

Some remarks on the taxonomy of Antarctic Leuconidae (Cumacea: Crustacea) with a description of a new species *Leucon intermedius* n. sp.

U. Mühlenhardt-Siegel

Zoologisches Institut und Museum, Universität Hamburg; Martin-Luther-King-Platz 3,
D-20146 Hamburg, Germany*

and

Abt. Morphologie der Tiere, Fakultät für Biologie, Universität Bielefeld,
D-33615 Bielefeld, Germany

ABSTRACT: The newly described species *Leucon intermedius* n. sp. differs from other known *Leucon* species by an inconspicuous antennal notch and the presence of only a few teeth at the dorsomedian crest. The species most similar to *Leucon intermedius* are *L. septemdentatus* and *L. inexcavatus* from the Antarctic/Subantarctic Ocean. A Table is given to allow direct comparison of the characteristics of all *Leucon* species known from the Antarctic/Subantarctic Ocean. Forty-one specimens of *Leucon intermedius* n. sp. were collected at depths ranging from 109 to 791 m in the vicinity of the Amery Depression (Indian Sector) and near King George Island (South Shetland Islands). Problems in distinguishing the Antarctic/Subantarctic species of the genus *Eudorella* are discussed. The shape of the antennal notch is suggested as a better characteristic to distinguish the *Eudorella* species than the proportions of the articles of extremities. On the basis of this criterion, samples at the Zoological Museum, Hamburg are made up of two species of *Eudorella*: *gracilior* and cf. *fallax*.

INTRODUCTION

14 species of the genus *Leucon* from Antarctic/Subantarctic waters have been described in scientific literature. Watling (1991) introduced subgenera for all *Leucon* species which were known to him. One essential characteristic for the determination of the subgenera is the length of the flagellum of antenna 1 compared to the basal segment of antenna 1. However, one species was missing in his list and others have only recently been described. For one of these species the description is incomplete, or no information is available about the described criterion; thus, a reference to the subgenus level is not possible. The subgenera and the Antarctic/Subantarctic species are: subgen. *Crymoleucon*: *Leucon antarcticus* Zimmer 1907, *L. breidensis* Gamo 1987, *L. inexcavatus* Ledoyer 1977, *L. intermedius* n. sp., *L. kerguelensis* Zimmer 1908, *L. sagitta* Zimmer 1907, *L. septemdentatus* Zimmer 1902, *L. vanhoeffeni* Zimmer 1907; subgen. *Leucon*: *Leucon assimilis* Sars 1887, *L. adelae* Petrescu 1991; subgen. *Macrauloleucon*: *Leucon*

* Address for all correspondence

parasiphonatus Mühlenhardt-Siegel 1994, *L. weddelli* Ledoyer 1993; subgen. *Alytoleucon*: *Leucon polarsterni* Ledoyer 1993; subgenus unidentified: *Leucon meredithi* Petrescu 1991.

In order to make the differential diagnosis of the Antarctic/Subantarctic species easier, a Table has been set up containing all the important characteristics. This Table can easily be extended when further new species become known. This is the major advantage of the Table in comparison to a determination key which has to be changed every time a new species is described.

Some remarks on the taxonomy of the genus *Eudorella* in Antarctic/Subantarctic waters are given. The classic character for the determination of *Eudorella* species is the shape of the anterolateral margin of the carapace, especially the antennal notch (Stebbing, 1913; Lomakina, 1968; Barnard & Given, 1960; Jones, 1971). Watling (1991) ignores this character and prefers the proportions of the articles of the uropodal rami and the proportion (length to width) of the 6th article of pereopod 1. The practicability of using these characteristics is discussed.

MATERIAL AND METHODS

The *Eudorella* species collected during German Antarctic expeditions aboard RV "Polarstern" and FRV "Walther Herwig" in the Scotia Arc region have been deposited at the Zoological Museum, Hamburg, Germany. The expeditions took place in austral summer (November/December, February to April 1984/85, October to December 1987) and the austral winter of May/June 1986. For station lists see Hempel (1985), Anonymous (1986), Fütterer (1988) and Anonymous (1990).

Sampling gear was a van Veen grab (0.1 m² size). All grab samples were sieved at once using a 0.5 mm screen mesh, and the benthos was fixed in 4 % borax-buffered formalin-seawater solution. All sorting was carried out at a later date using a stereo microscope. The material was transferred to 70 % ethanol for preservation.

459 specimens of *Eudorella gracilior* and 727 specimens of *Eudorella* cf. *fallax* were identified. The material from the Amery Depression in the Indian Ocean Sector was collected by M. O'Loughlin. This sampling was also carried out with a van Veen grab and an epibenthic sledge during the Australian Antarctic Expedition in January and February 1993. 47 specimens of *Eudorella gracilior* were present in the material collected during the above Australian Antarctic Expedition.

Types and paratypes of the newly described species have been deposited at the Museum of Victoria, Melbourne, Victoria 3000, Australia.

H o l o t y p e: J 38352, adult female, 3.66 mm length.

T y p e l o c a l i t y: 68°36.87' S 74°31.11' E, Amery Depression, 694 m, diatomaceous clay,

D a t e: 22nd January 1993

P a r a t y p e s: J 38360, subadult male, 3.66 mm length.

L o c a l i t y: 68°26.47' S 74°22.23' E, Amery Depression, 689 m,

D a t e: 17th February 1993

J 38352, adult female, 3.71 mm length. 1 juvenile female, 5 subadult females, 1 juvenile male, 3 subadult males.

Locality and date: same as holotype.

Additional material examined: J 38359, 1 adult female carrying 7 eggs, used for SEM, 3 adult females, 2 subadult males. 68°56.69' S 73°36.78' E to 68°56.63' S 73°37.53' E, 786 to 791 m, Amery Depression (17th February 1993).

J 38350, 1 adult female carrying eggs, 1 adult female, 1 juvenile female. 68°42.20' S 77°30.22' E, SW Davis Base, 710 m, silty fine sand (17th January 1993).

J 38351, 2 adult females carrying eggs, 5 subadult females. 68°59.20' S 74°59.56' E, Amery Depression, 746 m, diatomaceous ooze (22nd January 1993).

J 38353, 5 subadult females, 2 juvenile females, 68°27.06' S 74°12.38' E, Amery Depression, 687 m, sandy diatomaceous ooze (22nd January 1993).

J 38354, 1 adult female, 1 subadult female, 68°56.63' S 73°34.16' E, southern part of Amery Depression, 783 m, coarse, sandy clay (23rd January 1993).

J 38355, 1 adult female carrying eggs, 1 subadult female, 68°6.15' S 72°14.90' E, Amery Depression, 788 m, diatomaceous clay (28th January 1993).

J 38356, 2 adult females, 66°53.69' S 63°06.34' E to 66°53.67' S 63°05.51' E, western MacRobertson Shelf, 367 to 439 m (11th February 1993).

J 38357, 1 adult female, 67°16.12' S 65°25.23' E to 67°16.47' S 65°25.75' E, MacRobertson Shelf, edge of Nielsen Basin, 109 to 121 m (12th February 1993).

J 38359, 1 subadult male, 68°04.36' S 72°17.81' E to 68°04.44' S 72°18.11' E, Amery Depression, 765 m (17th February 1993).

1 juvenile male, 62°04.94' S 57°38.97' W, King George Island (South Shetland Islands), soft clay, 280 m (12th November 1987).

Leucon intermedius n.sp.

D i a g n o s i s: Carapace: surface with scales. Pseudorostrum: long, turned slightly upwards, even in males rather long. Dorsomedian line: serrated with very few (4 to 7) teeth in the anterior third of the carapace, the last one or two teeth after a gap in the line. Antennal notch: shallow, very small, unpronounced. Anterolateral margin: serrated, 3 to 4 teeth dorsal of the antennal notch.

E t y m o l o g y: the species is called *L. intermedius* because its characters are between those of *L. septemdentatus* and *L. inexcavatus*.

D e s c r i p t i o n: The description is based on the holotype, an adult female, carrying 7 eggs in the brood pouch (Fig. 1).

Length: 3.4 mm

Eyes: none

I n t e g u m e n t: scaly structure on carapace, abdomen and extremities (Plate 4, Figs 1, 3).

C a r a p a c e: shorter than free thoracic segments, length: 0.75 mm, width: 0.54 mm, height: 0.51 mm, no more than 6 teeth on dorsomedian line, fine setae irregularly dispersed on carapace.

P s e u d o r o s t r u m: long (0.21 mm), with 10 fine setae on each lobus arising from the anterior margin of the pseudorostrum.

S i p h o n a l t u b e (branchial tube): short, free part as long as pseudorostrum.

A n t e n n a l n o t c h: unpronounced with 3 teeth dorsal of the antennal notch. The variability of shape of the antennal notch of 13 specimens is illustrated in Plate 2.

Anteroventral margin of carapace: with few (4) denticles.

5 free thoracic segments (0.84 mm): first segment very narrow, cephalon and thorax (1.62 mm) a little shorter than abdomen (1.77 mm).

Abdomen: slightly shorter than thorax, 5th abdominal segment longer than the other, all segments covered with a few fine setae.

Telson: not free (0.27 mm), covered with some fine setae. The description of the extremities is based on the paratype (J 38352) female (3.71 mm).

First antenna (antennula) (Plate 1, Fig. a): accessory flagellum at least as long as first segment of main flagellum.

Second antenna (antenna): very small in female.

Mandible, Maxillae 1 and 2, Maxilliped 1 and 2: same as for genus in general.

Maxilliped 3 (Plate 1, Fig. b): basis slender, with 3 long plumose setae, exopod present with long setae.

Pereiopod 1 (Plate 1, Fig. c): longest of the extremities, basis slender, longest article; 4th as long as 5th article, 6th article somewhat shorter. Exopod with long setae (not illustrated).

Pereiopod 2 (Plate 1, Fig. d): 6th article longer than 5th. Exopod with long setae (not shown in Figure).

Pereiopod 3 (Plate 1, Fig. e): basis longest article, article 2 to 4 nearly equal in length, article 6 very short. Exopod with long setae (not shown in Figure).

Pereiopod 4 (Plate 1, Fig. f): 6th article very small. No exopod, as is normal for family.

Pereiopod 5: not illustrated, same as in male. No exopod, as is normal for family.

Uropods: Peduncle nearly as long as exopod, with 5 spines at the inner margin, exopod longer than endopod, each ramus with 2 articles. First article of endopod with 5 spines at the inner margin, second article of endopod with 4 spines and 1 terminal one (Plate 1, Fig. g).

Differences between males and females: The paratype – a subadult male (Fig. 2) – is of the same size as the holotype. The sexual differences typical for this family – the development of antenna 2, 4 pairs of exopods at pereopods and 2 pairs of pleopods – were clearly discernible. Additional differences were observed between males and females. The carapace of male is slightly longer than the free thoracic segments. Extremities (Plate 3) are longer and stouter in the male than in the female and there are more spines at the inner margin of the uropods peduncle and endopods in the former.

REMARKS

The species bearing the closest resemblance to *Leucon intermedius* n.sp. is *Leucon septemdentatus* Zimmer 1902. Due to the paucity of teeth in the dorsomedian crest, the new species differs from *L. septemdentatus* in having very few spines at the inner margin of the uropods' peduncle and endopod. Furthermore, these spines are not plumose in males as they are in *L. septemdentatus*. The antennal notch is unpronounced, as in *Leucon inexcavatus* Ledoyer 1977, but in this species the dorsomedian line is serrated due to a double line with many more teeth than in *L. intermedius* n.sp.

14 species of the genus *Leucon* from Antarctic and Subantarctic waters have been described up to now. Table 1 summarizes the characteristics to facilitate a comparison between these species.

Genus *Eudorella*

The other Antarctic/Subantarctic genus of the family Leuconidae is *Eudorella* with 5 described species: *E. fallax* Zimmer 1909, *E. gracilior* Zimmer 1907, *E. similis* Calman 1907, *E. sordida* Zimmer 1907 and *E. splendida* Zimmer 1902. Different opinions have been expressed in the literature concerning the validity of the Antarctic and Subantarctic species of the genus. Stebbing (1913) thought *E. similis* to be synonymous with *E. splendida*, an opinion shared by Lomakina (1968) and Ledoyer (1977). Furthermore, Stebbing related *E. fallax* closely to *E. sordida*. However, Lomakina (1968) supposed *E. fallax* and *E. sordida* to be different forms of *E. splendida*.

Jones (1971) established a key to the Antarctic and Subantarctic cumaceans based on Lomakina (1968) with some alterations, and distinguished *E. gracilior*, *E. splendida* and *E. aff. truncatula*. Barnard & Given (1960) distinguished in their artificial key the species of the genus *Eudorella* and listed *E. splendida*, *E. sordida*, *E. gracilior* and *E. fallax*. The main characteristic according to this key is the shape of the anterior carapace sinus: which in *E. splendida* is "sinuate, with 2 evanescent serrations", in *E. sordida* "sinuate", in *E. fallax* it is "flat bottomed" and in *E. gracilior* it is "flat bottomed and bounded above by serrations". Watling (1991) thought *E. gracilior* and *E. sordida* to be closely related, as also *E. splendida* and *E. similis*. In his opinion, *E. fallax* appears to be a valid species. Watling's main characteristics to distinguish the species are as follows: the uropods' exopod is much shorter than the endopod basal article, as in *E. gracilior* (including *E. sordida*) and *E. fallax*. The second alternative is that the uropods' exopod is about as long as or longer than the endopod basal article (*E. splendida*, including *E. similis*). To separate *E. gracilior* and *E. fallax* he recommends the pereopod 1's article 6 as a possible character. In *E. gracilior* it should be "5–6 times as long as wide, the antennule both flagella with naked margins" while in *E. fallax* article 6 is only "2–3 times as long as wide, antennule accessory flagellum with plumose setae distally on margin".

The anteroventral margin including the antennal notch as given in Barnard & Given (1960) appears to be a very useful character when comparing the figures of Zimmer 1909, Calman 1907 and the holotype of *E. splendida* (Fig. 3). Taking this into consideration, *E. gracilior* cannot be closely related to *E. sordida* as suggested by Watling (1991), and *E. fallax* cannot be related to *E. splendida* as suggested by Lomakina (1968).

Based on the shape of the anterolateral margin as a main character, one can only conclude that there are two *Eudorella*-species in the material of the collection of the museum in Hamburg: *E. gracilior* and *E. cf. fallax*. The shape of the anterolateral margin and the antennal notch changes slightly during growth, but the main feature – the flat bottom – remains in all size groups. The denticles dorsal of the antennal notch in *E. gracilior* are formed in males at a length of about 3 mm. The variability of the antennal notch shape of *E. gracilior* based on the material of the Victoria Museum (J 38369) and specimens from the Antarctic Peninsula area (63°23.27' S 57°00.22' W) is shown for females (Plate. 5) and males (Plate 6).

For comparison the antennal notch shape of *E. cf. fallax* is shown in Plate 7. The anterior carapace sinus for this species is flat bottomed also, but the ventral carapace

Table 1. The characteristics of Antarctic/Subantarctic *Leucon* species. 1: based on the description or a later description of the same author; 2: not mentioned but drawn by the author; 3: derived from other authors; free space: no details given, f = female, m = male

Characteristics	<i>L. assimilis</i> Sars, 1887	<i>L. polarstermi</i> Ledoyer, 1993	<i>L. adalae</i> Petrescu, 1991	<i>L. sagitta</i> Zimmer, 1907	<i>L. vanhoeffeni</i> Zimmer, 1907	<i>L. antarcticus</i> Zimmer, 1907	<i>L. septidentatus</i> Zimmer, 1902	<i>L. breidensis</i> Gamu, 1987	<i>L. inexcavatus</i> Ledoyer, 1977	<i>L. intermedius</i> n.sp.	<i>L. parasiphonatus</i> Mühlenhardt-Siegel, 1994	<i>L. weddelli</i> Ledoyer, 1993	<i>L. keyguensis</i> Zimmer, 1908	<i>L. meridithi</i> Petrescu, 1991
Sex of holotype		f	f	f	f	f	f	f	f	f	f	f	m	f
Accessory flagellum of antenna 1:														
less than 1/2 of main flagellum's basal article	3	1	2	1	1	1	1	1	1	1	2	2	1	1
2/3 to 3/4 of main flagellum's basal article														
as long as main flagellum's basal article														
longer than main flagellum's basal article														
Uropods:														
exopod shorter than endopod		1				1	1	2	1	1	2	1		1
exopod as long as endopod	3		2	1	1								1	
exopod longer than endopod														
Uropod's peduncle:														
shorter than the rami	3		1	1		1	1	1	2		1			
longer than the rami														
as long as one ramus														
Number of spines at inner margin	5	6	2	4	12-14	5-7	8-10	6	5	4-6	2-3	3	1	2
Dorsomedian crista's denticle row:														
up to the end of carapace, with a little														
interruption near the end	3	1		1	1	1	1	2	1	1	2-3	3	1	2
up to 2/3 of the carapace														
1/2 and less of the carapace			1	1	1	1	1	2						

margin's teeth are very small and closely placed. Even the adults do not have teeth dorsal of the antennal notch.

Inspection of Plate 8 allows a comparison of the extremities. The uropods' peduncle shows a large number of spines: 12 in females, 14 in males, at the inner margin in *E. gracilior*, but only 4 (in males and females) in *E. cf. fallax*. The uropod endopod's inner margin of *E. gracilior* also carries many spines but has only a few in *E. cf. fallax*. According to Watling (1991), the uropod exopod is longer than the endopod's basal article in *E. fallax*. In the present material this was found not to be the case. Another character of *E. fallax* according to Watling (1991) is the length of the 6th article of pereopod 1, which should be 5–6 times longer than wide – in the present material this could not be found.

Unfortunately, the whereabouts of the type-material of *E. fallax* is not known (Bacescu, 1988), so a direct comparison with the types is impossible.

From the above discussion, however, it is concluded that the following species are found in the Antarctic/Subantarctic waters:

E. gracilior, *E. fallax*, *E. sordida* and *E. splendida*. While the artificial key to the genus *Eudorella* introduced by Barnard & Given (1960) using the shape of the antennal notch as a main characteristic is very useful, the key by Watling (1991) using the length of article 6 of the pereopod 1 and the uropod's rami is not appropriate, because the proportions of the extremities are variable during growth.

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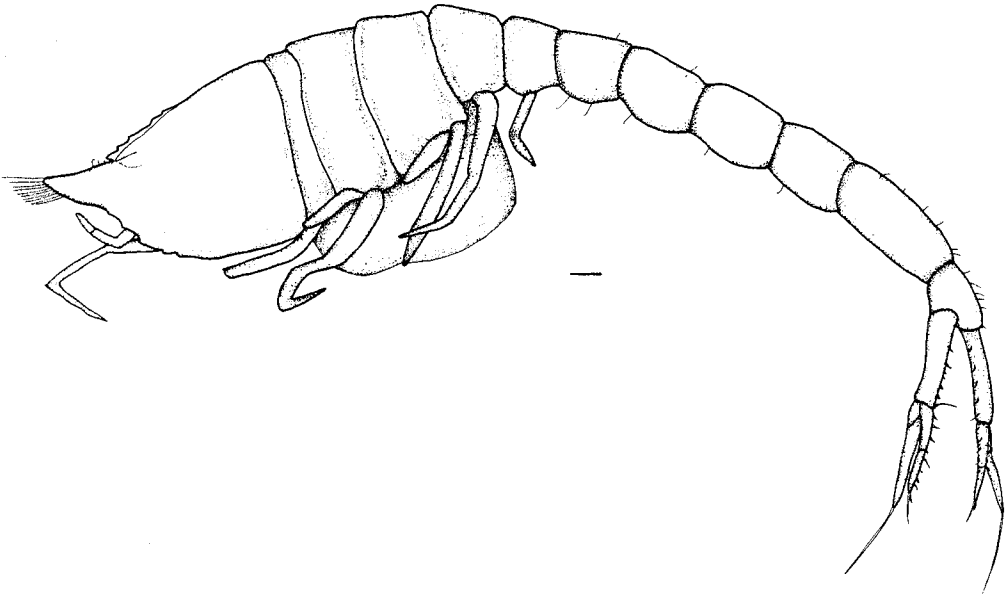


Fig. 1. *Leucon intermedius* n.sp., female. Habitus; scale bar 0.1 mm

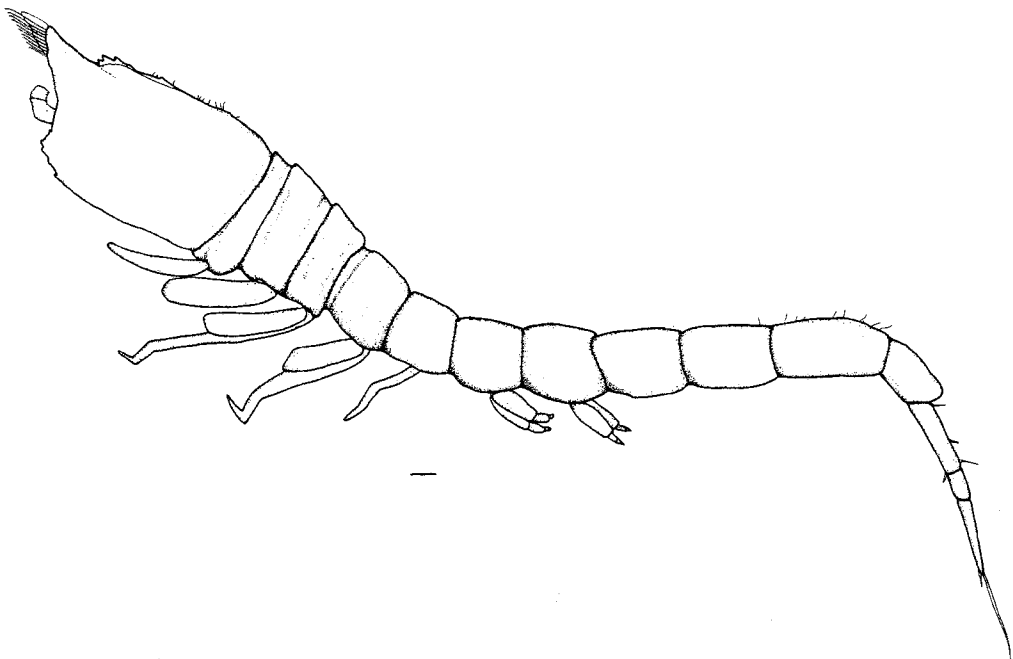


Fig. 2. *Leucon intermedius* n.sp., male. Habitus; scale bar: 0.1 mm

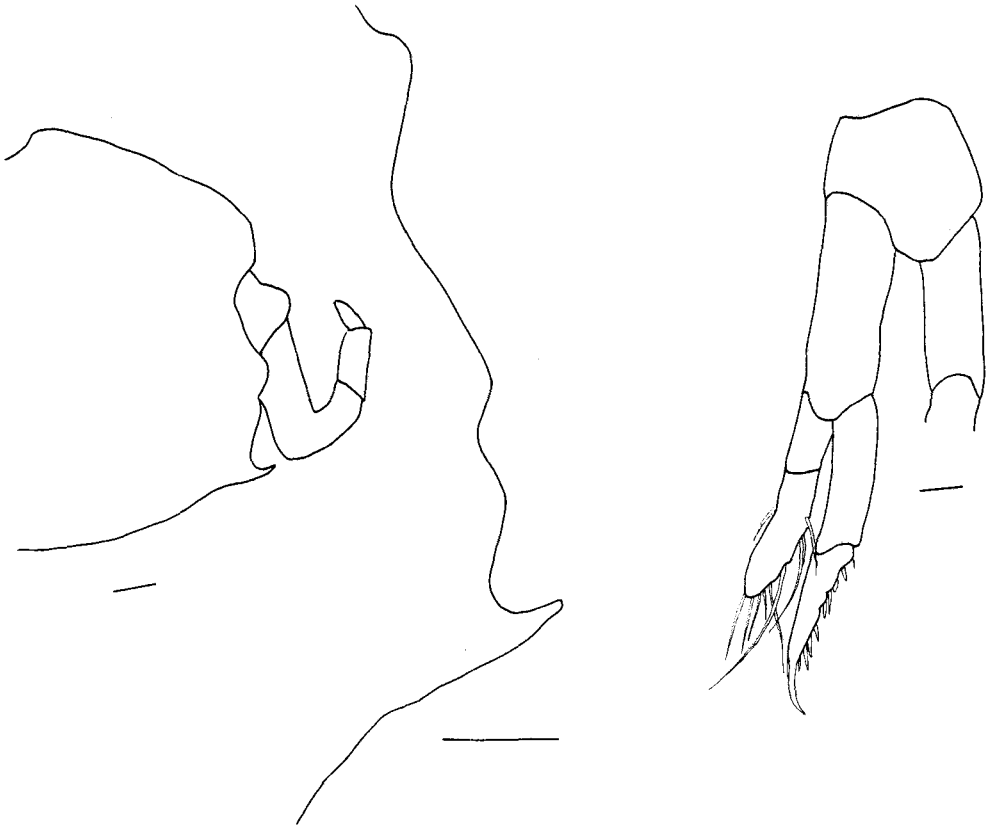


Fig. 3. *Eudorella splendida* Zimmer 1902, holotype, juv. male. Anterolateral margin (left); uropod (right); scale bars: 0.1 mm



Plate 1. The extremities of *Leucon intermedius* n.sp., female. Fig. a antenna 1; Fig. b maxilliped 3; Fig. c pereopod 1; Fig. d pereopod 2; Fig. e pereopod 3; Fig. f pereopod 4; Fig. g telson and left uropod; scale bar: 0.1 mm



Plate 2. The variability of the anterolateral margin of *Leucon intermedius* n.sp. Fig. a–k female; Fig. b juvenile; Fig. h (paratype) and i: subadult; Fig. e, g and k adult; Fig. l–n male; scale bar: 0.1 mm



Plate 3. The extremities of *Leucon intermedius* n. sp., male. Fig. a antenna 1; Fig. b maxilliped 3; Fig. c pereopod 1; terminal article is missing; Fig. d pereopod 2; Fig. e pereopod 3; Fig. f pereopod 4; Fig. g pereopod 5; Fig. h right uropod; scale bar: 0.1 mm

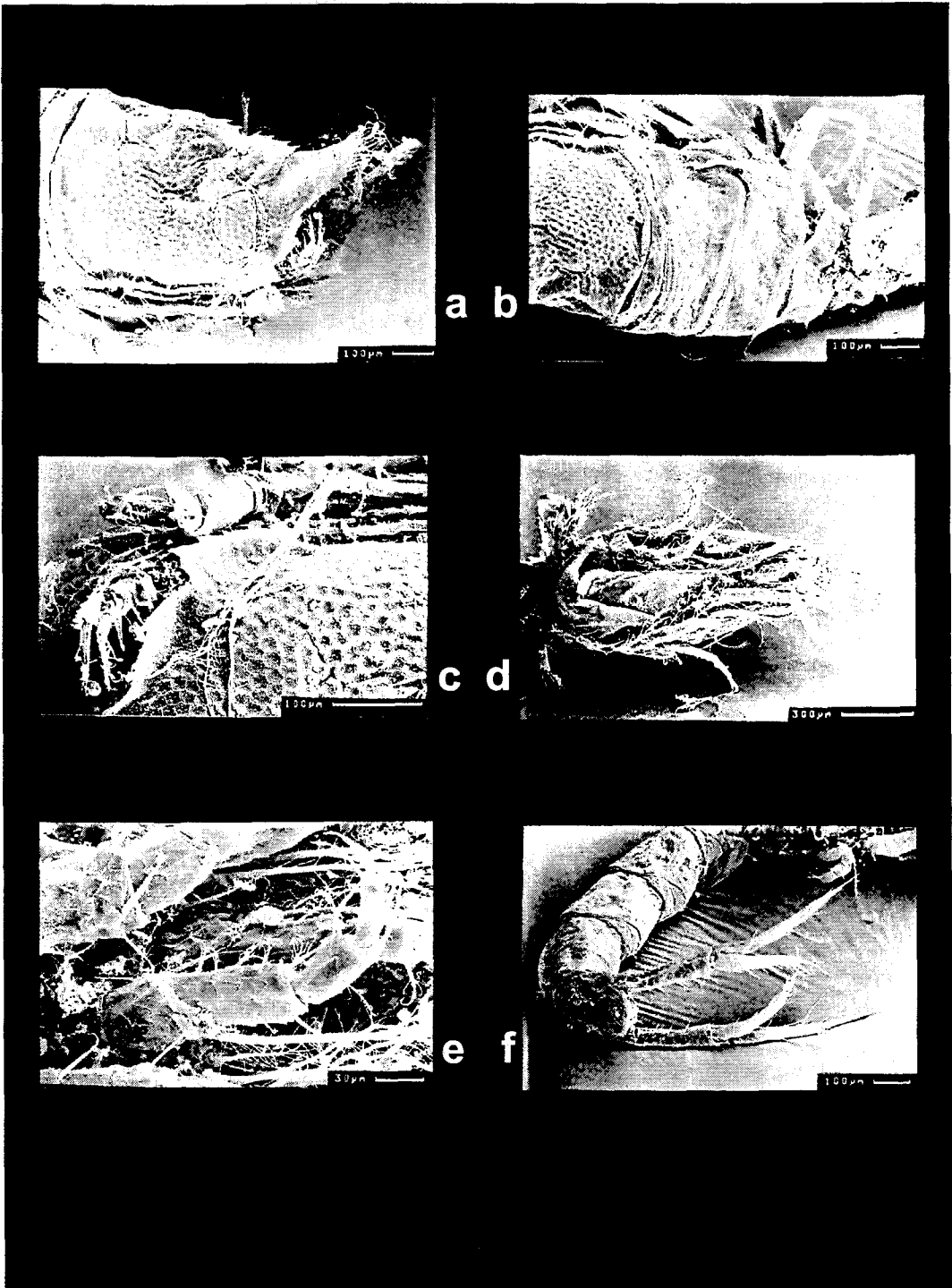


Plate 4. SEM photographs of *Leucon intermedius* n.sp., adult female. a: carapace; b: free thoracic segments; c: antennal notch; d: thorax seen from ventral; e: maxilliped 3; f: telson and uropods

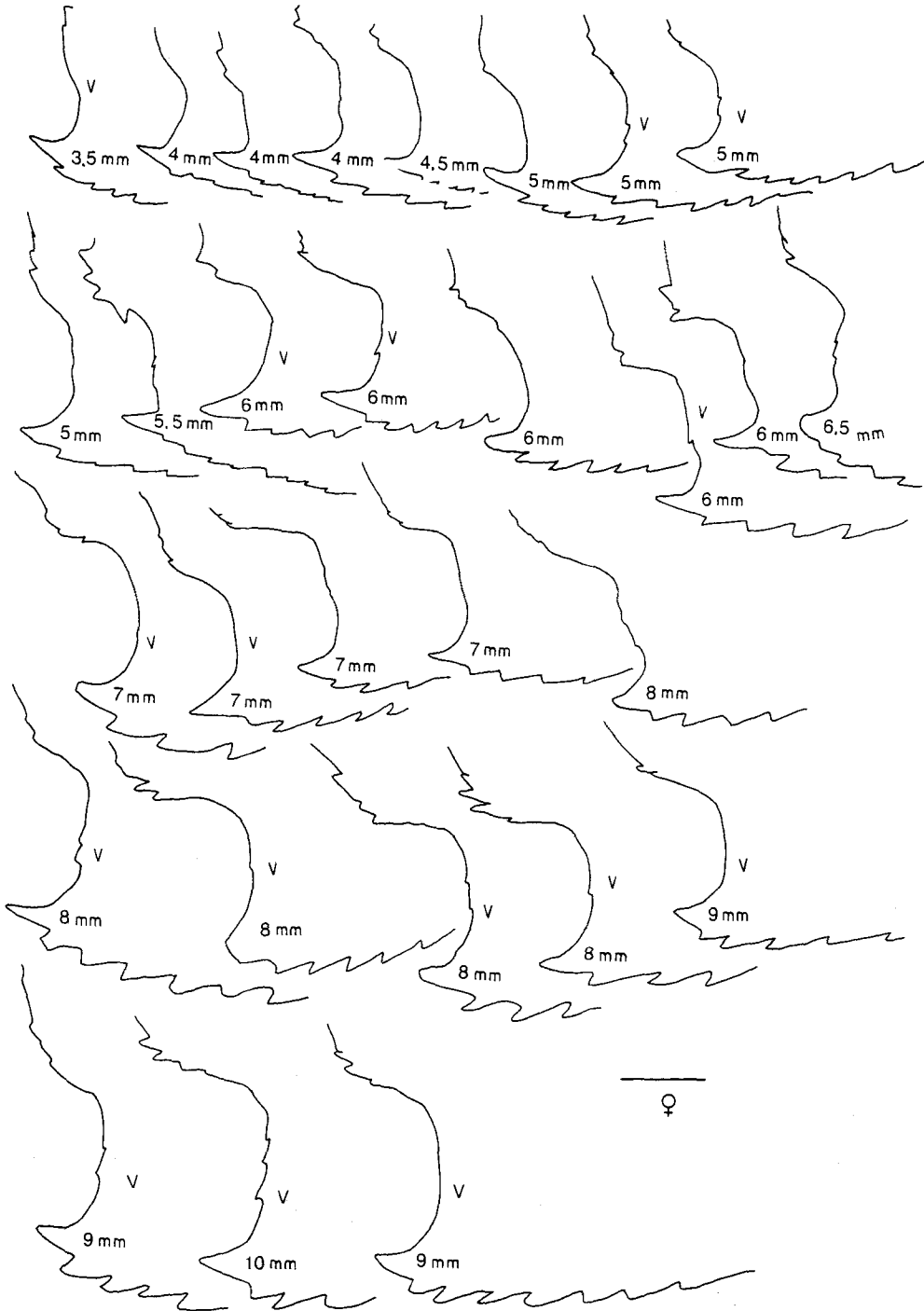


Plate 5. *Eudorella gracilior* Zimmer 1907, female, anterolateral margin. Scale bar: 0.1 mm; the total length of each specimen is given. The specimens marked with V are from the Victoria Museum material, the others from the Antarctic Peninsula

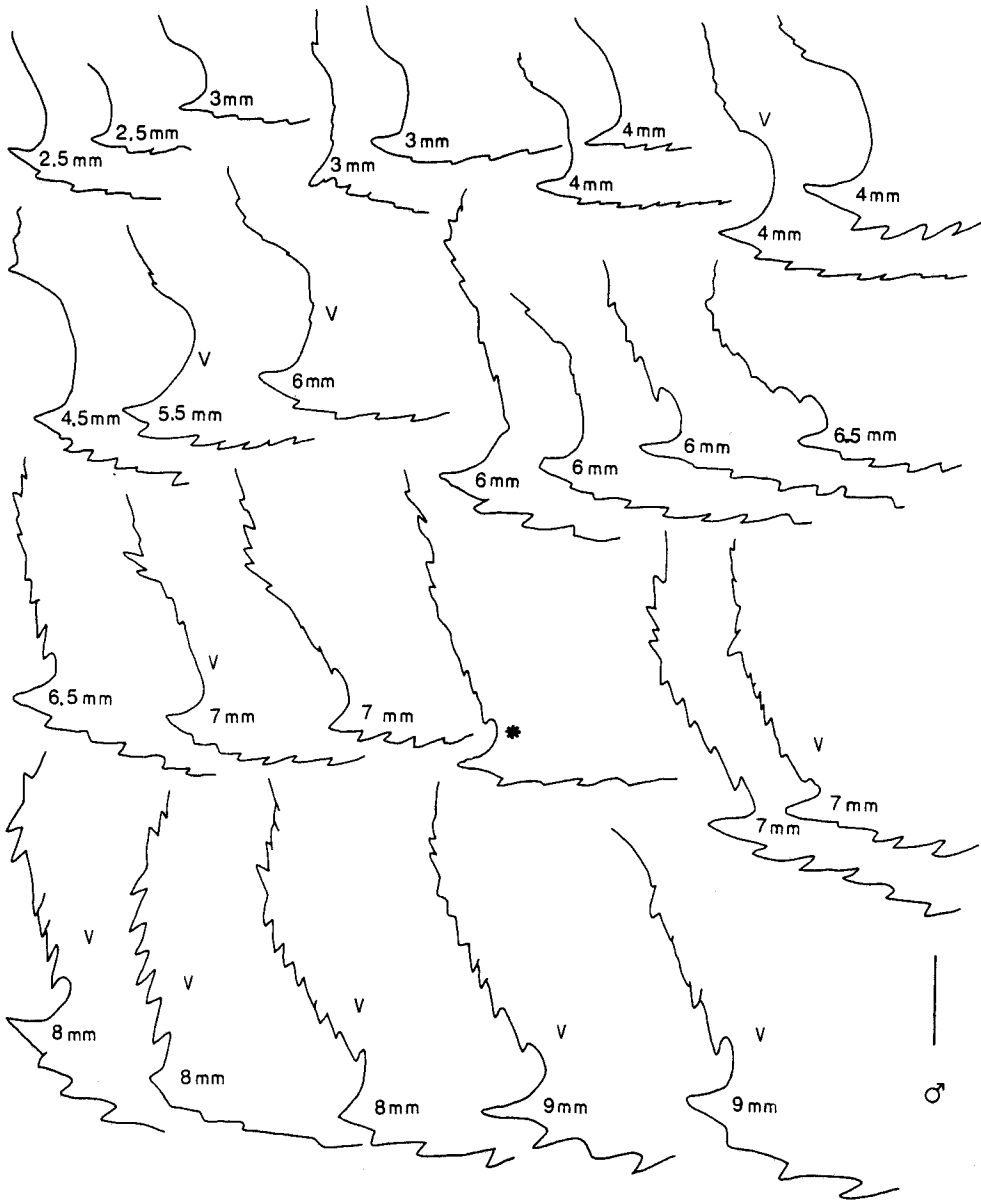


Plate 6. *Eudorella gracilior* Zimmer 1907, male, anterolateral margin. Scale bar: 0.1 mm; the total length of each specimen is given; * abdomen was missing. The specimens marked with V are from the Victoria Museum material, the others from the Antarctic Peninsula

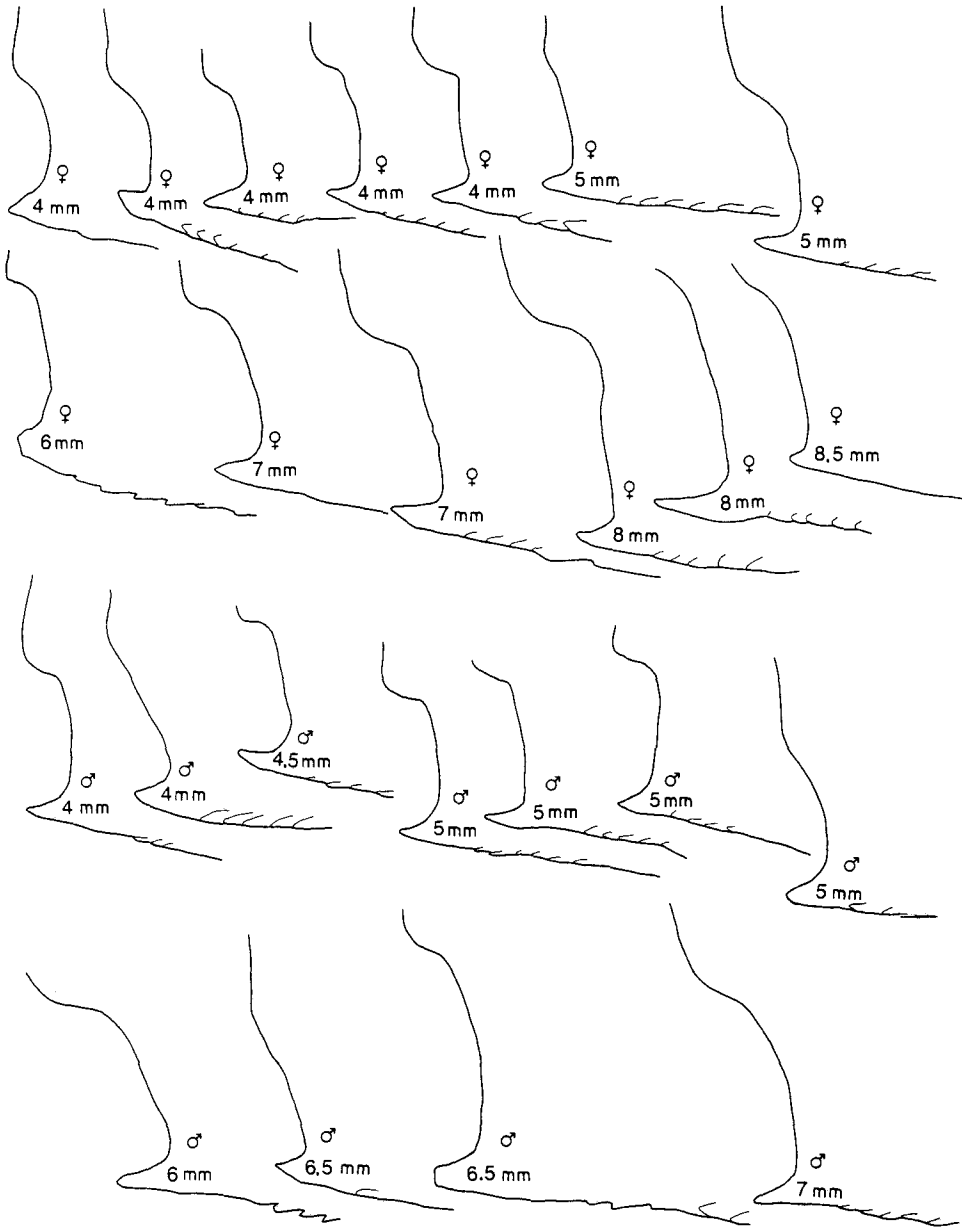


Plate 7. *Eudorella* cf. *fallax* Zimmer 1909, anterolateral margin in females and males. Scale bar: 0.1 mm; the total length of each specimen is given

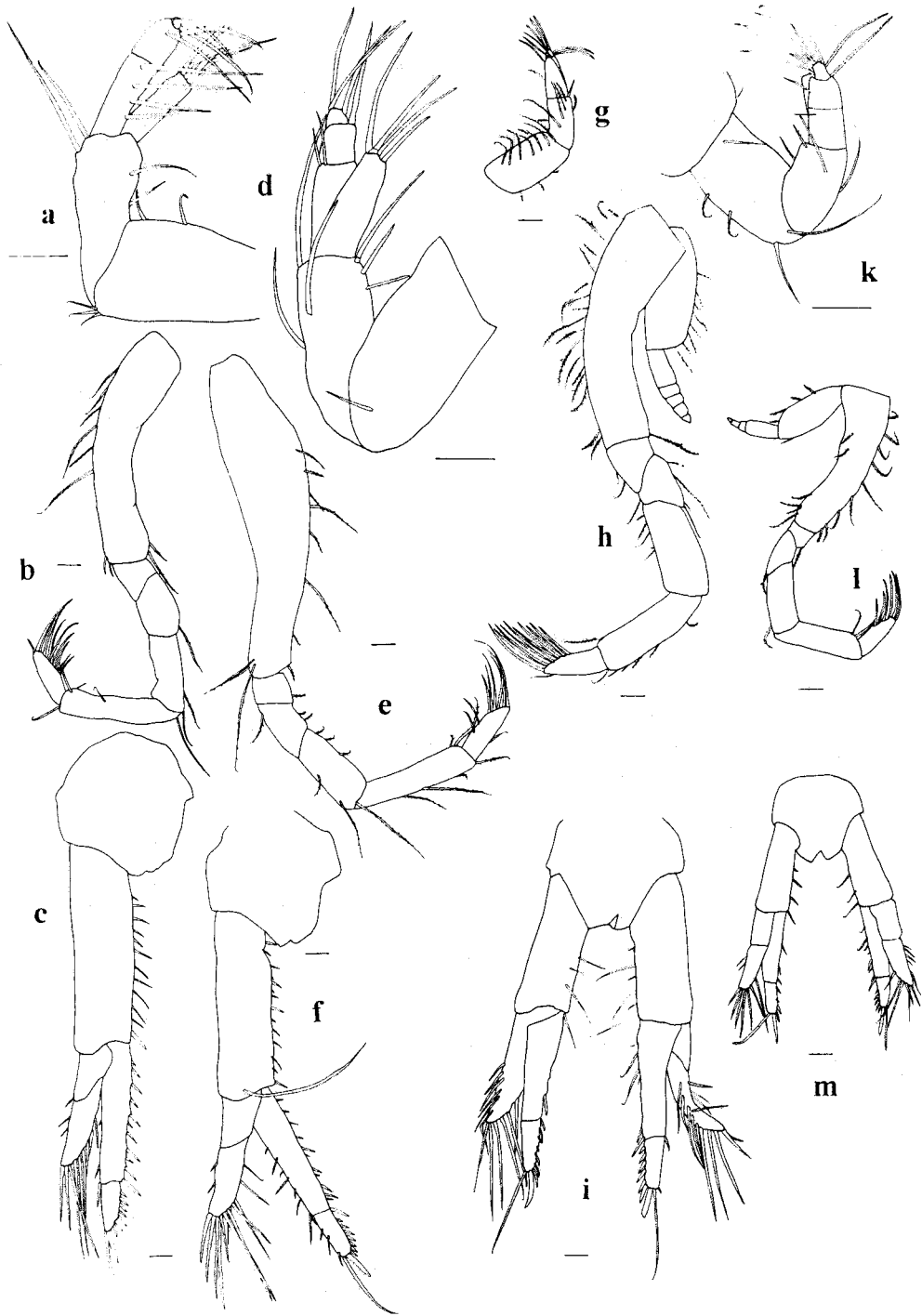


Plate 8. a-c: *Eudorella gracilior*, female. Fig. a: antenna 1; Fig. b: pereopod 1; Fig. c: left uropod; d-f: *Eudorella gracilior* male; Fig. d: antenna 1; Fig. e: pereopod 1; Fig. f: left uropod; g-i: *Eudorella* cf. *fallax*, female; Fig. g: antenna 1; Fig. h: pereopod 1; Fig. i: uropods; k-m: *Eudorella* cf. *fallax*, male; Fig. k: antenna 1; Fig. l: pereopod 1; Fig. m: uropods; scale bars: 0.1 mm