym of *T. brachyura*, even though the left manubrium of the former ends in a continuous or smooth 'hockey stick' shape. The trophi of *T. brachyura* appear to be particularly similar to those of *T. relicta* both in shape of the alulae and the 'crutch' at the end of the left manubrium.

Trichocerca rattus globosa ssp. nov.
Fig. 19

This species was found in four Signy Island lakes: in Light Lake and Tranquil Lake, where it was very common, and in Moss Lake and Pumphouse Lake. It was also found in the Maiviken Lakes of South Georgia.

It is a large species, in excess of 350 μm. The body is rotund or globose in shape, with a lorica 140 μm long and 100 μm wide. The body is naked, lacking anterior spines and

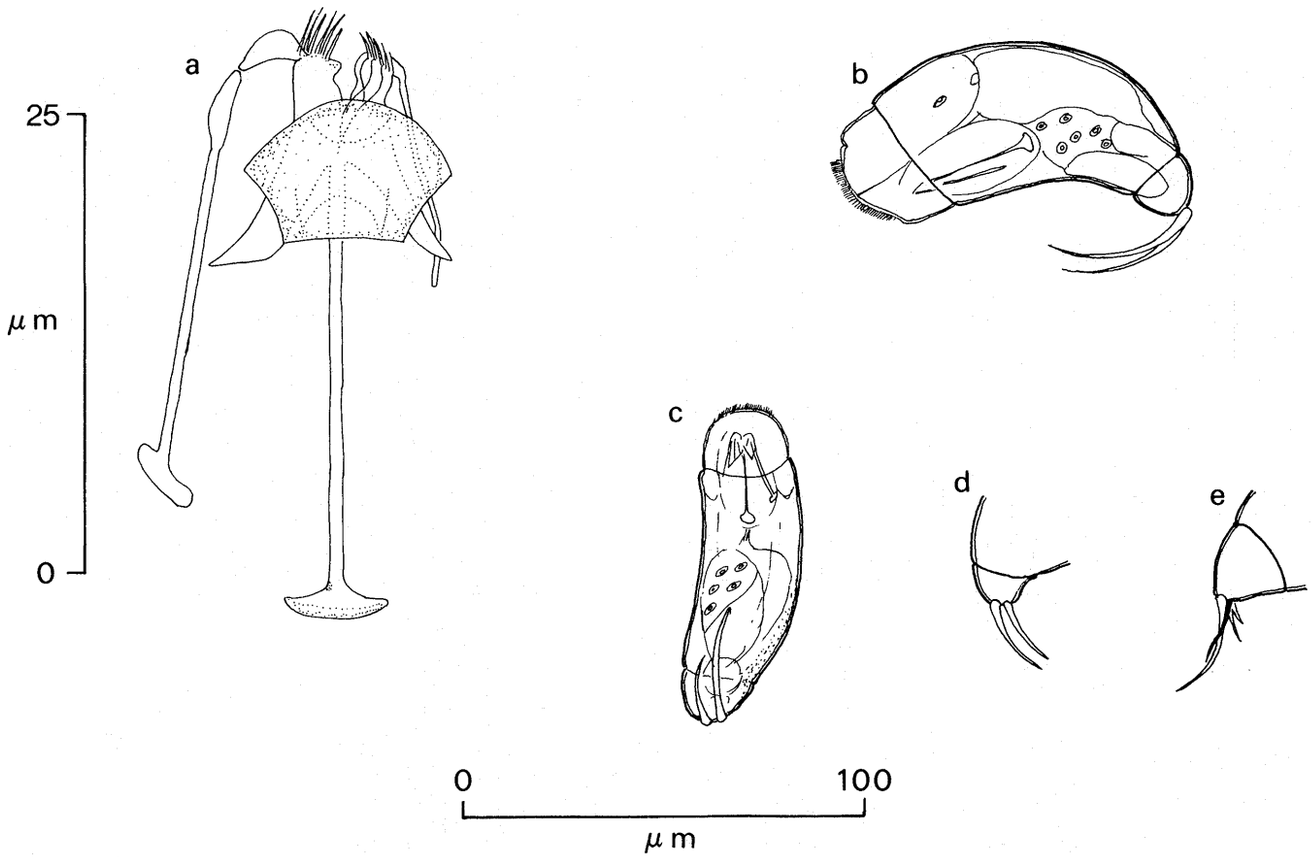

Fig. 18. *Trichocerca brachyura*: a – trophi, dorsal view; b – lateral view; c – ventral view; d – toes; e – toes.

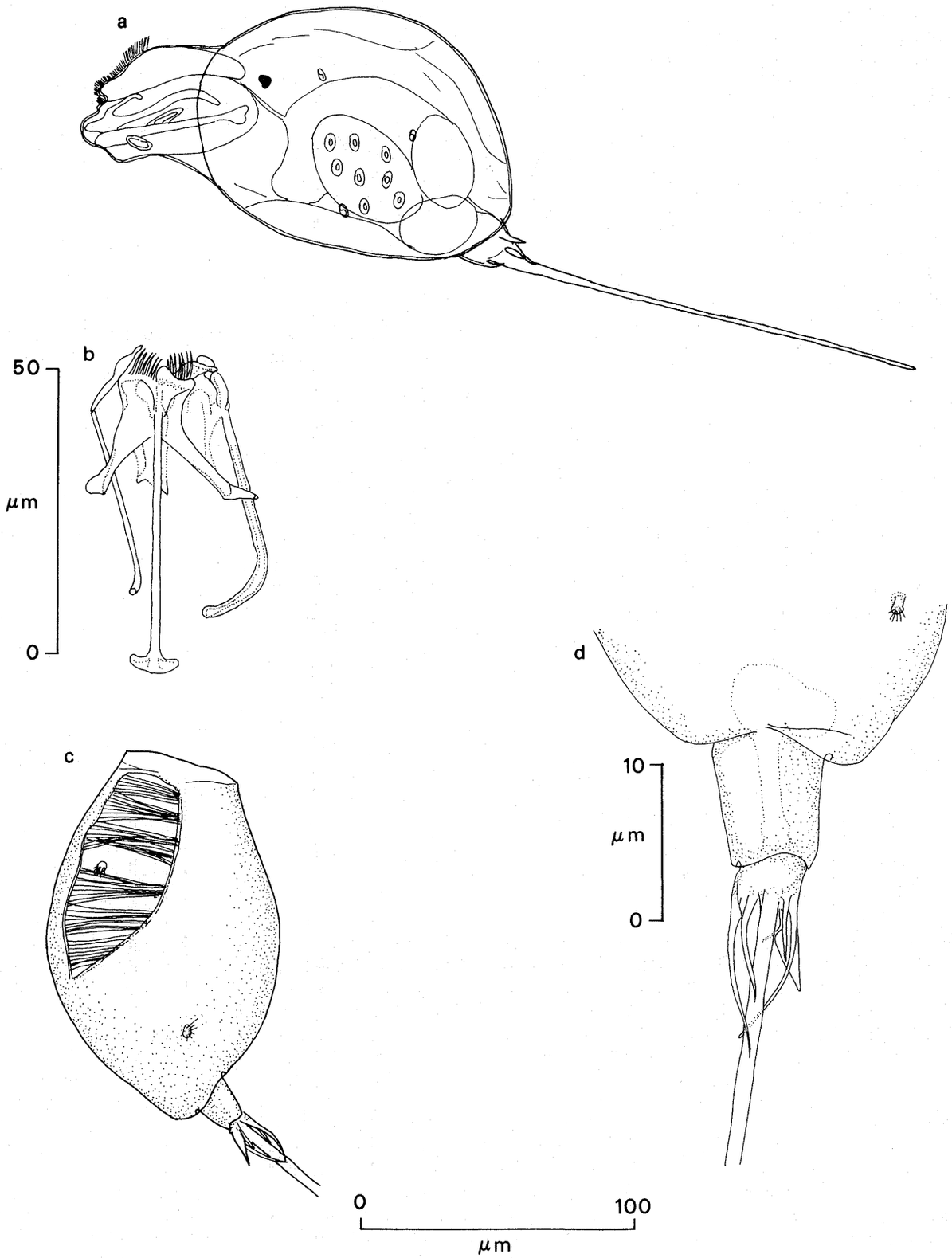

Fig. 19. *Trichocerca rattus globosa*: a – lateral view; b – trophi, ventral view; c – lorica, showing striated areas; d – toes and substyles.

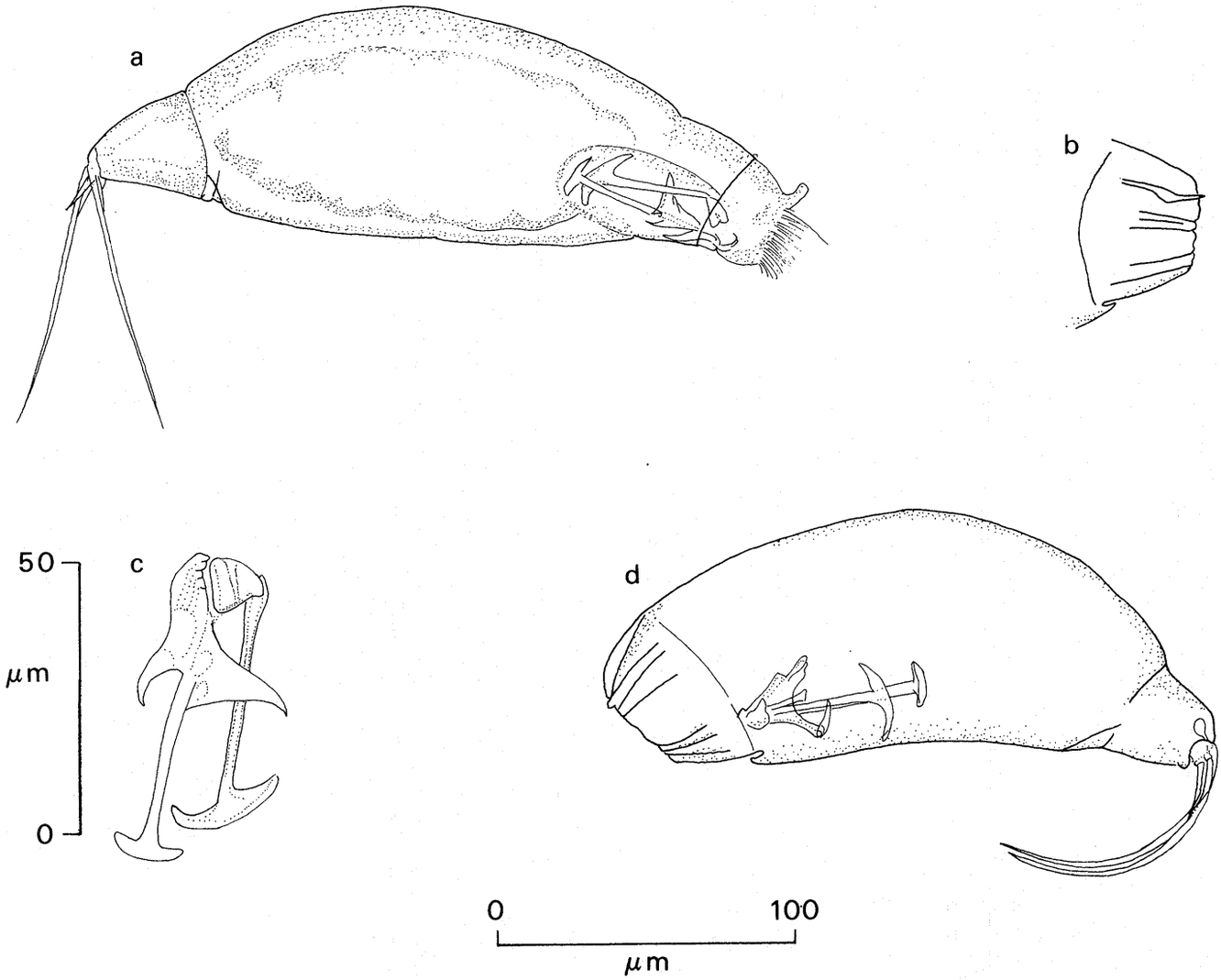

Fig. 20. *Trichocerca tigris*: a – lateral view; b – collar; c – trophi; d – lateral view.

prominences of any sort. There is no dorsal keel but there is a striated area, which is fairly level with the rest of the dorsal surface. This striated area extends backwards from the anterior margin for nearly two-thirds of the length and is 28 μm wide at the widest point. The foot is short (18–25 μm) and is composed of two segments. The basal segment is stout while the other is so short that it is sometimes barely distinguishable. The left toe (198–208 μm) is extremely long and straight and between one and a quarter and one and a half times the length of the body. At the base of this toe there are at least six sub-styles, four placed dorsally and two ventrally, and a triangular, scale-like prominence that is dorsal to the left toe. The trophi are large (55 μm) and very asymmetric. The left manubrium is 44 μm long and at its lower extremity it is gently rounded, having an 'old-style hockey stick' shape. The greatly reduced right manubrium is long and thin, being about three-quarters the length of the left at 32 μm. It is also curved towards the fulcrum but in a gentler curve. The alula of the right ramus ends in a knob-like process, while the left ramus is bluntly furcate. The fulcrum is long (42 μm) and the lower extremity is expanded into a broad base.

T. rattus globosa differs from the *sensu stricto T. rattus*, especially in the globular or swollen form of the body. These two species lack the dorsal keel that is so prominent in *T. rattus* f. *carinata* (Ehrenberg), in *T. bicristata* (Gosse) and in *T. lophoessa* (Gosse). The Signy specimens are closely allied to *T. rattus* f. *carinata*, but lack the prominent dorsal keel. The trophi of *T. rattus globosa* are similar to those of *T. rattus* and to the form *carinata* and virtually identical to those of *T. bicuspes* (Pell). *T. bicuspes* differs from *T. rattus globosa* in the presence of prominent lateral spines. In view of the similarities, it seems reasonable for *T. bicuspes* to be considered as a subspecies of *T. rattus* that is very closely related to our subspecies.

Trichocerca tigris (O. F. Müller)
Fig. 20

This species was not found at Signy Island but a number of specimens were obtained from the Maiviken Lakes,

Table V. Comparative measurements (all in μm) of *Trichocerca tigris* and the South Georgia specimens.

	after Koste (1978)	*Specimens from South Georgia*
Length of trunk	–	144–198
Length of foot	–	28–36
Length of trunk and foot	130–200	172–234
Length of toes	50–80	86–90
Length of trophi	41	54–64

South Georgia. These were somewhat larger than those quoted by Koste (1978) as detailed in Table V.

Most of our mounted specimens show the head protruding some way beyond the anterior edge of the head shield or 'hood', though the extent of this depends upon the degree of compression of the particular slide. Although we were able to clearly distinguish the trunk from the foot segment, the published data usually give just the body length. It was not possible to ascertain exactly how many sub-styles were present as they tended to lie flush with the base of each toe. In one specimen, it was possible to distinguish three and possibly four. Jennings (1903) shows four small sub-styles at the base of each toe.

The trophi, although considerably larger, conform closely in all other respects with the published data for this species, bearing the characteristically massive anchor-shaped left manubrium (39–43 μm). The right manubrium, which is rudimentary, is long and thin and about three quarters the length of the left. The fulcrum ranged from 36 to 54 μm. *T. tigris* is a widely distributed species, usually found in acid-water habitats.

Family: DICRANOPHORIDAE

Genus ***Dicranophorus*** Nitzsch

The members of this genus are usually partially loricated. The mastax has protrusible forcipate trophi. The manubrium is attached directly to the uncus and the uncus and rami join near their tips. The retrocerebral sac is unusually large and the sub-cerebral glands are absent. There are usually two eyes on the brain. The foot, which ends in two strong toes, is shorter than the lorica. A very active predatory group. Two species were found at Signy.

Dicranophorus permollis giganthea ssp. nov.* Fig. 21a, b

At first, *Dicranophorus permollis giganthea* and *Encentrum mustela* were thought to be large and small specimens of the same species so that the distribution of each is not precisely known. Collections that yielded specimens of both, or either, came from Sombre Lake, Heywood Lake, Changing Lake, Moss Lake, Pumphouse Lake, Light Lake, Spirogyra Lake, Tioga Lake, Emerald Lake and Twisted Lake. *D. permollis giganthea* is a large rotifer with an overall length of 446 μm. The body is elongate, dorsally gibbous towards the posterior end and tapers to a single roughly conical foot segment. The head is large and, though marked by a slight constriction, it is not well defined. The rostral hood is small and the corona is ventrally orientated. The toes are of medium length (36 μm) in relation to the size of the body and are comparatively straight. There are two pairs of pedal glands, one almost as long as the foot segment, the other smaller. The trophi are of special interest as our identification largely depends on this feature. The rami (23 μm) are widely separated and terminate in simple incurved points that lack alulae and inner marginal teeth. Towards their base, they widen slightly and then narrow before joining the upper end of the fulcrum. The general outline tends to be somewhat square rather than lyrate. The fulcrum is long (18 μm) and widens at its lower end. The unci are long (19 μm), slender and bear a single tooth. They have a slight knob-like swelling half way down, which give the appearance of a joint. The unci are indirectly attached to the upper end of the manubria by the sclerified invaginations of the pharyngeal wall, known as the intramallei. The manubria are extremely long (38 μm) and gently curving. The upper extremities are bulbous and the lower extremities are slightly widened like slender spoon handles. There is a single eyespot on the brow. Neither eggs nor males were seen. The Signy specimens were voracious carnivores, feeding on Gastrotrichs and small rotifers. The stomach of one of the mounted specimens contains trophi of *Encentrum mustela* and *Cephalodella megalocephala.*

We believe that our specimens are identical with the *Pleurotrocha* sp. described and illustrated by Murray (1910) from Blue Lake on Ross Island and that, in all probability, the *Pleurotrocha* sp. listed, but not described or illustrated, by Dougherty and Harris (1963) and by Spurr (1975) from the same region, is the same species. Murray (1910) declined to name his specimens but remarked that they bore some resemblance in size (520 μm), activity and shape of the trophi, to *Pleurotrocha grandis* (now known as *Encentrum grande* (Western)), and in general outline, and especially in the shape of the trophi, to *Diglena permollis* (now known as *Dicranophorus permollis*). Since then (1910), several authors have discussed the affinities of Murray's Antarctic rotifer.

Bryce (1922) succeeded in hatching out a species of *Encentrum* from dry moss collected at Spitzbergen in the Arctic. This species, which Bryce named *E. murrayi*, bore sufficient resemblance to Murray's Cape Royds animal (a high gibbous dorsal profile and fairly long toes) for Bryce (1922) to consider the possibility that they were one and the same, although admitting that the two species differed in a number of respects. The trophi are sufficiently different to

*The identification of this species was the most difficult of the survey. This was because of the somewhat vague boundary that exists between the genus *Dicranophorus* and the closely related genus *Encentrum*. According to Harring and Myers (1928), the only really reliable distinguishing feature is the presence of well-developed mallei muscles in *Dicranophorus* and their complete absence in *Encentrum*. Other features that are sometimes quoted are the absence of sub-cerebral glands in *Dicranophorus* and the presence of intramallei (sclerified invaginations of the pharyngeal wall between the manubrium and the uncus) in the genus *Encentrum*. None of these criteria are entirely satisfactory. It is not always possible to examine the mallei muscles nor, for that matter, the sub-cerebral glands. One can usually examine the trophi for intramallei and the presence or absence of this structure may be a suitable criterion for the identification of the two genera. Unfortunately, several species that have intramallei, including the species under consideration, have been assigned to the 'wrong' genus of *Dicranophorus*. Clearly, a review of the genera *Encentrum*/*Dicranophorus* is urgently needed.

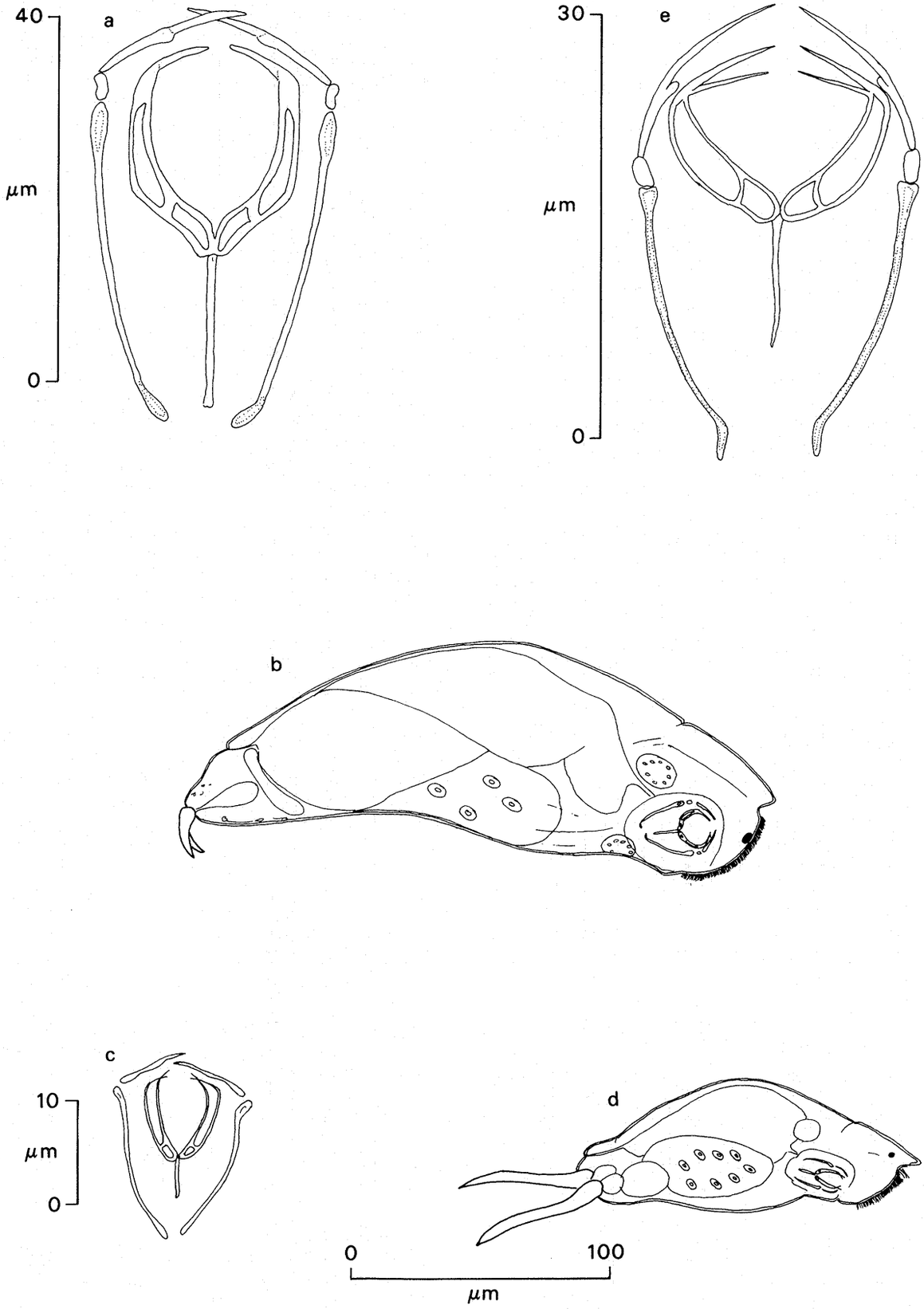

Fig. 21. *Dicranophorus permollis giganthea*: a – trophi, ventral view; b – lateral view. *Dicranophorus uncinatus*: c – trophi, ventral view; d – lateral view. *Encentrum mustela*: e – trophi, ventral view.

dispel any suggestion that *E. murrayi* and the Cape Royds and Signy specimens are the same.

Harring and Myers (1928) thought that *Encentrum grande* was possibly the identity of the Cape Royds specimens but, as can be seen from their own figure, the rami are quite different in shape. The external outline is less angular and, as a result of their shape, they are closer together. We also considered the similarity between the Signy specimens and *Encentrum orthodactylum* Wulfert. The rami are quite similar but the lower sections (of *E. orthodactylum*) do not possess an angular outer margin as they sweep in to meet the head of the fulcrum. Furthermore, the intramallei possess an inward pointing spur that has an intricate form (Wulfert, 1936), which is absent from the Signy specimens.

This leaves us with *Dicranophorus permollis* as the identification of the Signy specimens. The trophi are virtually identical, but the fact that the Signy and Cape Royds rotifers (at 446 and 520 μm, respectively) are twice the reported size of *D. permollis* (240 μm long in Harring and Myers (1928)) has led us to erect the new subspecies *giganthea*.

Beauchamp (1940) reported *D. permollis* from Îles Kerguelen. The identification was based solely on the trophi of a single contracted specimen.

Dicranophorus uncinatus (Milne)
Fig. 21c, d

This species was found in only four lakes (Table VII, p. 37) and then only rarely. It is medium-sized rotifer with a total length of 180 μm. There is a large, single foot segment (25 μm) with two long, strong toes. The toes, which were 62 μm long, were more than one-third of the total length. Eggs were not seen. The male was not seen. It is a predatory species.

Although the Signy specimens were somewhat smaller than those usually quoted, they fall well within the 100–280 μm range given by Koste (1978). *Dicranophorus uncinatus* is said to favour acid water habitats and has a wide distribution. It occurs all over Europe, including the British Isles, in Russia and the USA (de Ridder, 1972).

Genus ***Encentrum***

The members of this genus are cylindrical and usually illoricate or only partially loricated. The mastax has protrusible forcipate trophi. There is a small, intercalating piece between the manubrium and each uncus (the intra-mallei), and subcerebral glands are present (cf. *Dicranophorus*). Eyes are not usually present. The foot ends in two small toes. A very active, predatory group. One species was found at Signy.

Encentrum mustela (Milne)
Fig. 21e

In the field, this species was not distinguished from the larger *Dicranophorus permolis giganthea* so that its distribution on Signy Island is not precisely known. Collections that yielded specimens of either or both were made in Sombre Lake, Heywood Lake, Changing Lake, Moss Lake, Pumphouse Lake, Light Lake, Spirogyra Lake, Tioga Lake, Emerald Lake and Twisted Lake. It is a small rotifer, with total length between 123 and 190 μm. The toes were 10–14 μm long. The mastax has a length of 28 μm. The fulcrum is short (7 μm). The rami are short (11–13 μm) and stout. Their lower portions are slightly swollen and their terminal points are very fine and needle-like. The secondary teeth arise from the outer ventral margin of each ramus, a little below the terminal point. The lower pair of setae-like teeth point directly inwards, their tips almost touching when the rami are closed. The manubria (19–22 μm) are slender with the lower extremities turned slightly out. The unci (10–13 μm) are particularly delicate, being long and slender with a projecting tip halfway down the lower surface, which acts as a pivot on the terminal tooth of the ramus. Eggs were not seen and neither was the male. *E. mustela* is a solitary, predatory species.

Although some of the Signy specimens are smaller than the minimum size quoted for *E. mustela* by Koste (1978), the measurements quoted for the trophi are in close agreement with those given by Wulfert (1936). In Europe, this species is scarce in the summer (Koste, 1978) and is regarded as a cold stenotherm (de Ridder, 1972).

A small species of *Encentrum* has also been found from the pools at Rothera Point, Adelaide Island (Dartnall, 1980). From the very few specimens we have been able to examine, this species would appear to resemble most closely *E. gulo* Wulfert but more specimens are needed to confirm this identification.

Order: FLOSCULARIACEA

Family: FLOSCULARIIDAE

Genus ***Ptygura*** Ehrenberg

The corona of this genus is, when fully expanded, circular or kidney-shaped, with shallow ventral identation. The margin of the corona is ciliated. The dorsal antenna is small. The mastax has malleoramate trophi. Mostly sessile, most members of this genus are usually found in a gelatinous tube. Two species were found at Signy.

Ptygura crystallina (Ehrenberg)
Fig. 22a–d

This species was found in seven lakes (Table VII, p. 37). In Moss Lake, it was found on the upper surface and near to the growing tip of the *Calliergon sarmentosum* leaves (Priddle and Dartnall, 1978). In Light Lake, it colonized the algal felt in such numbers as to impart to small detached pieces a certain degree of movement, due to the combined action of their coronal cilia. It is a large species, in excess of 500 μm when fully extended. Mucus secretions from the foot glands collect a diverse assortment of debris and epiphytes to form a semi-opaque tube of untidy appearance into which the animal can quickly withdraw. The egg is clear, round or oval, 65 by 50 μm. The larval stage and the male were not seen.

The Signy specimens fall within the upper size range quoted for this species. *P. crystallina* has a world-wide distribution.

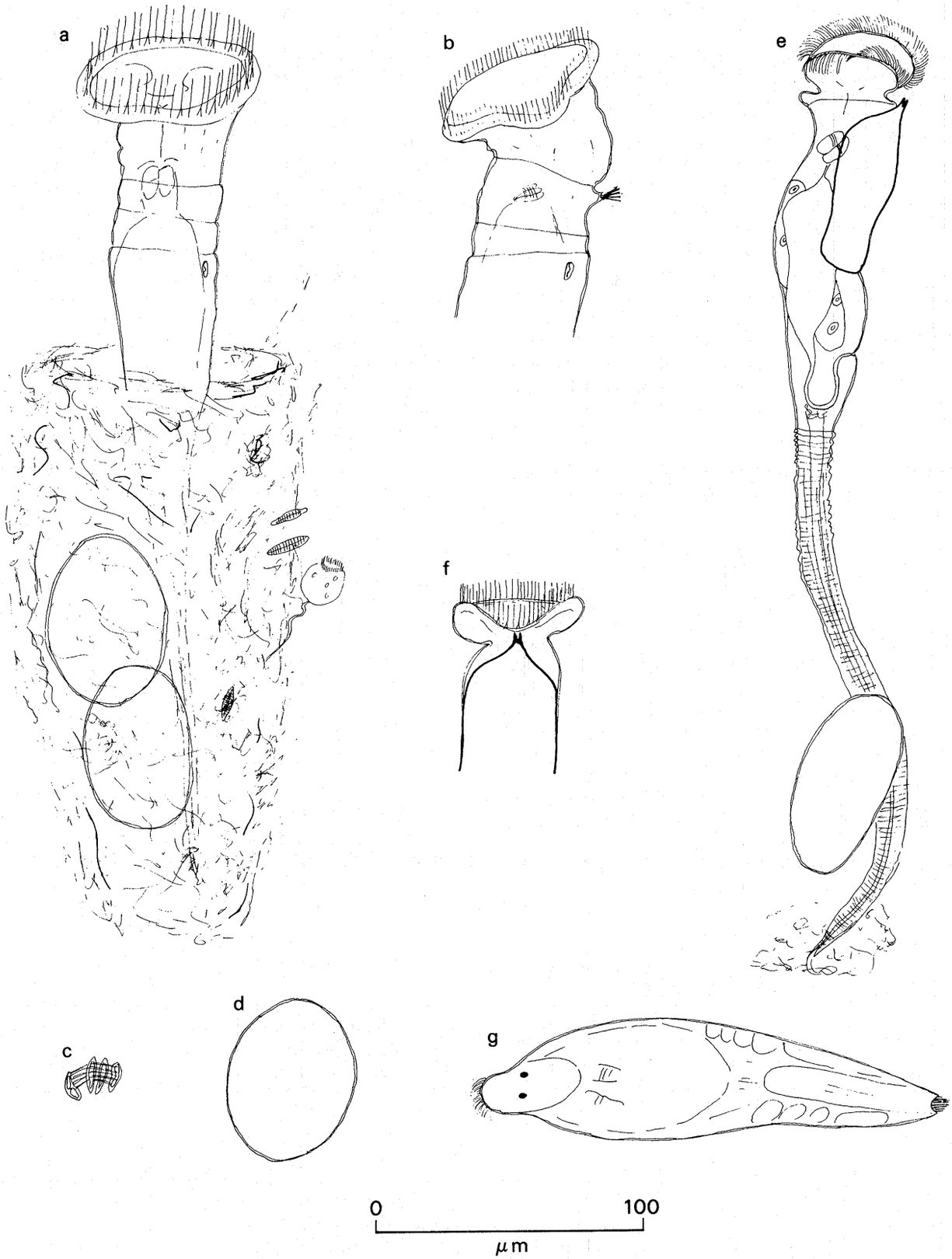

Fig. 22. *Ptygura crystallina*: a – ventral view; b – corona, lateral view; c – trophi; d – egg. *Ptygura melicerta*: e – lateral view; f – corona and dorsal shield; g – larval stage.

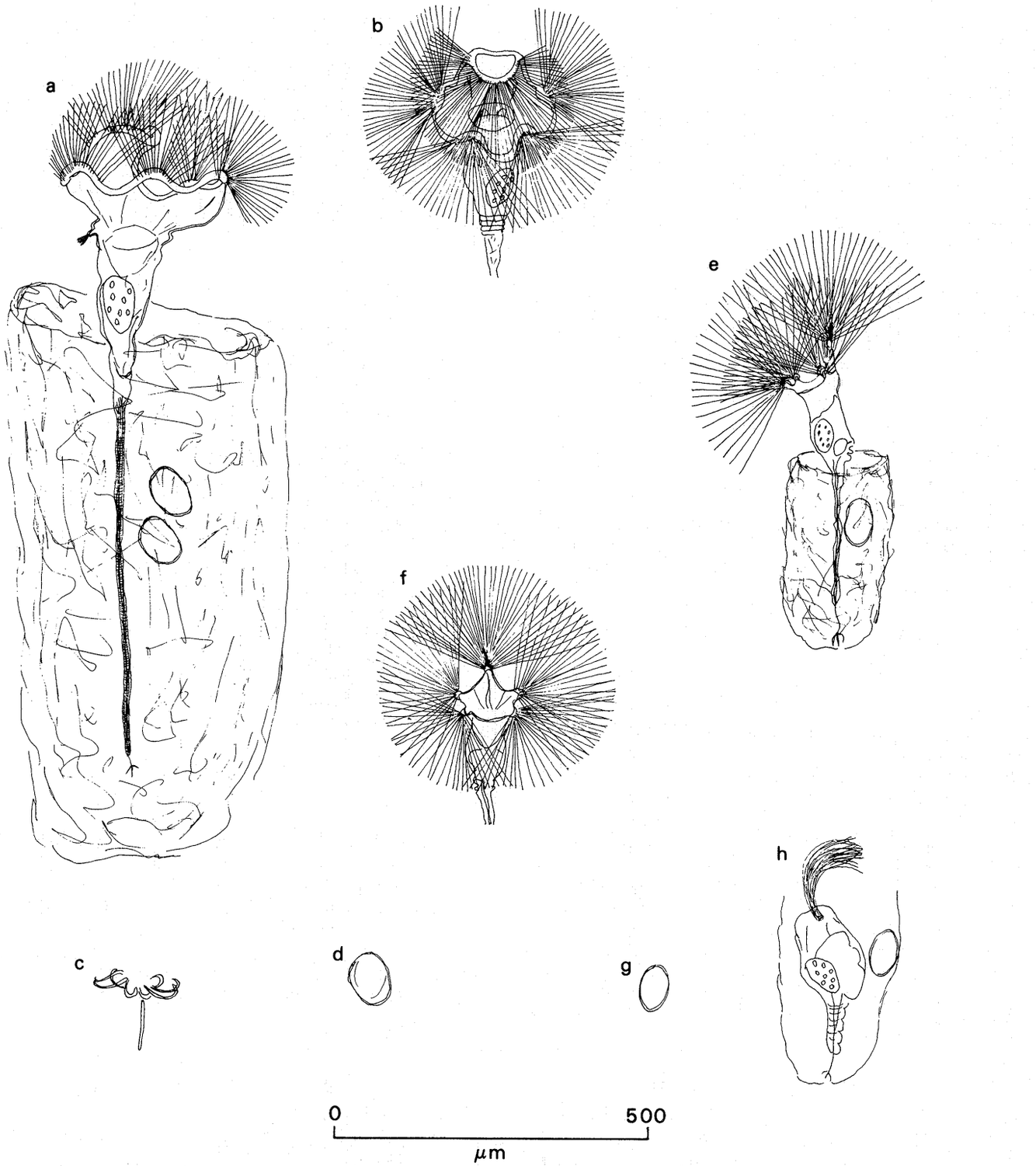

Fig. 23. *Collotheca gracilipes*: a – ventrolateral view; b – corona from above; c – trophi, ventral view; d – egg. *Collotheca ornata cornuta*: e – lateral view; f – corona from above; g – egg; h – contracted specimen, lateral view.

Ptygura melicerta Ehrenberg
Fig. 22e–g

This species was found in five lakes (Table VII, p. 37), being plentiful in those with mosses but otherwise rare. In Moss Lake, it was most commonly found in the axils of *Calliergon sarmentosum* leaves, where it was usually surrounded by epiphytes (Priddle and Dartnall, 1978). It is a large species, in excess of 400 μm when fully extended. The protective tube usually present in this genus is lacking. The eggs are brown and ellipsoidal (75 μm by 35 μm). The eggs hatch into a free-swimming 'larval stage', which possesses two frontal eyespots that disappear soon after settlement. At the time of settlement, the larvae are 150 μm long. There follows a very rapid increase in the length of the foot and adult size is achieved within 24 hours. Males were not seen. *P. melicerta* has a world-wide distribution.

Order: COLLOTHECACEAE

Family: COLLOTHECIDAE

Genus ***Collotheca*** Harring

In this genus the margins of the corona are furnished with long, very fine setae. The foot ends in a peduncle. The digestive system is very characteristic. The mastax has incudate trophi. Mostly sessile forms, the Collothecans are usually found in clear, gelatinous tubes. Two species were found at Signy.

Collotheca gracilipes Edmondson
Fig. 23a–d

This species was found in Sombre Lake, Moss Lake and Light Lake, where it was very rare. The largest specimens were found in Moss Lake. Like *C. ornata cornuta, C. gracilipes* was found attached to the undersides of the leaves of *Calliergon sarmentosum* (Priddle and Dartnall, 1978).

This species was the largest rotifer found, with a length of 1200 μm when fully extended. The dorsal coronal lobe is enormous and curves inwards over the buccal funnel. The dorsal antenna is very prominent and is found just below the coronal cup. The eggs are brown and roughly circular (70 μm diameter) to elliptical (100 μm by 60 μm) in shape. The male was not seen.

Although Koste (1978) has recently reduced this species to a variety of *C. campanulata* (Dobie), we have retained the original designation.

Collotheca ornata cornuta (Dobie)
Fig. 23e–h

This species was found in nine Signy Island lakes (Table VII, p. 37), where it was fairly abundant. In Moss Lake, *C. ornata cornuta* was found on the aquatic moss *Calliergon sarmentosum* below the region of active growth and on the undersides of the leaves (Priddle and Dartnall, 1978). It is a large species, in excess of 600 μm when fully extended. The margin of the coronal funnel bears five knobs. The dorsal knob is the longest and has a short finger-like projection (subspecies *cornuta*). The eggs are light brown and oval (45 μm by 25 μm). The male was not seen.

Collotheca ornata cornuta has a world-wide distribution and has been recorded several times before from the Antarctic. Murray (1910) found it at Cape Barne and Cape Royds (recorded as *Floscularia cornuta*) and it has subsequently been reported from the McMurdo Sound area by Armitage and House (1962) (though their record is for *C. ornata*, no mention being made of the subspecies *cornuta*), and by Dougherty and Harris (1963). *C. ornata cornuta* has also been recorded from pools in the Obruchev Hills (Korotkevich, 1958; Kutikova, 1958*b*).

Class: **BDELLOIDEA**

Order: BDELLOIDEA

Family: ADINETIDAE

Genus ***Adineta*** Gosse

Rotifers in this small group lack the normal bdelloid wheel organ of separate trochal circles on pedicels. The rostrum is short, broad and unable to be retracted. The corona consists of two, flat ciliated areas on the ventral side of the head, which are separated by a narrow longitudinal groove. The body is spindle-shaped and the head is wider than the neck. The stomach has a distinct and ciliated lumen. The foot is narrow and fairly long with two spurs and three toes. Eyespots are usually absent. All members of the genus are oviparous, except *A. grandis*. The mastax has ramate trophi and a dental formula of 2/2. Adinetids do not swim but creep caterpillar fashion, or glide over the bottom. Three species were found at Signy.

Adineta barbata Janson
Fig. 24a, b

This very active species was only found in Sombre Lake and Tioga Lake, where it was very rare. It is a medium-sized rotifer (325 μm), greyish-brown in colour. The spurs, which are almost as long as the joint to which they are fixed, are long and heavy. *A. barbata* is normally found in drying mosses and has a world-wide distribution (Bartoš, 1951). It has been reported from the Antarctic before: from the McMurdo Sound area by Murray (1910) and Dougherty and Harris (1963).

Adineta gracilis Janson
Fig. 24c

This very active species was only found in Heywood Lake and Tioga Lake, where it was very rare. It is a medium-sized rotifer (300 μm), transparent to pale grey in colour. The spurs are very short. The eggs are oval and transparent (70 μm by 50 μm). *A. gracilis* is normally found in drying mosses and has a world-wide distribution (Bartoš, 1951). It has been reported from the Antarctic before: from the McMurdo Sound area (Murray, 1910), from Haswell Island (Donner, 1972), from Langhovde (Sudzuki, 1964) and from Signy Island at the SIRS (Jennings, 1976; Donner, 1980).

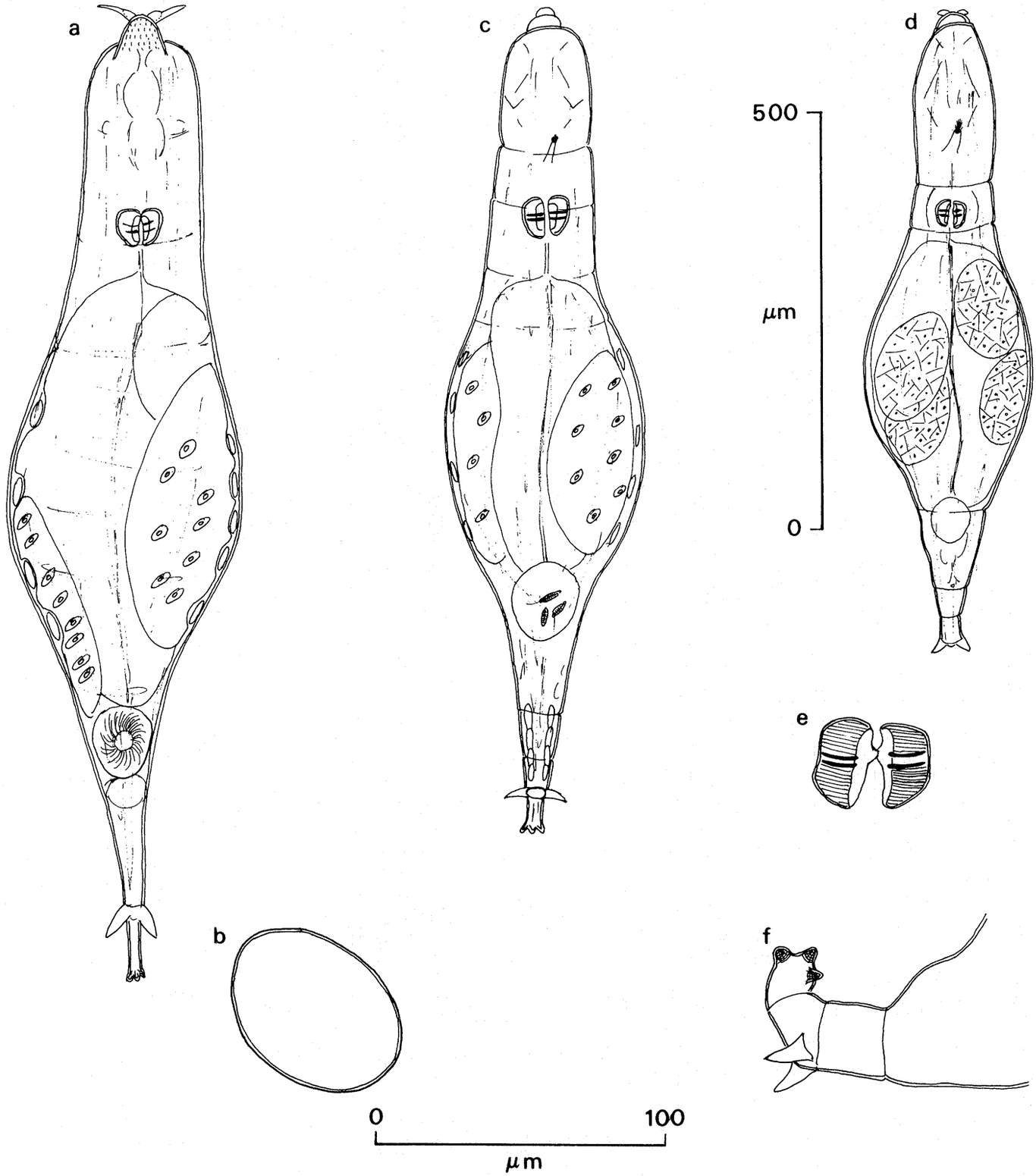

Fig. 24. *Adineta barbata*: a – dorsal view; b – egg. *Adineta gracilis*: c – dorsal view. *Adineta grandis*: d – dorsal view; e – trophi; f – toes and spurs.

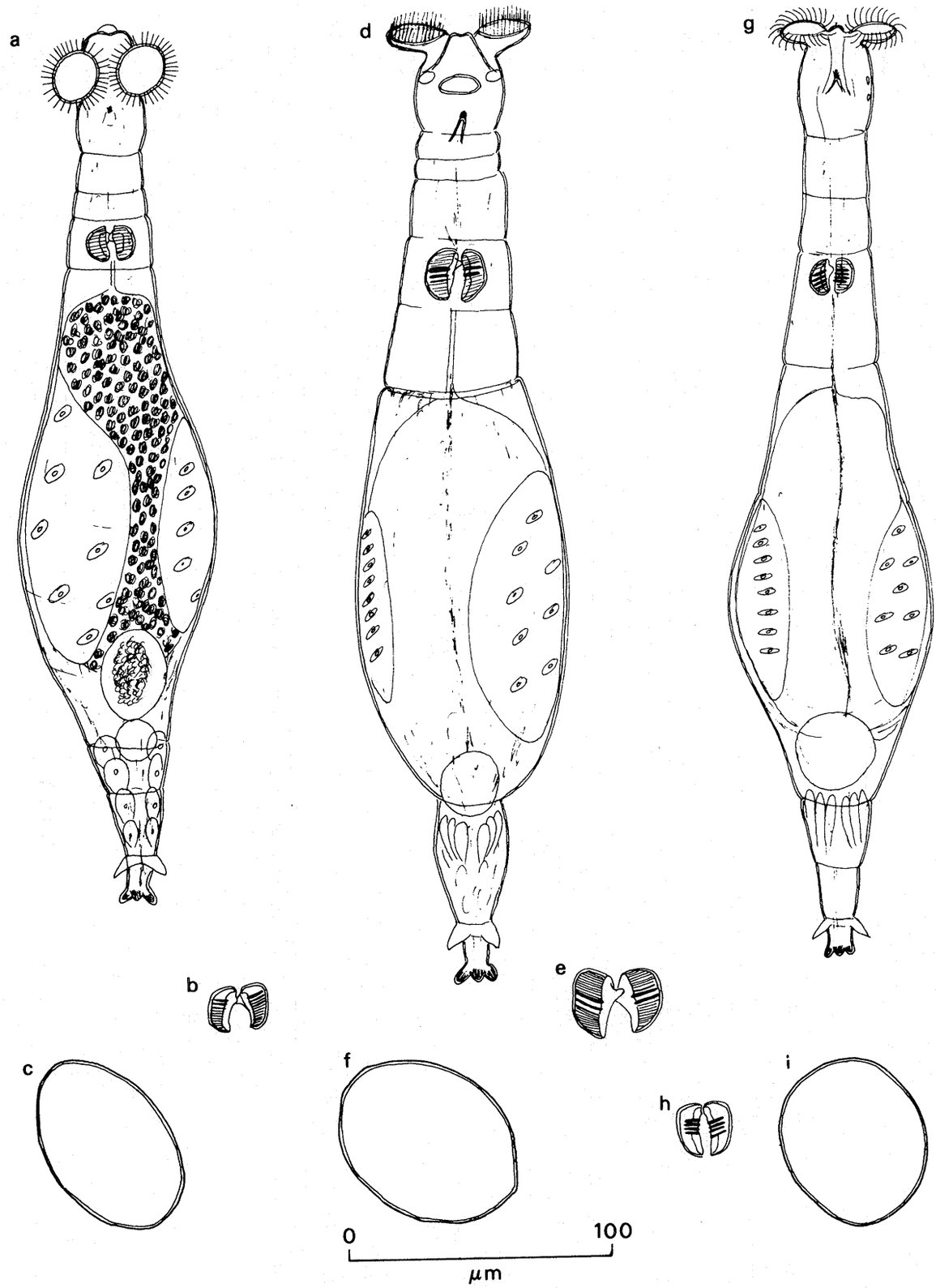

Fig. 25. *Habrotrocha constricta*: a – ventral view; b – trophi; c – egg. *Macrotrachela concinna*: d – dorsal view; e – trophi; f – egg. *Macrotrachela* sp.: g – dorsal view; h – trophi; i – egg.

Adineta grandis Murray
Fig. 24d–f

This species was only found in pools (Table VI, p. 36). It is a very large (750 μm) brown-coloured rotifer, with a pair of very tiny toes. *A. grandis* is viviparous. The young (up to 8) are only born after the death of their mother. *A. grandis* has only been reported from the Antarctic from the McMurdo sound area (Murray, 1910; Dougherty and Harris, 1963; Spurr, 1975) and from Haswell Island (Donner, 1972; Opalinski, 1972*a*).

Family: HABROTROCHIDAE

Genus ***Habrotrocha*** Bryce

In this genus the stomach lacks a lumen. The syncitial mass contains food vacuoles, which may have a frothy appearance and give the impression that the food is compressed into pellets. The wheel organ is generally smaller than the head. The neck is often long and the upper lip is large and bluntly triangular. The foot is short and there are three toes. The genus is oviparous. A number of species live in tubes or sheaths. Only one species was found, in the Signy lakes.

Habrotrocha constricta Dujardin
Fig. 25a–c

This species was only found creeping along the bottom in Tioga Lake, where it was rare. It is a medium-sized (375 μm) bdelloid, greyish-brown in colour. The wheel is small, just a little larger than the neck. The upper lip is large and bluntly triangular. The ramate trophi are covered with fine striae and have a dental formula of 8/8. The foot is fairly short and the small spurs touch at their base. The egg is oval (70 μm by 50 μm) and transparent. *H. constricta* has a world-wide distribution (Bartoš, 1951) and has been found in the Antarctic before. Murray's (1910) first report of it from the McMurdo Sound area has subsequently been confirmed by Dougherty and Harris (1963). *H. constricta* has also been found at Signy Island before, at the SIRS (Jennings, 1976; Donner, 1980).

Family: PHILODINIDAE

Genus ***Macrotrachela*** Milne

In this genus the foot always has three toes of equal size. The wheel organ, a corona with two separate trochal circles on pedicels, is usually wider than the head. The surface of the body is usually decorated with cuticular thickenings and hypodermal knobs. Eyespots are absent. The genus is oviparous. Two species were found at Signy Island, one of which was also found at South Georgia.

Macrotrachela concinna Bryce
Fig. 25d–f

This species was only found in Gourlay Pool, where it was rare. It was probably washed in from the surrounding moss banks, as it has been found at Signy before, at the SIRS (Jennings, 1976; Donner, 1980).

The body of this medium-sized (375 μm) bdelloid lacks the cuticular thickenings so common in this genus. The wheel organ is fractionally wider than the neck. The upper lip is large, extending as far as the wheel discs, and has an anterior notch. The dorsal antenna is very small (approximately one quarter the width of the neck). The trophi have a dental formula of 2/2. The stomach has a green to greeny-brown colour. The foot is short and made up of three segments. The spurs are short and heavy and touch at their bases. The eggs are smooth, brown and oval (75 μm by 55 μm) with a slight hint of a polar knob. This species is usually found in mosses and it has been reported from most of Europe and North America (Bartoš, 1951).

Macrotrachela sp.
Fig. 25g–i

This species was found in six lakes (Table VII, p. 37) and was fairly abundant. In Moss Lake, it was found on the upper surface of the leaves of *Calliergon sarmentosum* almost completely buried by epiphytes. The head and neck protruded through a small hole in the epiphyte cover that was just wide enough to take the neck. When disturbed, the head is rapidly withdrawn, making the animal very difficult to detect. This species is the 'unknown bdelloid' of Priddle and Dartnall (1978). It is a very thin species, with a long neck (total length 350 μm). The wheel organ is small, being the same size or sightly smaller than the neck. The dorsal antenna is also small and is composed of two segments. The body lacks cuticular thickenings and has an orange to orange-red colour. The teeth on the ramate trophi have a dental formula of 4/4. The spurs are small and widely separated. The eggs are transparent, circular to oval in shape (60 μm by 50 μm).

Genus ***Philodina*** Ehrenberg

In this genus, the wheel organ is perfectly developed and the rostrum is retractable. The foot, which is almost half the length of the body, has two short spurs and four toes. The cuticle, in the majority of cases, is thin and lacks cuticular thickenings and appendages. Normally there are two eyespots. Apart from *P. gregaria*, which is viviparous, the genus is oviparous. Three species were found at Signy.

Philodina gregaria Murray
Fig. 26

This species was found in most of the pools on Signy Island that are enriched by seal and penguin excreta. It is sufficiently abundant in some to form blood-red patches, which often extended over several square metres. The maximum density recorded in Gourlay Pool was in excess of 50 million individuals per square metre (Dartnall, unpublished). It is a very large rotifer with a total length over 600 μm. The body is bright red and there are two orange eyespots. The ciliary discs are large, being more than twice the width of the neck. The teeth on the ramate trophi have a dental formula of $2_{+1}/2_{+1}$. The spurs are moderately long and widely separated. *P. gregaria* is viviparous and up to 32 young per adult were produced in culture experiments (Dartnall, unpublished).

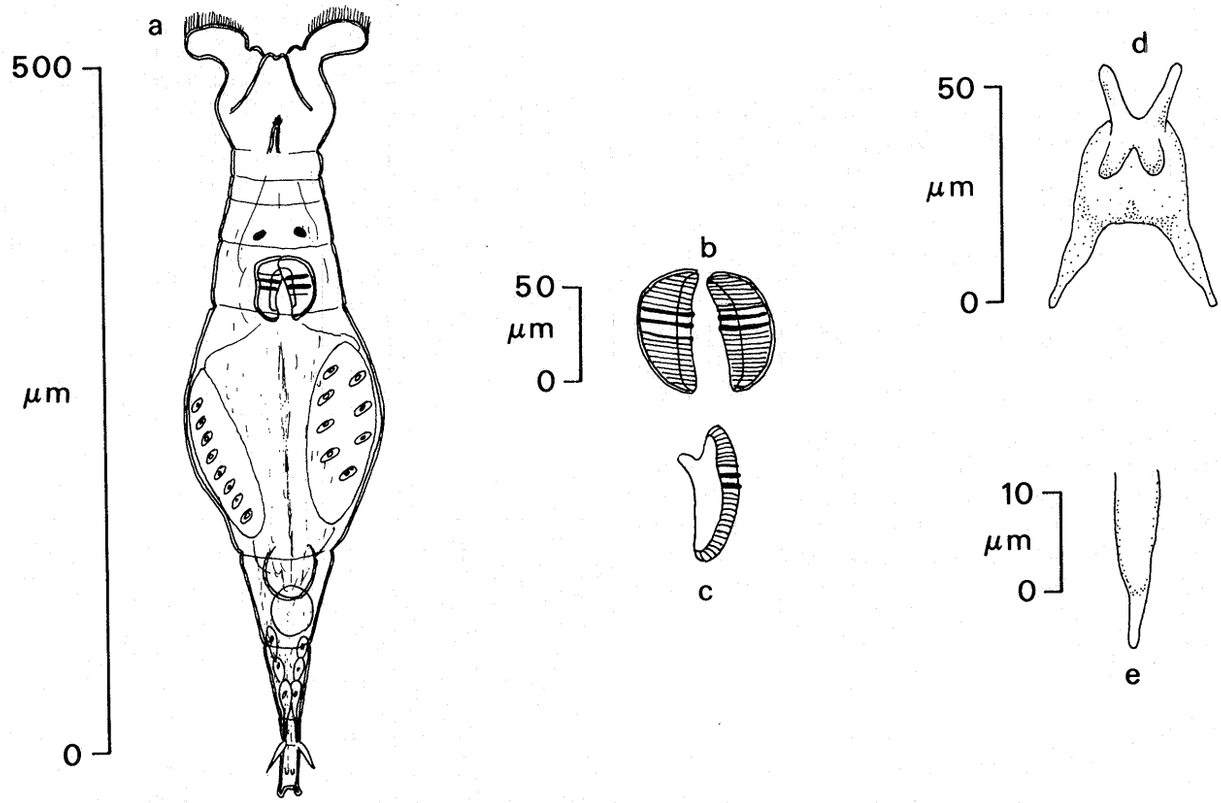

Fig. 26. *Philodina gregaria*: a – dorsal view; b – trophi; c – trophi, lateral view; d – toes and spurs; e – spur.

Like *Adineta grandis, Philodina gregaria* is endemic to the Antarctic and has frequently been recorded from the McMurdo Sound area (Murray, 1910; Armitage and House, 1962; Dougherty and Harris, 1962; Spurr, 1975; Cathey and others, 1981) and from Haswell Island (Donner, 1972; Opalinski, 1972*a*) and from the Antarctic Peninsula, at Red Rock Ridge, Stonington (Schmitt, 1945) and Ablation Point, Alexander Island (Heywood, 1977).

In their comparative study of two small lakes on Ross Island, Goldman and others (1972) observed red patches, which they attributed to *Philodina roseola*. In our view, this is a very doubtful identification since there is no other report of *P. roseola* from the Antarctic and *P. gregaria* (which we believe to be responsible for the red patches) is very similar to *P. roseola*. Moreover, this is the location where Murray (1910) first reported *P. gregaria*. For these reasons, we have not included *P. roseola* in Table IX.

Philodina sp. 'A'
Fig. 27a–e

This species was the most frequently encountered lakes bdelloid (Table VII, p. 37). In Moss Lake, it was usually found on the growing tip of the mosses (Priddle and Dartnall, 1978, where it was identified as ?*Philodina*). It is a brown rotifer of medium size (350 μm) with a pair of pale orange eyespots. It possesses a long dorsal antenna (20 μm) and large ciliary discs. The teeth on the trophi have a dental formula of 2/2. The spurs are small and the four toes are of almost equal size. A creeping species, which was rarely observed swimming, it is oviparous, laying large, brown, oval eggs, which have a small polar knob (65 μm by 50 μm).

Philodina sp. 'B'
Fig. 27f–i

This species was usually found creeping through the algal felts found on the sublacustrine shelves of Changing Lake, Moss Lake, Orwell Lake and Light Lake. It was also found in the samples from Rothera Point, Adelaide Island (Dartnall, 1980). It is a large (450 μm), red rotifer, with a pair of red/orange eyes. The ciliary discs are large, being twice the width of the neck. The teeth on the trophi have a dental formula of 2/2 or $2_{+1}/2_{+1}$. The spurs are small, as are the toes. It is oviparous. Large, orange-red, oval eggs, with a prominent polar knob (85 μm by 70 μm) are laid.

Genus ***Rotaria*** Scopoli

In this genus, all parts of the body, particularly the foot, spurs and toes, may be greatly extended. Eyespots, when present, are found on the rostrum. The foot has three toes. All members of the genus are viviparous. Only one species was found, at South Georgia.

Rotaria sp.
Not figured

A single specimen was found in the samples from the Maiviken Lakes. The cuticle of this large bdelloid, which was more than 500 μm, is smooth and lacks cuticular thickenings. The rostrum, which is very large, bears two large eyespots. The trophi have a dental formula of 2/2.

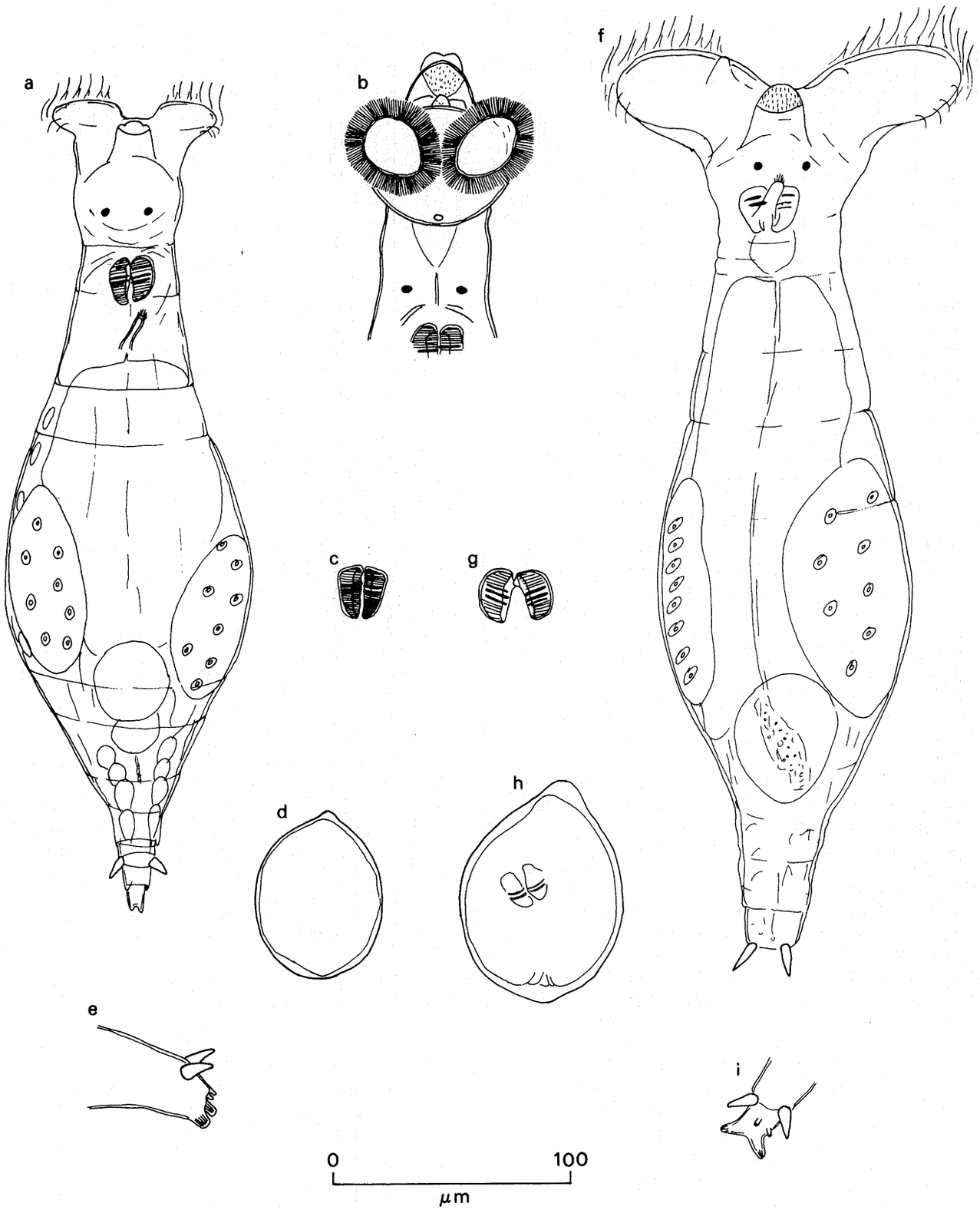

Fig. 27. *Philodina* sp. 'A': a – dorsal view; b – corona, ventral view; c – trophi; d – egg; e – toes and spurs. *Philodina* sp. 'B': f – dorsal view; g – trophi; h – egg; i – toes and spurs.

III. DISCUSSION

1. *Signy Island*

Of the 42 species of rotifer found in this study, 38 were present at Signy Island. Thirty of these (24 Monogononta and six Bdelloidea) were found in the lakes and eight (five Monogononta and three Bdelloidea) in the pools. No species was common to both habitats (Tables VI and VII).

The pools are much harsher than the lakes since they are frozen solid for at least nine months each year and, during the brief summer, they are subjected to rapid fluctuations in temperature accompanied by periodic refreezing. Of the eight species found, two (*Adineta grandis* and *Philodina gregaria*) are endemic and occurred in all the pools except the SIRS Pool (Table VI). This pool is a flooded moss carpet and perhaps should be regarded as a terrestrial habitat, subject to inundations. *Epiphanes senta*, a cosmopolitan species, is normally found in small pools enriched by domesticated animals. Consequently, its presence in these pools enriched by seals and penguins is not surprising. Apart from *Macrotrachela concinna* and *Resticula gelida*, the remaining species (*Cephalodella catellina, Colurella colurus compressa* and *Notholca salina*) are commonly reported from brackish habitats. The presence of *Macrotrachela concinna* in the Gourlay Pool is probably accidental as this species is normally reported from terrestrial habitats.

The distribution of rotifers in the lakes is given in Table VII. Although the various lakes were not all sampled with equal frequency or thoroughness, we believe that the sampling programme described in the methods was sufficiently complete to render it unlikely that future work will find many additional species or a radically different distribution of the species already found. Thus, we consider, for example, the difference between the number of species in Moss Lake (25) and Heywood Lake (7) to be highly significant.

Heywood and others (1980) and Priddle and Heywood (1980) have put forward an outline classification scheme and evolutionary sequence for the Signy Island lakes. If the number of rotifer species found is introduced into this scheme (Table VII), it is clear that relatively few species were found in either the ultra-oligotrophic or the very enriched lakes. This is attributable to the fact that the rotifers found in this study were invariably associated with benthic vegetation. The proglacial lakes are too young to have developed an extensive benthic vegetation, while, in the enriched lakes, light needed to maintain such vegetation would be progressively quenched with the development of a rich phytoplankton. Thus, it is only in lakes that fall in the middle of the trophic range at Signy and which are suitable for the development of benthic vegetation, that many species of rotifer were found. It is worth noting that the species present in the enriched lakes are mainly the uncommon predatory ones such as *Dicranophorus permollis giganthea, D. uncinatus, Encentrum mustela* and *Eosphora najas*.

2. *South Georgia*

From the samples obtained for us from the South Georgian lakes, 15 species of rotifer were identified (Table VIII). This list, in contrast to that accumulated at Signy over a period of two years, is necessarily incomplete because of the casual and opportunistic nature of the samplings. If the list of species found at South Georgia and Signy had nothing in common then little more could be added. However, 11 of the 15 species found on South Georgia were also found at Signy and, since these were among the commonest of the Signy species, it seems probable that a more rigorous sampling programme would find many of the others. The four South Georgian species not present at Signy (*Lecane closterocerca, Mytilina mucronata longicauda, Trochocerca tigris* and *Rotaria* sp.) are, therefore, of particular interest as it seems likely that they cannot tolerate the harsher Signy conditions.

3. *Relation of the present findings to previous work*

The study of rotifers has formed part of the scientific programmes of many Antarctic expeditions and the results are widely scattered throughout the literature. The locations from where collections have been made are indicated in Fig. 28. We shall discuss these results under habitat headings rather than in a geographical or chronological context. The habitats are terrestrial and aquatic, with the latter further divided into pools, freshwater lakes and saline habitats.

a. *Terrestrial habitats.* Rotifers have been collected from terrestrial habitats on eight separate occasions. Two of these were from the Antarctic Peninsula. Richters (1920) examined moss samples from four locations at the northern end of the peninsula that had been collected by the Swedish South Polar Expedition of 1901–03 and Beauchamp (1913) examined moss washings from Jenny Island (67°44′S, 68°24′W) that had been collected by the Second French Antarctic Expedition, 1908–10. Richters (1920) identified his specimens as *Callidina* spp. This genus is no longer

Table VI. Distribution of rotifers in selected pools at Signy Island.

	Wallows by Amos Lake	*Wallows Pool*	*Polynesia Point pools*	*Paal Harbour pools*	*SIRS Pool*	*Gourlay Pool*
Cephalodella catellina	–	–	–	+	–	–
Colurella colurus compressa	–	–	–	+	–	–
Epiphanes senta	+	+	–	+	–	+
Notholca salina	–	–	+	+	+	–
Resticula gelida	–	+	–	+	+	+
Adineta grandis	+	+	+	+	–	+
Macrotrachela concinna	–	–	–	–	–	+
Philodina gregaria	+	+	+	+	–	+

Table VII. Distribution of rotifers in the lakes of Signy Island.

	Increasing eutrophication																
	Ultra-oligo-trophic lakes		*Oligo-trophic lakes*			*Enriched lakes*						*Grossly enriched lakes*			*Lakes of unknown affinities*	
	Gneiss Lake	*Orwell Lake*	*Moss Lake*	*Emerald Lake*	*Tranquil Lake*	*Sombre Lake*	*Light Lake*	*Pumphouse Lake*	*Twisted Lake*	*Knob Lake*	*Spirogyra Lake*	*Bothy Lake*	*Amos Lake*	*Heywood Lake*	*Changing Lake*	*Tioga Lake*
MONOGONONTA																
Cephalodella auriculata	–	–	+	+	–	+	+	+	–	+	+	–	–	–	+	–
Cephalodella forficata	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Cephalodella gibba	–	–	+	+	+	+	+	–	–	+	–	–	–	+	–	–
Cephalodella megalocephala	–	–	+	+	–	+	+	+	–	+	–	–	–	–	+	+
Collotheca gracilipes	–	–	+	–	–	+	+	–	–	–	–	–	–	–	–	–
Collotheca ornata cornuta	–	–	+	–	+	+	+	+	+	–	+	–	–	–	+	+
Dicranophorus permollis giganthea	–	–	*	*	–	*	*	*	*	–	*	–	–	*	*	*
Dicranophorus uncinatus	–	–	+	–	–	+	+	–	–	–	–	–	–	+	–	–
Encentrum mustela	–	–	*	*	–	*	*	*	*	–	*	–	–	*	*	*
Eosphora najas	–	–	+	–	–	+	+	+	–	–	–	–	+	–	–	–
Euchlanis dilatata parva	–	–	+	+	+	+	+	+	+	+	–	–	–	+	+	+
Lecane lunaris	–	–	+	–	+	+	+	+	+	–	+	–	–	–	+	+
Lepadella intermedia	–	–	+	–	+	+	+	–	–	+	–	–	–	–	–	–
Lepadella patella oblonga	–	–	+	+	+	+	+	+	+	–	–	–	–	–	–	+
Lepadella rhomboides signiensis	–	–	+	–	–	–	–	–	+	–	–	–	–	–	–	–
Lepadella triptera	–	–	+	–	–	–	+	–	–	–	–	–	–	–	–	–
Notholca walterkostei	–	–	+	+	+	+	+	+	+	+	+	+	–	+	+	–
Notholca walterkostei reducta	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
Ptygura crystallina	–	–	+	–	+	+	+	+	–	+	–	–	–	–	–	+
Ptygura melicerta	–	–	+	+	–	+	+	–	–	–	–	–	–	–	+	–
Scaridium bostjani	–	–	+	+	–	+	+	–	–	–	–	–	–	–	–	–
Trichocerca brachyura	–	–	+	–	–	+	+	+	+	–	–	–	–	–	–	–
Trichocerca rattus globosa	–	–	+	–	+	–	+	+	–	–	–	–	–	–	–	–
Wulfertia sp.	–	–	+	–	–	–	+	–	–	–	–	–	–	–	–	–
BDELLOIDEA																
Adineta barbata	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	+
Adineta gracilis	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	+
Habrotrocha constricta	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
Macrotrachela sp.	–	–	+	–	+	–	+	–	–	+	–	–	–	–	+	+
Philodina sp. A	–	–	+	+	+	+	+	+	+	+	–	+	–	–	+	+
Philodina sp. B	–	+	+	–	–	–	+	–	–	–	–	–	–	–	+	–
Number of species	0	1	25	9	13	20	25	14	10	9	6	2	1	7	12	14

*It was not possible to distinguish between *Dicranophorus permollis giganthea* and *Encentrum mustela* in the field.

Table VIII. List of species found in the South Georgia lakes.

Cephalodella auriculata
Cephalodella gibba
Eosphora najas
Euchlanis dilatata parva
Lecane closterocerca
Lecane lunaris
Lepadella intermedia
Lepadella patella oblonga
Mytilina mucronata longicauda
Notholca walterkostei
Trichocerca brachyura
Trichocerca rattus globosa
Trichocerca tigris
Macrotrachela sp.
Rotaria sp.

recognized and its former members have been distributed among several genera (Harring, 1913), so that Richters' work is of little taxonomic value. The bdelloid rotifers examined by Beauchamp (1913) were too contracted for him to attempt identification. However, he did identify two species of Monogononta, namely *Lindia torulosa* Dujardin and *Colurella colurus* (reported as *C. amblytela*).

Sudzuki (1964) has carried out an extensive investigation of the moss-water community at Langhovde (69° 13′ S, 39° 45′ E), a few kilometres away from the Japanese station, Syowa. He found three species of Monogononta (*Encentrum antarcticum* Sudzuki, *E. bryocolum* Sudzuki and *Lepadella patella matsuda* Sudzuki) and ten species of bdelloidea (*Adineta gracilis, Adineta* sp., two species of

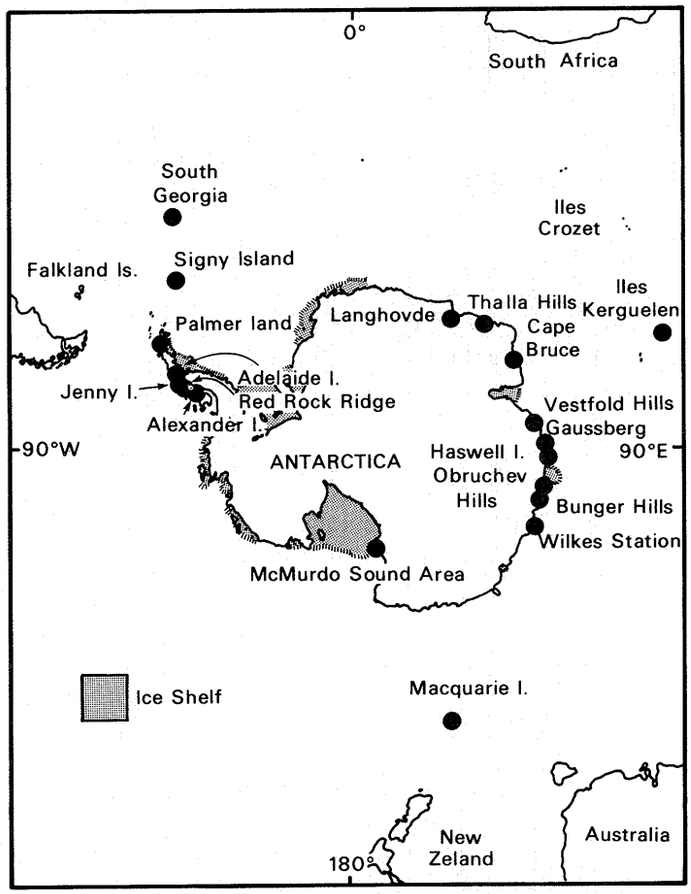

Fig. 28. Map of the Antarctic showing the locations of Signy Island, South Georgia, and the other areas where rotifer investigations have been made.

Habrotrocha, Macrotrachela sp., three species of *Mnobia, Philodina* sp. and a *Rotaria* sp. Since then, Sudzuki (1979) has examined the fauna of terrestrial interstices at Langhovde, the Vestfold Hills (68°34′S, 78°11′E), Gaussberg (66°48′S, 89°12′E) and the Bunger Hills (66°10′S, 101°00′E). In this survey, only one species of rotifer, *Encentrum bryocolum*, was found at Langhovde. Unidentifiable bdelloids were noted at the Vestfold Hills and Bunger Hills, while at Gaussberg, Sudzuki (1979) also recorded an unidentified species of *Habrotrocha* (which resembles *H. gulosa*), together with *Macrotrachela insolata* de Koning, *Macrotrachela nixa* Donner, *Macrotrachela* sp. and a *Philodina* sp. Bdelloid rotifers were reported at Gaussberg by Richters (1907). These specimens, which were collected by the German South Polar Expedition of 1901–03, were assigned to the now obsolete genus *Callidina* and it is impossible to re-assign any of the unidentified species. One species that can be re-assigned is *Callidina papillosa* Thomson, which is now known as *Habrotrocha papillosa*. However, as the original identification was based solely on an egg description, the result must be considered doubtful as several species have similarly shaped and sized eggs.

Murray (1910) found two species of terrestrial rotifer among specimens collected by him while a member of the British Antarctic Expedition, 1907–09, in the McMurdo Sound area. They were *Adineta longicornis* Murray and *Callidina tridens* Milne. The latter species is now known as *Macrotrachela tridens*.

Three collections have been made in the South Orkney Islands. In 1906, Murray reported a bdelloid rotifer (*Rotifer* sp.) in mosses taken by the Scottish Antarctic Expedition (1902–04) at Laurie Island. Four years later, he (Murray, 1910) stated that 'the *Rotifer vulgaris* casually reported in that paper (1906) must be regarded with doubt as all the others were added and it was probably accidentally introduced to the bottle' at a later time.

In the early 1970s, Jennings examined rotifers and tardigrades from moss carpets on Signy Island. He also sent dried samples of the mosses to Dr J. Donner. In his Ph.D. thesis, Jennings (1976) recorded 12 species of Bdelloidea (as identified by Donner) and a number of unidentified Monogononta. The bdelloids were *Adenita gracilis, A. steineri* Bartoš, *A. vaga* Davis, *Habrotrocha constricta, H. crenata* Murray, *H. pulchra* Murray, *Macrotrachela concinna, M. kallosoma* (Schulte), *Mnobia ostensa* Donner, *M. vicina* Donner, *Philodina plena* Bryce and *Philodina* sp. In 1980 Donner published his own list, which differed slightly in that two species (*Mnobia vicina* and *Philodina* sp.) were omitted and three (*Macrotrachela musculosa* Milne, *Cephalodella rotunda bryophila* Wulfert and *Encentrum* sp.) were added. Donner (1980) incorrectly implies the source of Jennings' material as Stanley, Falkland Islands, South Atlantic, whereas it was, in fact, Signy Island.

Three of these species (*Adineta gracilis, Habrotrocha constricta* and *Macrotrachela concinna*) were found in the present survey. They were only rarely observed in the lakes and pools of Signy Island and had presumably been washed in from outside. We should add *Adineta barbata* to the list of Signy terrestrial species, since it was found only rarely and is normally reported from drying mosses (Bartoš, 1951). Donner (1980) includes just two species of Monogononta in his list, *Cephalodella rotunda bryophila* and an *Encentrum* sp. We sampled the water overlying one of Jennings' sites, a flooded moss carpet (SIRS II), and recorded *Notholca salina* and *Resticula gelida*.

b. *Aquatic habitats*. In the past, bodies of fresh water in the Antarctic have been classified according to their surface area or length. Thus, Korotkevich (1958) defines a body of water up to 50 m across as a pond, from 50 to 200 m as a small lake, from 200 to 400 m as a lake and over 400 m as a large lake. Heywood (1977), on the other hand, defines a pool as a body of water up to 1 m deep and with a surface area up to 250 m^2, a pond as one with a surface area of 500 to 10000 m^2 and up to 6 m deep and a lake as any body of water larger than this. We believe that size is not an appropriate criterion for categorizing bodies of fresh water in the Antarctic and suggest that whether or not they freeze solid in the winter is of far greater biological and chemical significance. Thus, we denote as pools those bodies of water, irrespective of size, that freeze solid and those that do not as lakes. Thus, Murray's 'lakes' (1910) in the McMurdo Sound area become pools, as do some of the 'lakes' of Korotkevich (1958) and Kutikova (1958*b*) in the Bunger Hills.

Uncertainties are associated with the work of Kutikova

(1958*b*), Heywood (1977) and de Paggi (1982). It is not clear where Kutikova's (1958*b*) samples were taken in the Vestfold, Obruchev and Bunger hills. Since her list is almost identical with Korotkevich's (1958) from lakes and pools in the same locations, we have combined their results. Heywood (1977) recorded three species of Monogononta (*Lindia torulosa antarctica* (reported as a new form of *L. torulosa* but unnamed (Hollowday, unpublished)), *Notholca walterkostei* (reported as an unnamed variety of *N. verae*) and *Colurella colurus compressa*? (reported as a *Colurella* sp.)) and two species of Bdelloids (*Philodina antarctica* Murray and *Philodina gregaria*) from various bodies of water from Ablation Point, Alexander Island (70° 49′ S, 68° 25′ W). Although it is possible to classify each site as either a pool or a lake, it is not clear if all five species were found everywhere. Conversely, Paggi (1982) found *Cephalodella gibba, Dicranophorus uncinatus, Epiphanes senta, Keratella americana* Carlin, *K. cochlearis* (Gosse), *Keratella* sp., *Lecane lunaris, Lepadella patella, Notholca salina* and *N. walterkostei* in a series of 'lagoons' on King George Island, South Shetland Islands (62° 00′ S, 58° 15′ W). Although the distribution of rotifers in the 16 'lagoons' is clearly stated, insufficient information was presented to classify the 'lagoons' as either pools or lakes.

c. *Pool rotifers*. The first major and perhaps the most important Antarctic rotifer investigation was carried out by James Murray with the British Antarctic Expedition, 1907–09. He (Murray, 1910) examined several small pools ('lakes' according to Murray) at Cape Royds on Ross Island and from the Stranded Moraines west of McMurdo Sound. He found four species of Monogononta and eleven species of Bdelloidea (Table IX). Since Murray's time, several investigators (Armitage and House, 1962; Dougherty and Harris, 1963; Donner, 1972; Spurr, 1975; Cathey and others, 1981) have carried out studies in this area. These later studies have added only two species (*Macrotrachela insolata* and *Philodinavus* sp.) to Murray's original list (1910) of Antarctic rotifers (Table IX).

Pool rotifers have also been reported from the Antarctic Peninsula. Schmitt (1945) found the bdelloid *Philodina gregaria* in a freshwater pool only 30 cm deep at Red Rock Ridge (68° 17′ S, 67° 13′ W). Dartnall (1980) examined benthic vegetation from a number of small pools, the largest of which had a surface area of about 800 m^2 and a maximum depth of 2.2 m, at Rothera Point, Adelaide Island (67° 34′ S, 68° 07′ W). Only four species were found: *Colurella colurus* (probably *C. colurus compressa*), *Encentrum* sp. (possibly *E. gulo*? – see description of *E. mustela*, p. 27), *Resticula gelida* and an unidentified species of *Philodina*.

On the east coast of Antarctica (between 45°E and

Table IX. Pool rotifers from the McMurdo Sound area.

	Murray (1910)	*Armitage and House (1962)*	*Dougherty and Harris (1972)*	*Donner (1972)*	*Spurr (1975)*	*Cathey and others (1981)*
Cephalodella catellina[1]	+[2]	+[3]	+[2]	–	+[3]	+[3]
Collothera ornata cornuta	+[4]	+[5]	+	–	–	+[6]
Dicranophorus permollis giganthea[7]	+	–	+	–	+	–
Epiphanes senta	+[8]	+	+	–	–	–
? Notomatid species	–	–	+	–	–	–
Loricated form	–	–	+	–	–	–
Adineta barbata	+	–	+	–	–	–
Adineta gracilis	+	–	–	–	–	–
Adineta grandis	+	–	+	+	+	–
Adineta vaga	+	–	–	–	–	–
Adineta sp.	–	–	+[9]	–	–	+
Habrotrocha angularis	+[10]	–	+	–	–	–
Habrotrocha constricta	+[10]	–	+	+	–	–
Macrotrachela habita	+[10]	–	+	–	–	–
Macrotrachela insolata	–	–	–	+	–	–
Philodina alata	+	–	+	–	–	+
Philodina antarctica	+	–	+	–	–	–
Philodina gregaria	+	–	+	+	+	+
Philodina sp.	+	++[11]	–	–	–	–
Philodinavus sp.	–	–	–	–	–	+

[1]Although reported as *Diaschiza* (≡ *Cephalodella*) *tenuior* or *Cephalodella* (≡ *Diaschiza*) sp. by the various authors we believe this species was in fact *Cephalodella catellina* – see description page 16 for justification.
[2]Reported as *Cephalodella* (≡ *Diaschiza*) *tenuior*.
[3]Reported as *Cephalodella* (≡ *Diaschiza*) sp.
[4]Reported as *Floscularia cornuta* = *Collothera ornata cornuta*.
[5]Reported as *Collothera ornata*.
[6]Reported as *Collotheca* sp.
[7]Reported as *Pleurotrocha* sp. (See description of *Dicranophorus permollis giganthea* page 25 for justification.)
[8]Reported as *Hydatina* (≡ *Epiphanes*) *senta*.
[9]According to Dougherty and Harris (1963), probably identical with one of the three species listed by Murray (1910) without description, namely *A. gracilis, A. longicornis* or *A. vaga*.
[10]Reported as *Callidina*. This genus is not recognized now, and the specimens ascribed to it have been re-distributed to several genera (see Harring, 1913).
[11]According to Dougherty and Harris (1963), the specimens found by Armitage and House were presumably *P. gregaria*.

111°E), eight investigations have been carried out. For the most part, these surveys have each yielded less than half a dozen species. Opalinski (1972*b*) found *Lepadella patella, Macrotrachela* sp. and an unidentified species in shallow pools in the Thalla Hills (67°40′S, 45°50′E). Russell (1959) reported *Lepadella elliptica* Wulfert from a frozen 'tarn' at Cape Bruce (67°24′S, 60°38′E). In the Vestfold Hills, Everitt (1981) found *Notholca verae, Lepadella patella, Ptygura* sp. and two unidentified Monogononta, *Philodina gregaria, Philodina* spp., *Macrotrachela quadricornifera* (Milne), *Habrotrocha constricta* and *Mnobia russeola* Zelinka from Deep Lake Tarn (68°33′S, 78°11′E).

From Haswell Island (66°31′S, 93°00′E), Opalinski (1972*a*) recorded *Adineta grandis* and *Philodina gregaria* while Donner (1972) found both of these bdelloids plus *Adineta gracilis, Habrotrocha elusa* Milne and *Epiphanes senta*.

In the Obruchev Hills (66°33′S, 99°51′E), Korotkevich (1958) and Kutikova (1958*b*) found one species of bdelloid, an unidentified species of *Mnobia*. In the Bunger Hills (66°10′S, 101°00′E), these authors found *Epiphanes senta* and *Philodina* sp. in shallow brackish pools (called lakes).

Finally, in a series of tiny brackish pools on the Clark Peninsula near to Wilkes station (66°06′S, 110°37′E), Thomas (1965, 1972) found five species: *Brachionus calyciflorus* Pallas, *Brachionus quadridentatus* Hermann, *Habrotrocha* sp., ?*Philodina* sp. and an unidentified 'sessile' species.

In the sub-Antarctic, Russell (1959), working on material collected some 20 years earlier by the British–Australian–New Zealand Antarctic Research Expedition (1929–31), found *Cephalodella* sp., *Trichocerca bidens* (Lucks) and *Lepadella patella* plus a number of unidentified bdelloids belonging to the genera *Philodina* and *Adineta* from a boggy creek at Lusitania Bay on Macquarie Island.

At Îles Kerguelen, from a number of pool-type habitats (streams, lakelets and nearby damp vegetation), Russell (1959) found *Cephalodella catellina, Colurella adriatica* Ehrenberg, *Colurella colurus, Filinia maior* Colditz, *Keratella sancta* Russell, *Lecane mawsoni* Russell, *Lepadella acuminata* (Ehrenberg), *Lepadella patella, Lopocharis oxysternon* (Gosse), *Notommata cyrtopus* Gosse plus a number of unidentified bdelloids belonging to the genera *Philodina* and *Adineta*. Beauchamp (1940) reported *Dicranophorus permollis* and *Philodina jeanneli* Beauchamp from here.

d. *Freshwater lake rotifers*. The small number of Antarctic lakes that have been examined for rotifers have yielded very few results. Opalinski (1972*b*) examined a number of lakes in the Thalla Hills (67°40′S, 45°50′E). In Lake Glubokye, he found only *Lepadella patella* while in several smaller lakes, only 3–5 m deep, he found an unidentified species of *Macrotrachela* and an unidentified genus.

At Lake Krukvatnet in the Vestfold Hills (68°34′S, 78°11′E), Korotkevich (1958) and Kutikova (1958*b*) recorded *Proales reinhardti* (Ehrenberg) and a *Philodina* sp.

In the Obruchev Hills (66°33′S, 99°51′E), Korotkevich (1958) found in a couple of deep lakes *Lepadella patella, Collotheca ornata cornuta* (given as *C. cornuta*), *Habrotrocha* sp. *Mnobia* sp., *Philodina alata* and *Philodina* sp. Kutikova (1958*b*) also lists these species plus *Cephalodella sterae* (Gosse) though, once again, does not make it clear where they came from.

In the Bunger Hills (66°10′S, 101°00′E), Korotkevich (1958) identified *Lepadella patella, Notholca verae, Rhinoglena foetensis* (Varga), *Philodina alata, Philodina* sp. and an unidentified bdelloid from Lake Figurnoye and in another deep lake found *Epiphanes senta, Notholca verae* and a *Philodina* sp. Kutikova's (1958*b*) list includes all these species plus *Proales reinhardti*.

Finally, in moist algal samples taken from the edges of four freshwater lakes in South Victoria Land (77–79°S, 160–169°E), Cathey and others (1981) found six species of rotifer: *Cephalodella* sp. (reported as *Diaschiza* sp.), *Collotheca* sp., *Philodina gregaria, P. alata, Adineta* sp. and *Philodinavus* sp.

e. *Saline lake rotifers*. As well as the freshwater lakes and pools so far mentioned, there are a number of other bodies of water in the Antarctic. These include highly saline (hypersaline) lakes, volcanic lakes that are warmed by fumarole activity plus a number of unusual 'lakes', such as bodies of fresh water trapped between the land and a floating ice shelf and lying above and in direct contact with the sea. (See Heywood (1972) and Priddle and Heywood (1980) for reviews.) Biological data from these lakes are very limited and we can find only two records of rotifers in such 'lakes'. Armitage and House (1962) found *Philodina* spp. in both Lake Bonney and Lake Vanda in South Victoria Land. Cathey and others (1981) found *Philodina gregaria, P. alata* and *Philodinavus* in Lake Bonney, both species of *Philodina* in Lake Fryxell and only *P. gregaria* in Lake Vanda. These lakes consist of a saline body of water overlain with a freshwater layer. Needless to say, the rotifers were found in the freshwater part and at the 'lake' edges.

Recently, Lair and Koste (1984) have described three species, *Filinia terminalis kergueleniensis* Lair and Koste, *Keratella sancta* and *Notholca* cf. *jugosa* Gosse, from Lake Studer 2, a brackish lake at Iles Kerguelen.

Finally, there has been one report of marine rotifers. Zelinka (1927) described *Trichocerca artmanni* Zelinka (reported as *Rattulus artmanni*) and *Synchaeta triophthalma* Lauterborn from Observatory Bay, Îles Kerguelen and *Synchaeta rousseleti* Zelinka from Gauss station, which was presumably the winter anchorage of the S.S. *Gauss* (the German South Polar Expedition, 1901–03) and situated some 80 km to the north of Gaussberg (66°48′S, 89°19′E).

4. *Concluding remarks*

The above discussion should have made it clear that the apparent impressiveness of the bibiography is illusory. Some of the observations are of a purely casual nature. Murray's (1910) record of *Adineta longicornis* and *Macrotrachela tridens* amongst mosses at Cape Royds, Schmitt's (1945) record of *Philodina gregaria* from a pool at Red Rock Ridge and our suggestion that *Adineta barbata, Adineta gracilis, Habrotrocha constricta* and *Macrotrachela concinna* are terrestrial species, come into this category. These observations, though valuable, need to be augmented by further studies.

A good deal of the work that swells the bibliography is repetitious. Under this heading we may link Jennings'

(1976) and Donner's (1980) work on Signy mosses, Korotkevich's (1958) and Kutikova's (1958*b*) aquatic studies in the Vestfold, Obruchev and Bunger hills and the work done in the McMurdo Sound area as set out in Table IX.

Some studies are incomplete through inadequate sampling or unsuitable preservation techniques. Seldom is the rotifer taxonomist the actual collector and the collections provided by expeditions are frequently wanting. Thus, Russell (1959) could only name the monogononts from the samples collected for him at Iles Kerguelen and Macquarie Island, the many species of bdelloid present being so contracted as to be unidentifiable.

Even if the study of a particular habitat is both thorough and impartial, there will undoubtedly be other habitats in that area completely overlooked. The present study was restricted to fresh water and took no account of the terrestrial environment.

The known distribution of rotifers in the Antarctic strongly suggests that they will eventually be found in coastal regions right round the continent, but so far, only areas close to expedition bases have been explored. Rotifers probably also occur on the continent, in ice-free areas amongst the inland Nunataks, ablation areas and in the lakes that have been reported among the mountains that protrude through the ice sheet in Dronning Maud Land but, to our knowledge, no surveys have been carried out there.

The two most striking results of the present investigation are the number of species found and the fact that most of them are monogononts. It might be argued that the wealth of species is to be expected since Signy Island is not only the most northerly of the Antarctic locations (and so enjoys a milder climate) but is closer to its nearest continent, a conceivable source of such diversity, than any of the other Antarctic locations. On the other hand, the intensity of this study and availability of suitable sites for investigation has undoubtedly contributed to the number of species found. In the few cases where comparably intensive investigations have been carried out elsewhere, the results approach or even exceed those at Signy. Thus, Murray (1910) reported 15 species from the pools at Ross Island (cf. the eight species in the Signy pools).

Most of the species found in this survey occurred in the lakes. The finding of six species of Bdelloidea and 23 of Monogononta is at variance with the prevalent view that bdelloids are the principal group in the Antarctic. This has arisen because of the study of bdelloid-dominated habitats (pools and soil). No lake study comparable to that reported here has been carried out. There are many lakes in the Antarctic, including some with a well-developed benthic vegetation that includes mosses, such as some of the lakes at Ablation Point (Heywood, 1977), the Schirmacher Oasis and Bunger Hills (Savich-Lyubitskaya and Smirnova, 1959, 1964), Lake Yukidori (Hirano, 1979) and Lake Oyako (Nakanishi, 1977) and we believe that when these lakes are studied they will be found to support as rich and diverse a fauna as the Signy lakes.

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VI. APPENDICES

Appendix 1. Check list of rotifers reported from the Antarctic. The Antarctic is taken to be the area south of 60°.

Monogononta

Brachionus calyciflorus
Brachionus quadridentatus

Cephalodella auriculata
Cephalodella catellina
Cephalodella forficata
Cephalodella gibba
Cephalodella megalocephala
Cephalodella rotunda bryophyla
Cephalodella sterae

Collotheca gracilipes
Collotheca ornata cornuta

Colurella colurus
Colurella colurus compressa

Dicranophorus permollis giganthea
Dicranophorus uncinatus

Encentrum antarcticum
Encentrum bryocolum
Encentrum mustela
Encentrum sp.

Eosphora najas

Epiphanes senta

Euchlanis dilatata parva

Keratella americana
Keratella cochlearis
Keratella sp.

Lecane lunaris

Lepadella elliptica
Lepadella intermedia
Lepadella patella
Lepadella patella matsuda
Lepadella patella oblonga
Lepadella rhomboides signiensis
Lepadella triptera

Lindia torulosa
Lindia torulosa antarctica

Notholca salina

Notholca verae
Notholca walterkostei
Notholca walterkostei reducta

Proales reinhardti

Ptygura crystallina
Ptygura melicerta
Ptygura sp.

Resticula gelida

Rhinoglena foetensis

Scaridium bostjani

Synchaeta rousseleti

Trichocerca brachyura
Trichocerca rattus globosa

Wulfertia sp.

Bdelloidea

Adineta barbata
Adineta gracilis
Adineta grandis
Adineta longicornis
Adineta steineri
Adineta vaga
Adineta spp.

Habrotrocha angularis
Habrotrocha constricta
Habrotrocha crenata
Habrotrocha elusa
Habrotrocha pulchra
Habrotrocha spp.

Macrotrachela concinna
Macrotrachela habita
Macrotrachela insolata
Macrotrachela kallosoma
Macrotrachela musculosa
Macrotrachela nixa
Macrotrachela quadricornifera
Macrotrachela tridens
Macrotrachela spp.

Mnobia ostensa
Mnobia russeola
Mnobia spp.

Philodina alata
Philodina antarctica
Philodina gregaria
Philodina plena
Philodina spp.

Philodinavus sp.

Rotaria sp.

Appendix 2. Check list of rotifers reported from the sub-Antarctic. The sub-Antarctic is taken to include all those islands north of 60°S and south of the Antarctic convergence.

Monogononta

Cephalodella auriculata
Cephalodella catellina
Cephalodella gibba
Cephalodella sp.

Colurella adriatica
Colurella colorus

Dicranophorus permollis

Eosphora najas

Euchlanis dilatata parva

Filinia maior
Filinia terminalis kergueleniensis

Keratella sancta

Lecane closterocerca
Lecane lunaris
Lecane mawsoni

Lepadella acuminata
Lepadella intermedia
Lepadella patella

Lepadella patella oblonga

Lophocharis oxysternon

Mytilina mucronata longicauda

Notholca cf. *jugosa*
Notholca walterkostei

Notommata cyrtopus

Synchaeta triophthalma

Trichocerca artmanni
Trichocerca bidens
Trichocerca brachyura
Trichocerca rattus globosa
Trichocerca tigris

Bdelloidea

Adineta spp.

Macrotrachela sp.

Philodina jeanneli

Philodina spp.

Rotaria sp.

VII. INDEX TO TAXA

Generic and specific names are listed for the rotifers mentioned in this report. Names in parentheses are synonyms and non-valid names. Page numbers in **bold** type refer to a main description or illustration.