THE REDISCOVERY OF *CYCLOPICINA LONGIFURCATA* (SCOTT) (COPEPODA: CYCLOPINIDAE) IN DEEP WATER IN THE NORTH ATLANTIC, WITH A KEY TO GENERA OF THE SUBFAMILY CYCLOPININAE

RONY HUYS & GEOFFREY A. BOXSHALL

SARSIA

HUYS, RONY & GEOFFREY A. BOXSHALL 1990 05 09. The rediscovery of *Cyclopicina longifurcata* (SCOTT) (Copepoda: Cyclopinidae) in deep water in the North Atlantic, with a key to genera of the subfamily Cyclopininae. – *Sarsia* 75:17–32. Bergen. ISSN 0036–4827.

The marine cyclopoid, *Cyclopicina longifurcata* (SCOTT) is redescribed on the basis of the holotype and a second female, recently collected in deep water in the North Atlantic off the Azores. *Cyclopicina* is one of the most primitive cyclopoids known, displaying many of the extreme plesiomorphic character states in the family Cyclopinidae. A key to genera of the subfamily Cyclopininae is presented and three new genera, *Herbstina, Erythropolites,* and *Glareolina,* are established.

Rony Huys, Marine Biology Section, Institute of Zoology, State University of Gent, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium: and, Delta Institute for Hydrobiological Research, Vierstraat 28, 4401 EA Yerseke, The Netherlands. – Geoffrey A. Boxshall, Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD, England.

INTRODUCTION

In 1901 THOMAS SCOTT described a new species of cyclopinid copepod found during examination of the stomach contents of a small haddock, *Melanogrammus aeglefinus* (L.), caught in the northern North Sea about 120 km east by south of Sumburgh Head, Shetland (approximately 59° N 1° W, where the depth is between 50 and 100 m). SCOTT described the species under the name *Cyclopina longifurcata* in his text but used *Cyclopina longicaudata* in the figure legends. Both names have been used subsequently and this has led to some confusion. According to VERVOORT (1964) BREEMEN (1908) was the first author to mention this species after its description and he referred to it as *Cyclopina longicaudata* T. SCOTT. VERVOORT (1964) concluded that the valid specific name is therefore *C. longicaudata,* presumably on the grounds that BREEMEN was the first reviser. GIESBRECHT (1902) was the first author to cite this species after its description and he also used the name *C. longicaudata.* According to Article 24 of the ICZN the first reviser must mention both names together in order to indicate that a choice is being made. The first author to do this was KIEFER (1929) who used *C. longifurcata* as the valid name but also mentioned *C. longicaudata* on the same page. A new genus, *Cyclopicina,* was erected for this species by LINDBERG (1953) and *Cyclopicina longifurcata* (T. SCOTT, 1901) is its type and only species.

Contribution No. 457 of the Delta Institute for Hydrobiological Research, Yerseke, The Netherlands.

The original description of *C. longifurcata* was adequate to characterise this unusual copepod but is lacking in detail by modern standards. This species exhibits several of the most plesiomorphic character states found in the order Cyclopoida and it is redescribed here as part of our wider study of the ordinal relationships of the Copepoda as a whole. This redescription is based on the holotype and on a new specimen collected in deep water in the North Atlantic, to the southwest of the Azores.

MATERIAL AND METHODS

Holotype female *C. longifurcata,* stored in collections of British Museum (Natural History), BM(NH) Reg. No. 1956.9.25.24. Additional material: 1 female, collected at RRS *Discovery* Stn 10379 at about 35° N 33° W in the North Atlantic, using a RMT1+8M opening and closing net system fished up to 50 m off the bottom in approximately 2980 m of water. BM(NH) Reg. No. 1989.473.

Specimens were examined in lactophenol and dissections were placed in slide preparations sealed with glyceel (Gurr®, BDH Chemicals Ltd, Poole, England). All figures were prepared using a camera lucida on a Leitz Dialux 20 interference microscope. The dorsal cephalic shield of the new specimen was prepared for scanning electron microscopy (SEM) by dehydration through graded ethanol, critical point drying, and sputter coating with gold. It was examined on a JEOL JSM-840 microscope. The terminology applied to segmentation of the mandible and maxilliped follows that of BOXSHALL (1985), that of the caudal ramus armature follows HUYS (1988a).

SYSTEMATICS

Cyclopicina longifurcata (T. Scott, 1901)

Cyclopina longifurcata, n.sp. – T. Scott 1901:240–241.
Cyclopina longicaudata n.sp.– T. Scott 1901:280.
Cyclopina longicaudata: Giesbrecht 1902.
Cyclopina longicaudata: Breemen 1908.
Cyclopina longicaudata: Früchtl 1924.
Cyclopina longifurcata: Kiefer 1929.
Cyclopina longifurcata: Schäfer 1936.
Cyclopina longifurcata: (syn. *longicaudata):* Steuer 1940:4.
Cyclopina longifurcata: (syn. *longifurcata):* Steuer 1940:6.
Cyclopina longifurcata: Lang 1946.
Cyclopicina longifurcata: Lindberg 1953.
Cyclopicina longicaudata: Vervoort 1964.

Adult female

Body slender, cyclopiform, with 4-segmented prosome and 5-segmented urosome (Fig. 1A,B). Prosome comprising cephalothorax incorporating first pedigerous somite, and 3 free pedigerous somites. Surface of dorsal shield covering cephalothorax ornamented with bilaterally symmetrical pattern of integumental pores mapped in Fig. 1A,B. Lateral margins of shields carrying linear array of large pores (Figs 1C, 8A–C) interspersed with sensillae. Tergites of free somites similarly ornamented with integumental pores; linear array of pores also present on lateral margins of first and second free pedigerous somites. Tergites of second and third free somites ornamented with epicuticular lamellae; epimeral plates well developed. Total body length of new specimen 1.01 mm.

Urosome comprising fifth pedigerous somite, genital double somite representing fused genital and first abdominal somites, and 3 free abdominal somites. Fifth pedigerous somite with well developed tergites, ornamented with pores and epicuticular lamellae. Fifth legs originating ventrolaterally, beneath epimeral areas of tergite. Genital double somite about 1.7 times longer than wide; surface ornamented with pores and, in posterior part, with epicuticular lamellae. Copulatory pore (arrowed in Fig. 7A,B) large, located midventrally on double somite posterior to plate connecting sixth legs. Gonopores ventrolateral, paired, covered by common operculum derived from fused sixth legs. First and second free abdominal somites ornamented with pores and epicuticular lamellae. Anal somite ornamented with 3 pairs of sensillae, several pores and minute surface denticles (Figs 5C,D, 7D), and with row of spinules along posterior margin. Anus located dorsally, with poorly developed operculum.

Caudal ramus about 7.7 times longer than wide; entire surface ornamented with sensillae, pores and minute denticles, also with posterior row of spinules on ventral surface (Figs 5E, 7D). Armature consisting of 7 setae; accessory anterolateral seta (I), lateral seta (II), outer apical seta (III), terminal setae (IV, V), inner apical seta (IV) and dorsal seta (VII).

Antennule (Fig. 2A) 26-segmented; segmental armature as follows: I–1, II–1, III–2, IV–1, V–2, IV–1, VII–2, VIII–2, IX–2, X–2, XI–1 + aesthetasc, XII–2, XIII–2, XIV–2, XV–1, XVI–1, XVII–1, XVIII–1, XIX–1, XX–1, XXI–1, XXII–1, XXIII–1, XXIV–2, XXV–2 + 1 aestheasc, XXVI–7 + 1 aesthetasc. Segments XXIV and XXV with 1 of setae located at posterior distal angle. Apical aesthetasc fused at base to adjacent seta (Fig. 2B).

Antenna (Fig. 2C) 4-segmented: first segment comprising fused coxa and basis, armed with inner coxal seta proximally, 2 inner basal setae distally, and 3 outer setae carried on a small lobe (Fig. 2D) representing the exopod. First endopodal segment with 1 seta, second with 5 setae, third with 6 apical setae and some minute pinnules.

Mandible comprising small coxa with gnathobase (Fig. 3A) and a relatively large distal palp (Fig. 3B). Palp consisting of basis bearing 2 inner setae, 2-segmented endopod with 2 and 6 plumose setae on first and second segments respectively, and 4-segmented exopod with 1, 1, 1, and 2 plumose setae on first to fourth segments.

Maxillule (Fig. 3C) biramous, with 3-segmented protopod. Praecoxa partly fused to coxa, separated by suture on anterior surface only (Fig. 3D); coxa and basis distinct. Praecoxal arthrite well developed, produced distally, bearing 9 spinulate elements. Coxa with 3 outer surface plumose setae representing epipodite, no vestige of coxal endite present. Basis with 2 spinulate setae on inner margin, representing basal endites. Exopod 1-segmented, with 4 plumose setae on distal margin and a row of pinnules on inner margin. Endopod 1-segmented with 5 setae on distal margin and 2 on inner margin.

Maxilla (Fig. 4A) 6-segmented; comprising praecoxa, coxa, basis and 3-segmented endopod. Praecoxa with proximal endite bearing 2 setae, distal endite represented by small spinous process. Coxa with 2 endites, both armed with 3 setae, distal endite highly mobile with areas of flexible integument on both sides. Basis drawn out into a claw-like endite armed with 2 additional setae. Endopod bearing 3, 2, and 3 geniculate setae on first to third segments respectively.

Maxilliped (Fig. 4B) 7-segmented; comprising syncoxa, basis, and 5-segmented endopod. Syncoxa with 3 weakly developed endites (coxal in origin), armed with 1, 3, and 3 elements from proximal to distal. Praecoxal endite absent. Basis elongate, ar-

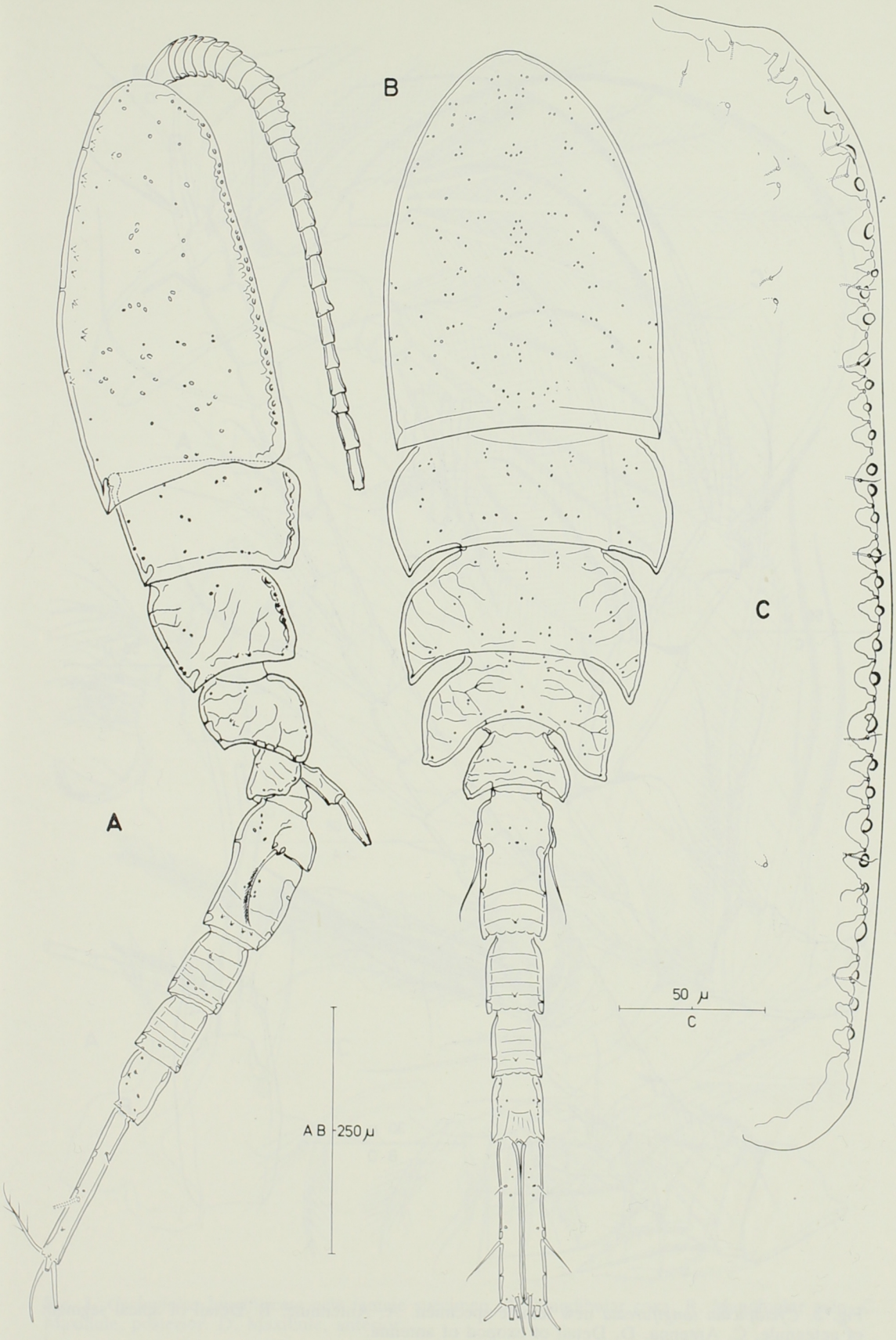

Fig. 1. *Cyclopicina longifurcata* new female specimen. A. Lateral. B. Dorsal. C. Lateral margin of dorsal cephalothoracic shield.

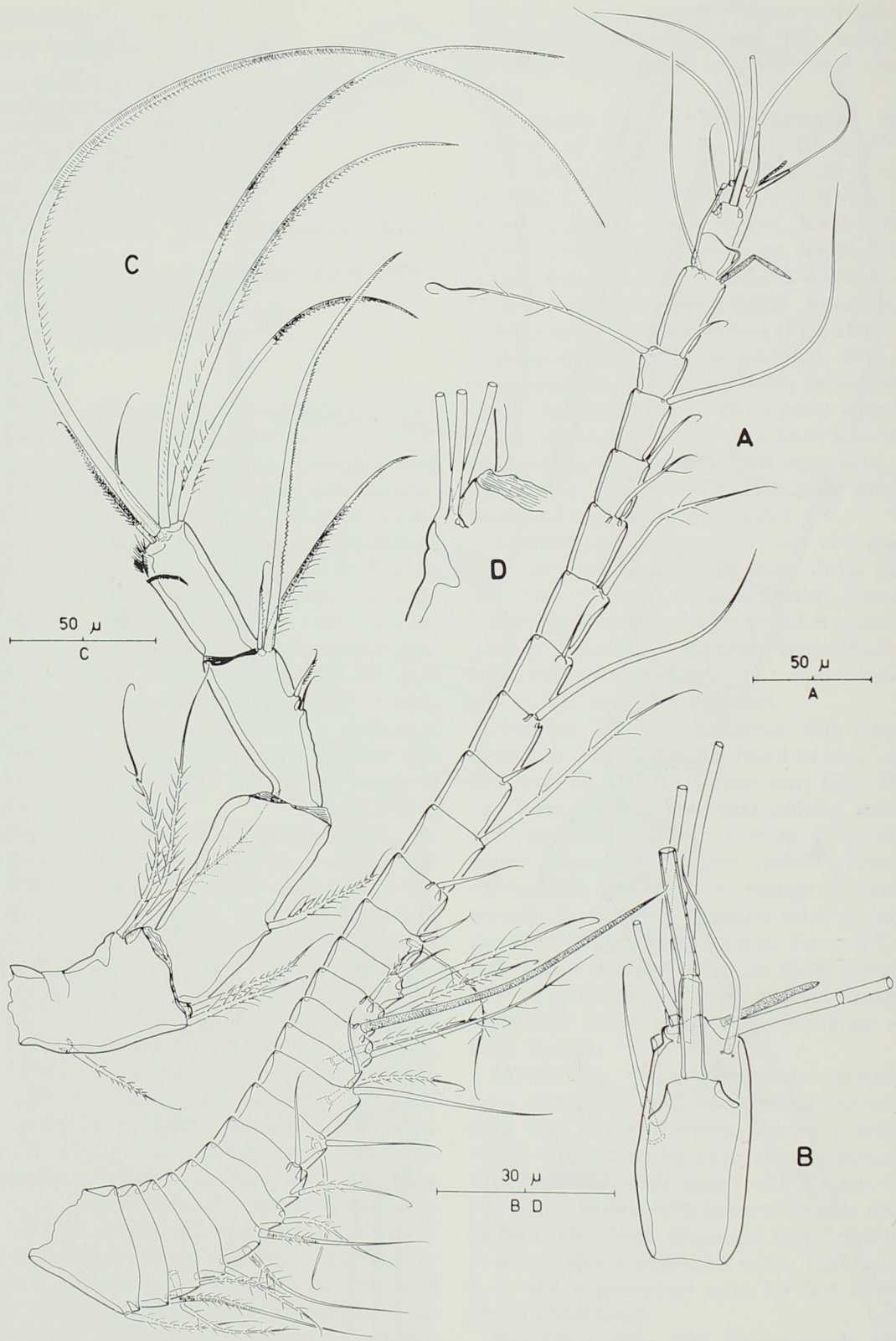

Fig. 2. *Cyclopicina longifurcata* new female specimen. A. Antennule. B. Detail of apical segment of antennule, C. Antenna. D. Detail of exopod of antenna.

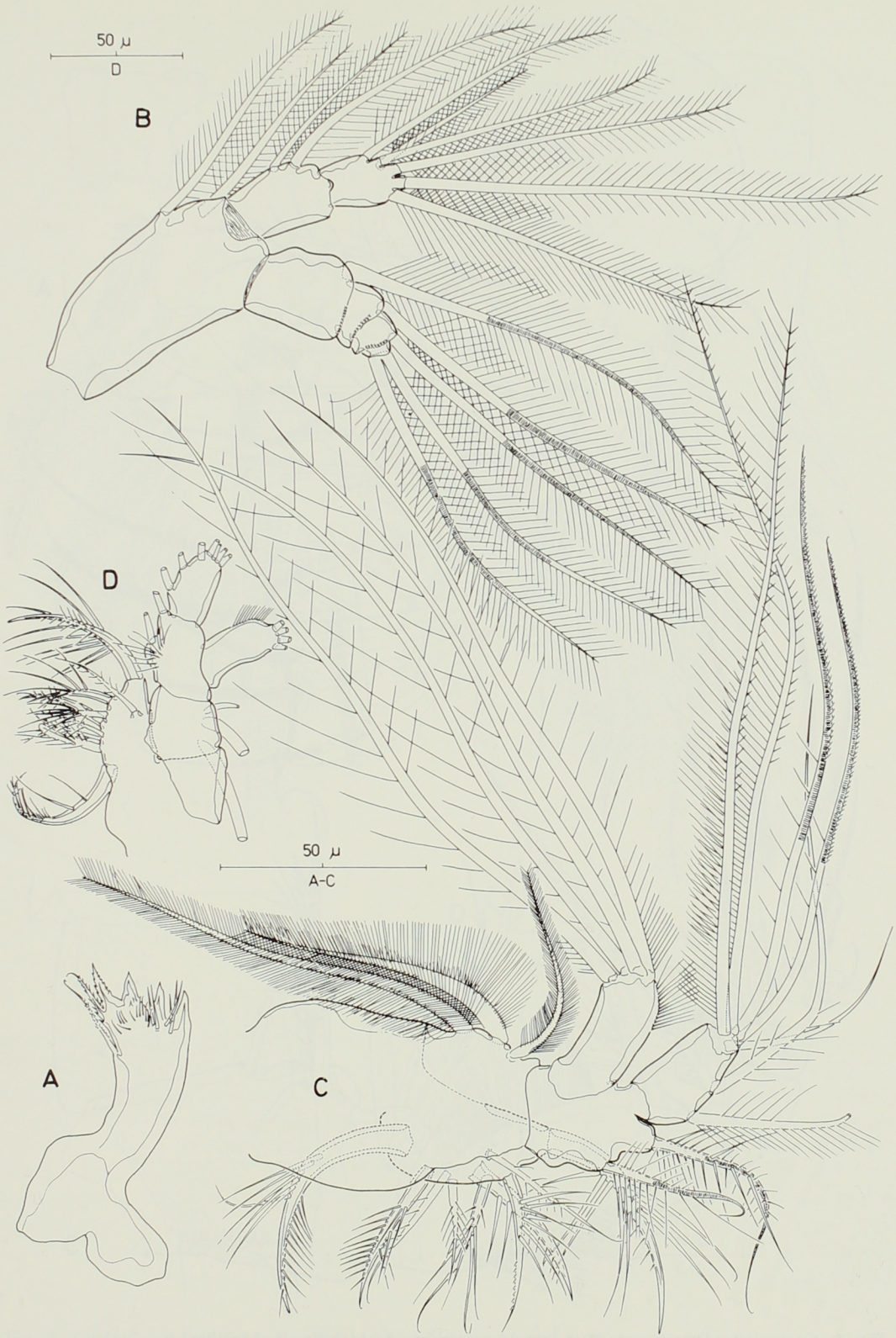

Fig. 3. *Cyclopicina longifurcata* new female specimen. A. Mandibular coxa, B. Mandibular palp. C. Maxillule, posterior. D. Maxillule, anterior.

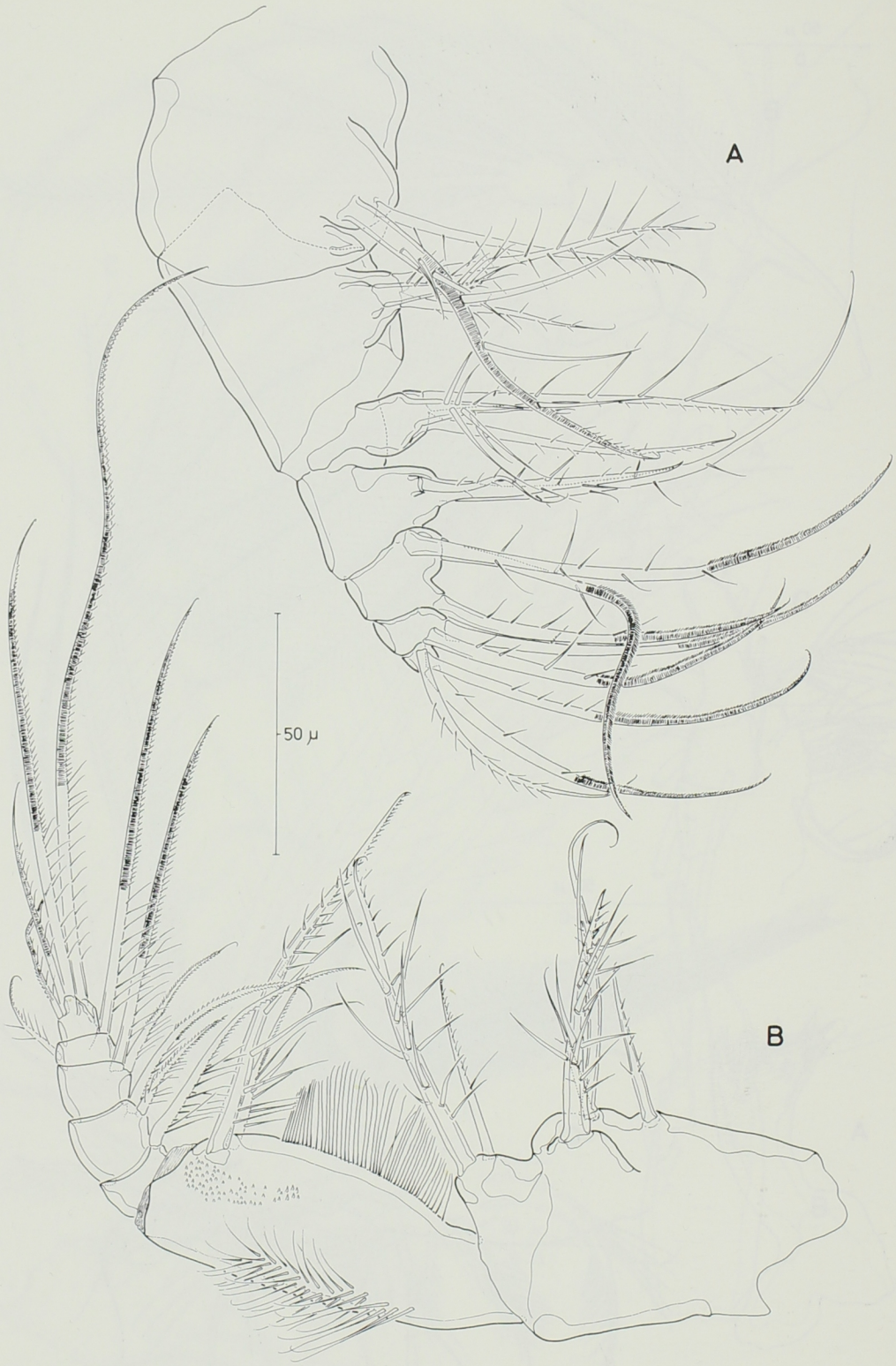

Fig. 4. *Cyclopicina longifurcata* new female specimen. A. Maxilla. B. Maxilliped.

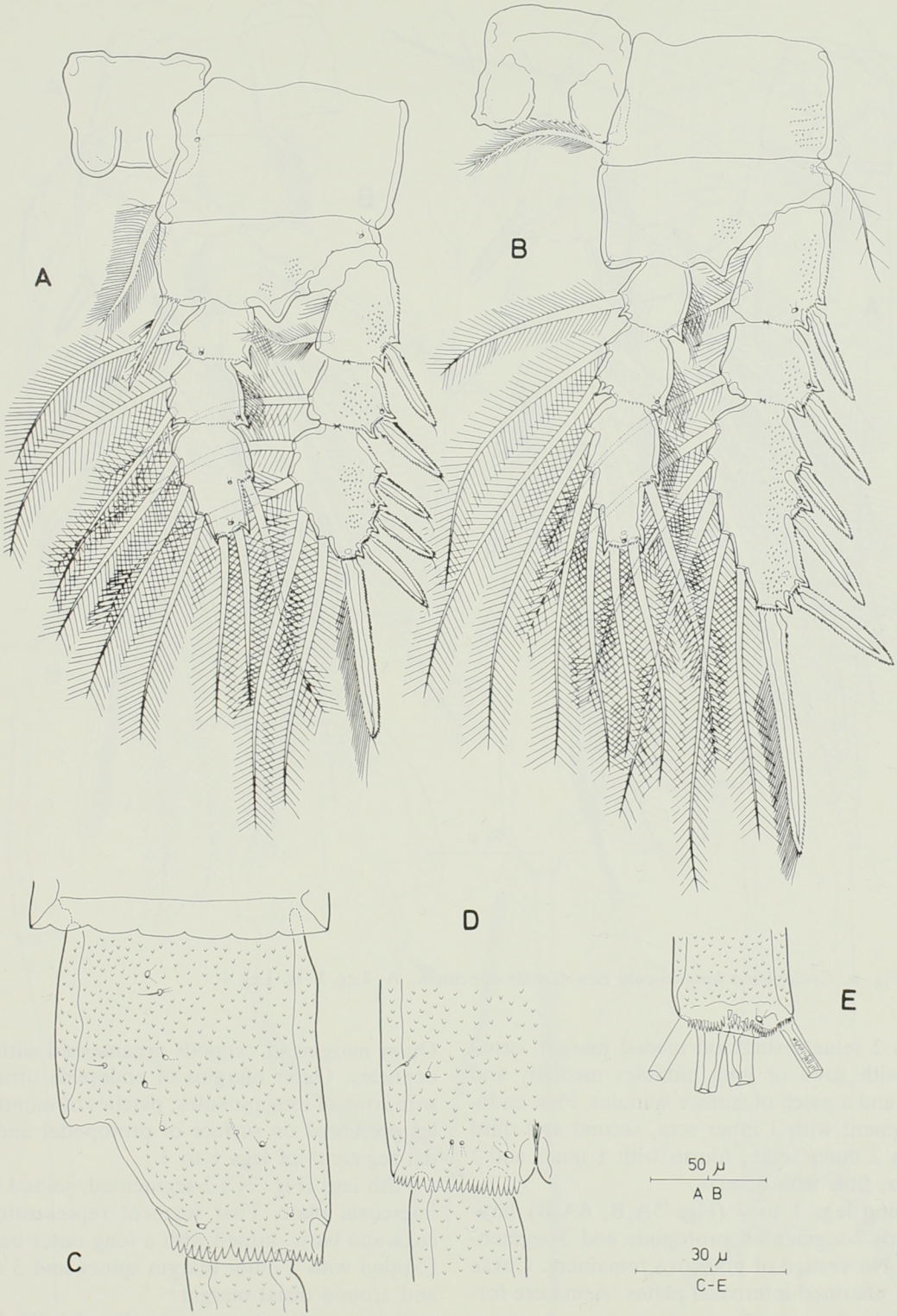

Fig. 5. *Cyclopicina longifurcata* new female specimen. A. Leg 1. B. Leg 2. C. Anal somite, lateral. D. Detail of anal somite, ventral. E. Tip of caudal ramus, ventral.

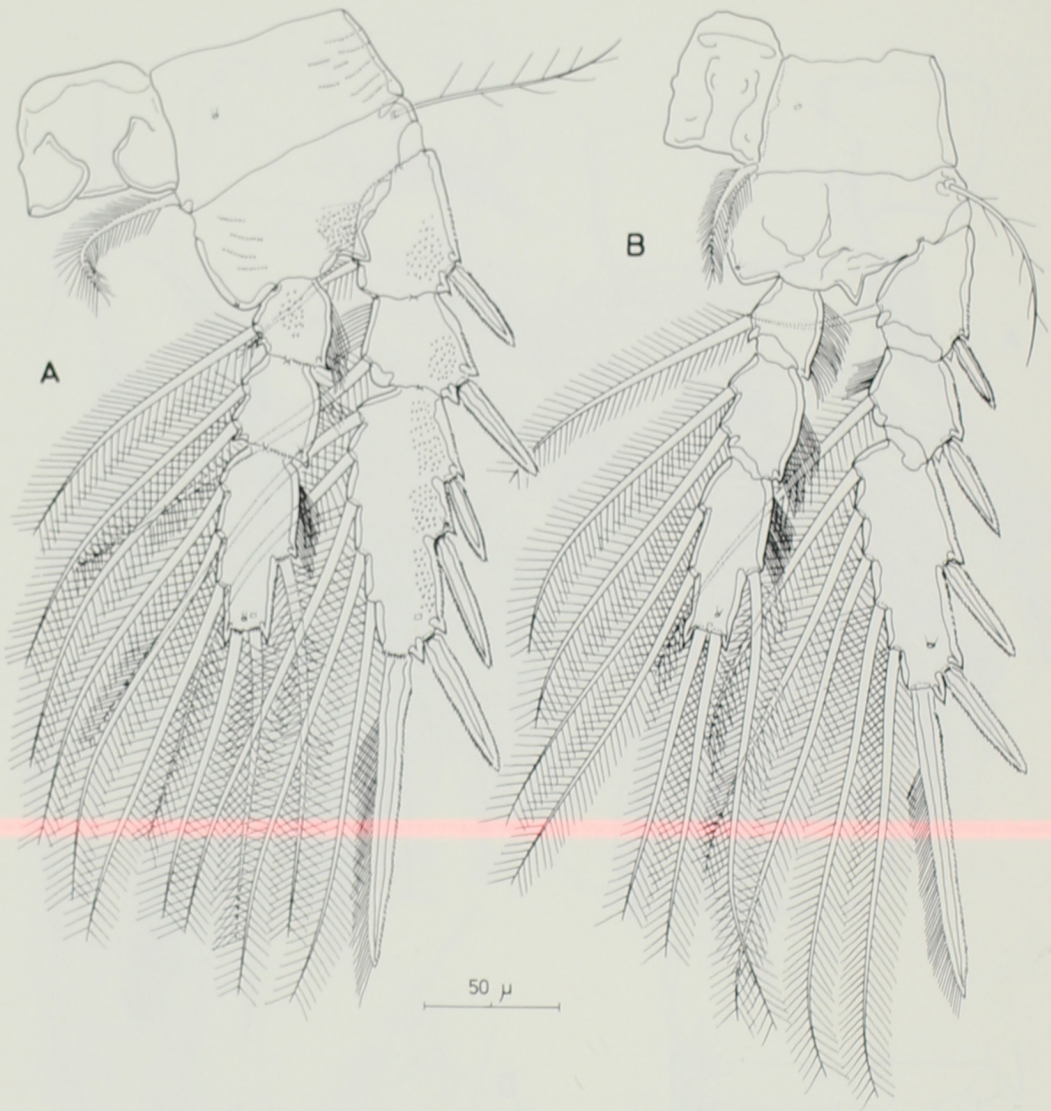

Fig. 6. *Cyclopicina longifurcata* new female specimen. A. Leg 3. B. Leg 4.

med with 2 setae distally on medial margin; ornamented with rows of long pinnules medially and laterally, and a patch of surface spinules. First endopodal segment with 1 inner seta, second and third each with 2 inner setae, fourth with 1 inner and 1 outer seta, fifth with 4 setae.

Swimming legs 1 to 4 (Figs 5A,B, 6A,B) biramous; with 2-segmented protopods and 3-segmented rami. No vestige of praecoxa remaining. Coxae joined by unarmed intercoxal plates. Armature formula as follows:

	coxa	basis	endopod	exopod
leg 1	0–1	0–I	0–1;0–2;1,2,3	I–1;I–1;III,I,4
leg 2	0–1	1–0	0–1;0–2;1,2,3	I–1;I–1;III,I,5
leg 3	0–1	1–0	0–1;0–2;1,2,3	I–1;I–1;III,I,5
leg 4	0–1	1–0	0–1;0–2;1,2,2	I–1;I–1;II,I,5

Outer margins of exopods ornamented with minute denticles. Outer margins of endopods ornamented with rows of long pinnules, patches of minute spinules presented on surface of protopodal and exopodal segments of legs 1 to 4.

Fifth legs (Fig. 7C) 2-segmented, joined by small intercoxal plate. First segment representing fused coxa and basis, armed with a long outer basal seta. Exopod with 2 outer margin spines and 3 setae on and around distal margin.

Sixth legs fused to somite (Fig. 7A,B), covering genital apertures; armed with a lateral seta and 2 small spines.

Male: unknown.

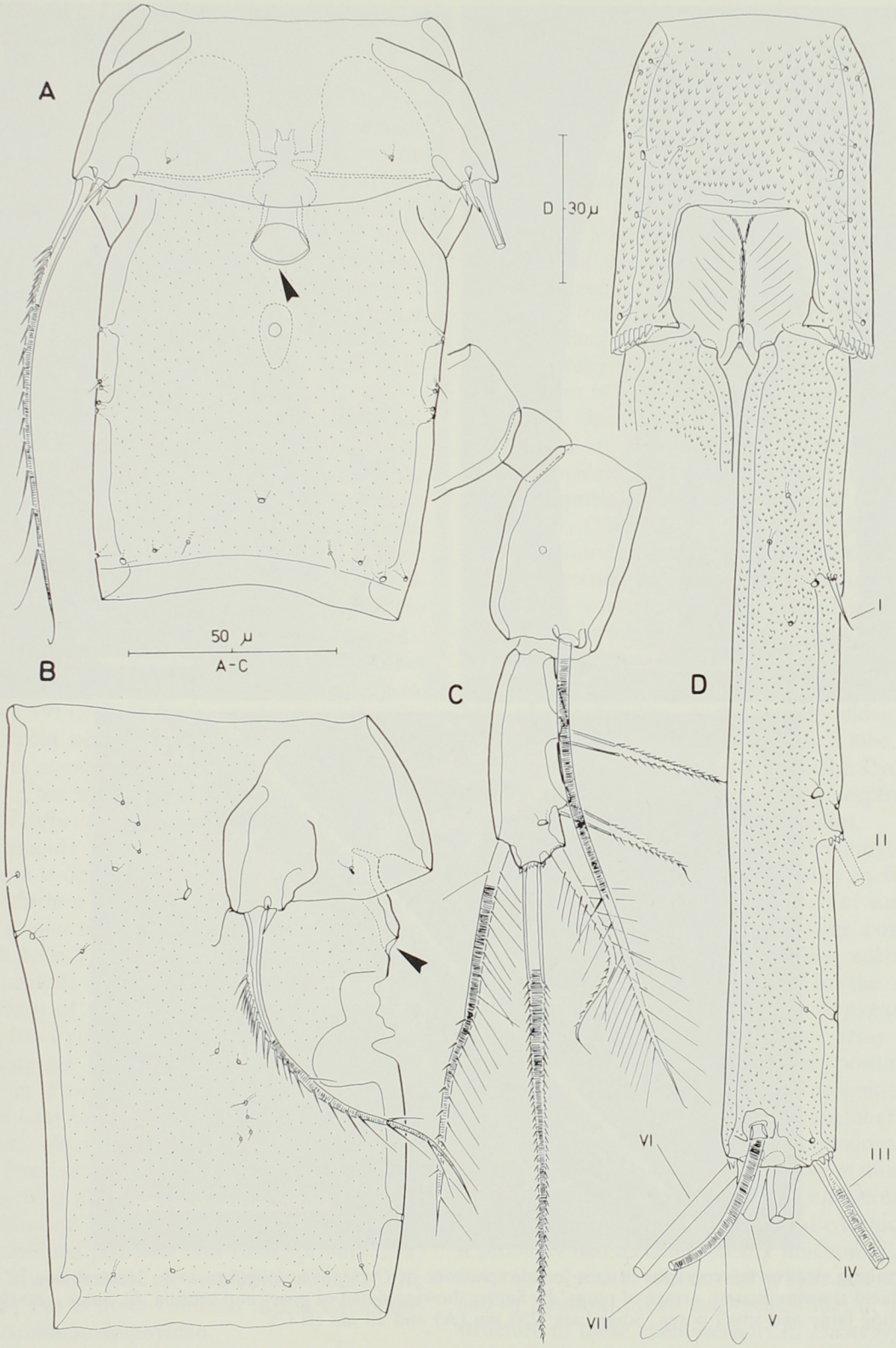

Fig. 7. *Cyclopicina longifurcata* new female specimen. A. Genital double somite of female, ventral with copulatory pore arrowed. B. Same, lateral. C. Leg 5, ventral. D. Anal somite and caudal rami, dorsal.

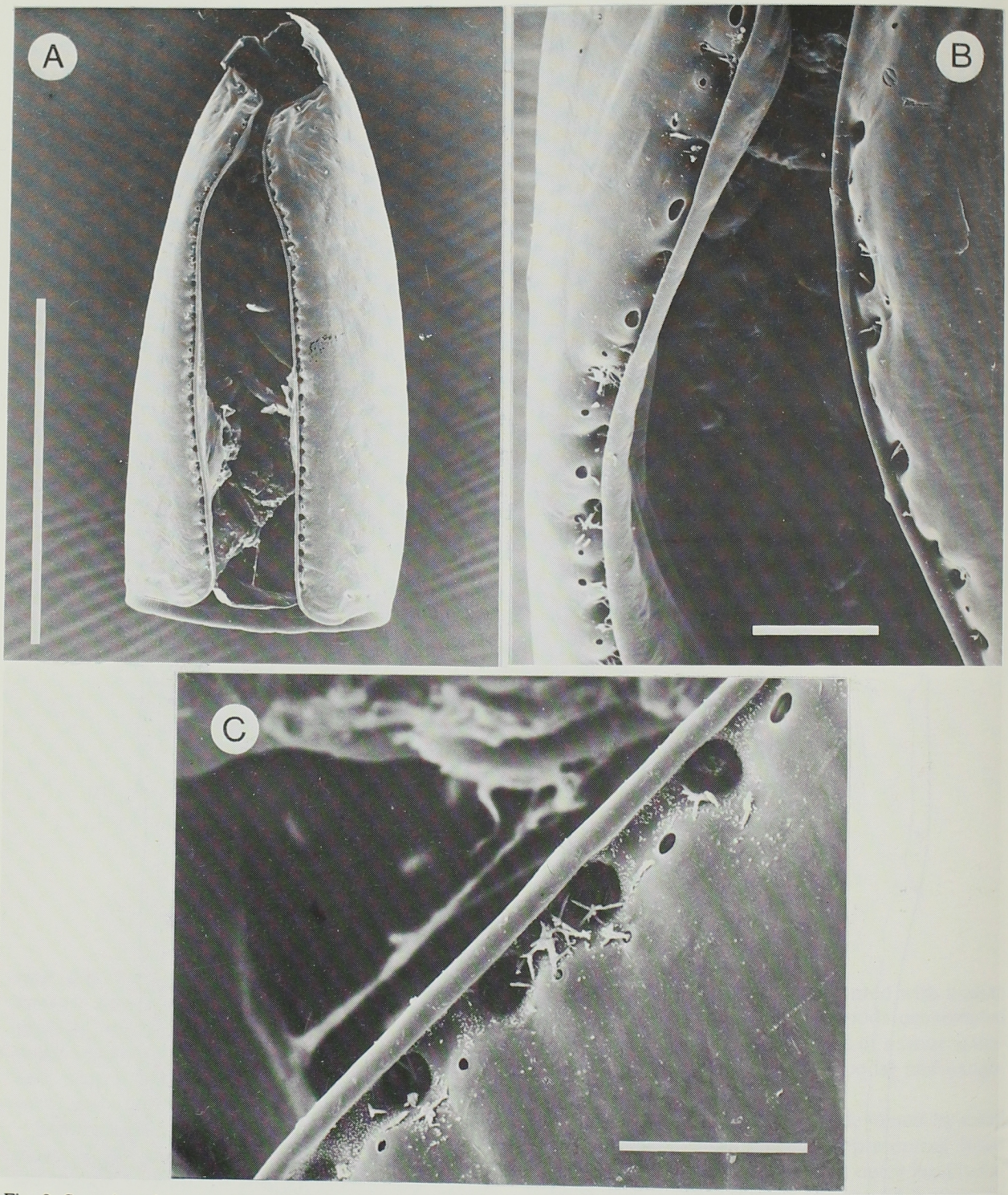

Fig. 8. Scanning electron micrographs of new female specimen of *Cyclopicina longifurcata* A. Ventral view of cephalothoracic shield showing margin arrays of pores. B. Same, showing detail of pores and sensilla, C. Same, showing detail of alternating large and small pores. Scale bars: 250 μm (A) and 10 μm (B,C).

DISCUSSION

The separation between the type locality, the shallow waters of the northern North Sea, and the new locality, in deep water off the Azores is remarkable. It is not known where the haddock, in the stomach of which the holotype was found, had been feeding but the excellent condition of the holotype led SCOTT (1901) to infer that it had only recently been ingested. It seems unlikely that the haddock had been feeding in deep water. So this copepod has both a wide depth range (about 300 m to shelf depths) and a wide latitudinal range (from 35° N to 59° N). There are, however, no significant differences between the two specimens.

C. longifurcata exhibits many of the most plesiomorphic character states found in the order Cyclopoida. It possesses 26 antennulary segments in the female. This is only one less than the maximum number known for any copepod, the 27 segments of certain female Misophrioida (BOXSHALL 1983; BOXSHALL & ILIFFE 1987; HUYS 1988b) and Calanoida (FOSSHAGEN & ILIFFE 1985). The exopod of the antenna is represented by a minute lobe bearing 3 setae. A maximum of 2 setae is known for other cyclopoids, as in *Oithona* (NISHIDA 1985) and *Cyclopina* (SARS 1913, 1918) for example. It is also the only cyclopoid with a seta on the antennary coxa, as found in some calanoids. There are 2 setae on the basis of the mandible in *C. longifurcata* and in *Cyclopetta difficilis* SARS compared to 1 or none in other cyclopoids. However, in C. *difficillis* the distalmost seta is derived from the proximal endopod segment which is incorporated into the basis (SARS 1913). A similar situation is found in many Oithonidae which have 3 setae on the basis. The epipodite on the maxillule is represented by 3 setae on the outer surface of the coxa. This number was also recorded for *Cyclopinodes elegans* (T. SCOTT) but only 2 setae are found in other Cyclopinidae (for example, in *Procyclopina polyarthra* HERBST and *Cyclopina laurentica* NICHOLLS) and in the families Oithonidae, Archinotodelphyidae, and Notodelphyidae. Four setae are present on the maxillulary exopod but this number is widespread amongst the less transformed cyclopoids. The enditic setation of the maxilliped [syncoxa and basis formula 0, 1, 3, 2, and 2] is the most plesiomorphic found in the Cyclopoida but is quite common in the Cyclopinidae and Archinotodelphyidae.

The setation formula of the first to fourth swimming legs comprises the maximum number of elements known for the Cyclopoida but is widely found in other genera, except for the presence of 2 inner setae on the second endopod segment of leg 1 which is shared only with *Cyclopinodes elegans* and *Pseudocyclopina belgicae* (GIESBRECHT). The fifth leg in the female bears 5 elements on the single free exopodal segment. This is the largest number known in the family Cyclopinidae, most of which have 4 or fewer elements. Within the Cyclopoida only *Archinotodelphys polynesiensis* MONNIOT has 6 elements on the free segment (MONNIOT 1988). The presence of a discrete intercoxal plate joining the protopods of the fifth legs is also a plesiomorphic state restricted to certain cyclopinid genera.

C. longifurcata is placed in the family Cyclopinidae. This family comprises 30 genera all of which possess a fully fused genital double somite in the female. This is an apomorphic character within the Cyclopoida since separate genital and first abdominal somites are retained in some members of the Notodelphyidae. The relationships of the seven families comprising the order Cyclopoida were examined by Ho (1986) and again by Ho & THATCHER (1989). However, neither Ho nor Ho & THATCHER gave a diagnostic apomorphy for the family Cyclopinidae. We were also unable to find a diagnostic apomorphy and it is possible that the Cyclopinidae is a paraphyletic taxon. The absence of a coxal endite on the maxillule, which is present in members of the families Archinotodelphyidae, Notodelphyidae, and Oithonidae as a small lobe bearing a strong apical seta, is shared with the Cyclopidae and its loss may represent a synapomorphy of the common ancestor of these two families.

The linear array of pores along the margin of the cephalic shield appears to be sensory in function. It is interesting to note the presence of similar arrays of sensory structures in the same position in members of other cyclopoid families, such as the Notodelphyidae and Oithonidae. In the atypical male form of the notodelphyid *Pachypygus gibber* HIPEAU-JACQUOTTE (1986) found an array of presumed chemosensory organs in this position. She suggested a possible role in mate recognition or in host location. In the males of some members of the planktonic family Oithonidae a cephalosome-flap organ is present along the margins of the dorsal shield. NISHIDA (1986) studied the ultrastructure of this organ in species of *Oithona* and concluded that it probably had a chemosensory function. Comparison of the results obtained by HIPEAU-JACQUOTTE and by NISHIDA reveals many similarities in the ultrastructure of these chemosensors in *Pachypygus* and *Oithona*. The array of similar organs in *Cyclopicina*, albeit in the female, could be interpreted as a primitive version of this cephalosome-flap organ.

KEY TO GENERA OF THE SUBFAMILY CYCLOPININAE

The most recent key to genera of the large subfamily Cyclopininae is that of WELLS (1967) which deals with 21 genera. The genus *Allocyclopina* KIEFER, 1954 was not included and the establishment of several new taxa since then has raised the number of valid genera to 27 (MOHAMMED & NEUHOF 1985). These newly described genera are *Heterocyclopina* PLESA, 1968; *Cryptocyclopina* MONCHENKO, 1979; *Cyclopuella* POR, 1979; *Cycloporella* MONCHENKO, 1981 and *Arctocyclopina* MOHAMMED & NEUHOF, 1985. Most recently MONCHENKO (1989) proposed a replacement name *Cyclopinotus* for his *Cycloporella* which was preoccupied, twice, by bryozoan genera. With the establishment of three new genera below, the number in the Cyclopininae now stands at 30. Abbreviations used in the following key to genera are: A1 = antennule, A2 = antenna, Md = mandible, Mx1 = maxillule, Mxp = maxilliped, P1–P6 = legs 1 to 6, exp (1–3) = exopod (segments 1 to 3), enp (1–3) = endopod (segments 1 to 3). Body length is measured from tip of rostrum to posterior margin of anal somite. This key is applicable to both sexes.

1. Enp. P1 2-segmented 2
   Enp. P1 3-segmented 8
2. Enp. P2–P4 2-segmented 3
   Enp. P2–P3 2-segmented, P4 3-segmented ..... *Microcyclopina* PLESA, 1961
   Enp. P2–P4 3-segmented 7
3. Exp. P1 2-segmented 4
   Exp. P1 3-segmented 5
4. Exp. P2–P4 2-segmented ..... *Arenocyclopina* KRISHNASWAMY. 1957
   Exp. P2–P3 3-segmented (exp. P4 2-segmented in female. 3-segmented in male) ..... *Neocyclopina* HERBST, 1953
5. Exp2. P1–P4 with inner seta; enp1. P2–P4 with inner seta; enp2. P1–P4 with 3, 4 or 5 setae 6
   Exp2. P1–P4 without inner seta; enp1. P2–P4 without inner seta; enp2. P1–P4 with 2 setae ..... *Herbstina* gen. nov.
6. Exp3. P1–P4 with 8,9,9,8 spines/setae; enp2. P1–P4 with 4,5,5,5 spines/setae; A1 female 8-segmented ..... *Erythropolites* gen.nov.
   Exp3. P1–P4 with 7,9,7,7 spines/setae; enp2. P1–P4 with 4,3,4,4 spines/setae; A1 female 6-segmented ..... *Indocyclopina* WELLS, 1967
7. Enp2. P2–P4 with 1 inner seta; exp1–2. P1 without inner seta: A2 with basis ..... *Afrocyclopina* WELLS, 1967
   Enp2. P2–P4 with 2 inner setae; exp1–2. P1 with inner seta; A2 with alloibasis ..... *Cyclopuella* POR, 1979
8. P5 of both sexes comprising single segment bearing 4 setae/spines ..... *Paracyclopina* SMIRNOV, 1935
   P5 of several segments, or when 1-segmented bearing less than 4 setae/spines 9
9. Enp2. P1 with 2 inner setae 10
   Enp2. P1 with 1 inner seta 12
10. A1 female 26-segmented; exp. A2 represented by 3 setae, coxa with inner seta; basis Md. with 2 setae ..... *Cyclopicina* LINDBERG, 1953
    A1 female at most 21-segmented; exp A2 at most represented by 1 seta, coxa asetose; basis Md. with 1 seta 11
11. P5 2-segmented in female, 3-segmented in male; male exp. P2 with modified spines ..... *Pseudocyclopina* LANG, 1946
    P5 3-segmented in female, 4-segmented in male; male exp. P2 not modified ..... *Cyclopinodes* WILSON, 1932
12. Palp Md. uniramous, represented by a long segment bearing 2 setae ... *Psammocyclopina* WELLS, 1967
    Palp Md. biramous 13

13. Exp. Md. represented by single seta only ..... *Cyclopinella* Sars, 1913
Exp. Md. 3-segmented ..... *Cyclopinopsis* Smirnov, 1935
Exp. Md. 1– (in *Heterocyclopina*) or 4-segmented 14

14. Exp. P5 a single segment bearing 2 setae in both sexes;
A1 female 8-segmented ..... *Cryptocyclopina* Monchenko, 1979
Exp. P5 with at least 3 setae/spines; A1 female at least 9-segmented 15

15. P5 3-segmented in female (comprising coxa, basis and exp.);
4-segmented in male (with 2-segmented exp.) 16
P5 at most 2-segmented in female; at most 3-segmented in male 17

16. P1–P4 with 8,9,9,7 spines/setae on exp3, 6,6,6,5 on enp3;
A1 female 18–20-segmented ..... *Cyclopinoides* Lindberg, 1953
P1–P4 with 6,7,7,7 spines/setae on exp3, 4,4,4,4 on enp3;
A1 female 10-segmented ..... *Metacyclopina* Lindberg, 1953

17. A2 with strong plumose setae; basis Md. with 2 setae; female P5 1-segmented,
bearing 3 setae ..... *Cyclopetta* Sars, 1913
A2 not modified; female P5 2-segmented 18

18. Enp2. P4 with 1 inner seta 19
Enp2. P4 with 2 inner setae 20

19. A1 female 18-segmented; P5 male 3-segmented; exp. P5 female with 3 setae/spines ..... *Heterocyclopina* Plesa, 1968
A1 female 10-segmented; P5 male 2-segmented; exp. P5 female with 4 setae/spines ..... *Allocyclopina* Kiefer, 1954

20. Enp. Mxp 2-segmented 21
Enp. Mxp at least 3-segmented 22

21. Exp3. P3 with 8 spines/setae; exp. A2 represented by 2 setae;
A1 female 16-segmented ..... *Arctocyclopina* Mohammed & Neuhof, 1985
Exp3. P3 with 9 spines/setae; exp A2 absent:
A1 female 9-segmented ..... *Paracyclopetta* Wells, 1967

22. Enp3. P1 with 4 spines/setae ..... *Hemicyclopina* Herbst, 1953
Enp3. P1 with 5 spines/setae 23
Enp3. P1 with 6 spines/setae 25

23. Exp. A2 absent; epipodite Mx1 represented by 2 setae; exp. P5 with 2 spines & 1 seta in female ..... *Procyclopina* Herbst, 1955
Exp. A2 represented by 1 or 2 setae; epipodite Mx1 represented by 1 seta or absent; exp. P5 with 3 spines and 1 seta in female 24

24. Enp. Mxp 4-segmented; exp1. P1 without inner seta; female P5 with basis bearing outer seta ..... *Glareolina* gen.nov.
Enp. Mxp 5-segmented; exp1. P1 with inner seta;
female P5 with undivided protopod bearing outer seta and inner spine ..... *Parapseudocyclopinodes* Lindberg, 1961

25. Exp. A2 represented by 2 setae; A1 female at least 16-segmented 26
Exp. A2 represented by 1 seta or absent;
A1 female 10- to 13-segmented ..... *Cyclopina* Claus, 1862

26. Enp. Mxp 4-segmented; A1 female 19-segmented;
exp. P5 female with 3 spines ..... *Cyclopidina* Steuer, 1940
Enp. Mxp 3-segmented; A1 female 16-segmented; exp. P5 female with 2 spines flanking a median seta ..... *Cyclopinotus* Monchenko, 1989

Remarks

Working from the literature it is apparent that the genus *Microcyclopina* is a heterogeneous assemblage of highly reduced species. The discovery of *M. semireducta* and *M. exigua* (HERBST 1964, 1974) has broadened the generic diagnosis considerably since the description of the type species *M. arenicola*. HERBST (1964) relegated *Microcyclopina* to a subgenus of *Cyclopina* because of the similarities in setation of the antennary basis, in segmentation and armature of the mouthparts (especially the maxilliped) and in the fifth leg. He used only these characters because they have been traditionally employed in distinguishing cyclopinid genera. However, many additional characters can be used to define the genera, as pointed out by LINDBERG (1953) in his excellent revision of the subfamily.

There are substantial differences between *Microcyclopina* and *Cyclopina* in the segmentation of the antennules and swimming legs. These fully justify separate generic status and *Microcyclopina* is reinstated as valid genus. Furthermore, the noticeable discrepancies in swimming leg segmentation and armature between *M. arenicola* and *M. semireducta* are sufficient to warrant establishing a new genus, *Erythropolites* gen.nov., to accommodate the latter. The third species, *M. exigua,* is significantly more reduced than its supposed congeners and cannot be included in either of these genera. HERBST (1974) already suggested that reductions within the genus *Microcyclopina* might be polyphyletic and that *M. exigua* might, therefore, belong to a separate genus. We herein make *M. exigua* the type of *Herbstina* gen.nov. based on differences in the antennule, maxilliped, swimming legs 1 to 4 and fifth and sixth legs.

The diagnoses of these new or amended genera are as follows:

Erythropolites gen.nov.

Diagnosis. Cyclopininae. First pedigerous somite incorporated into cephalothorax. Antennule 8-segmented in female, 13-segmented in male. Exopod of antenna absent. Mandible with 2-segmented endopod and 4-segmented endopod. Endopod of maxilliped 3-segmented. Legs 1 to 4 with 2-segmented endopod. Legs 1 to 4 exopod segment 3 with 4,4,4,3 spines and 4,5,5,5 setae; exopod segment 1 with inner seta in leg 1, without inner seta in legs 2–4, segment 2 with inner seta; endopod segment 1 with inner seta, segment 2 with 4,5,5,5 setae. Exopod of leg 5 with 4 setae in male. Leg 6 with 2 elements in male.

Type and only species: *Erythropolites semireductum* (HERBST, 1964) comb. nov.

Etymology: The generic name is derived from the Greek *erythros,* meaning red, and *polites,* meaning a citizen, and refers to the type locality, the Red Sea. Gender – masculine.

Herbstina gen.nov.

Diagnosis. Cyclopininae. First pedigerous somite incorporated into cephalothorax. Antennule 9-segmented in female, 13-segmented in male. Exopod of antenna absent. Mandible with 2-segmented endopod and 4-segmented exopod. Endopod of maxilliped 2-segmented. Legs 1 to 4 with 2-segmented endopod. Legs 1 to 4 exopod segment 3 with 3,3,3,3 spines and 5,5,5,5 setae; exopod segments 1 and 2 without inner seta; endopod segment 1 without inner seta, segment 2 with 2 setae. Exopod of leg 5 with 6 setae in male. Leg 6 with 3 elements in male.

Type and only species: *Herbstina exigua* (HERBST, 1974) comb.nov.

Etymology: The genus is named after Dr Hans Volkmar Herbst in recognition of his work on cyclopinid copepods. Gender – feminine.

Microcyclopina PLESA, 1961

Diagnosis (emended). Cyclopininae. First pedigerous somite incorporated into cephalothorax. Antennule 8-segmented in female, 14 to 15-segmented in male. Exopod of antenna absent. Mandible with 2-segmented endopod and 1-segmented exopod. Endopod of maxilliped unconfirmed. Legs 1 to 3 with 2-segmented endopod, 3-segmented in leg 4. Legs 1 to 4 exopod segment 3 with 4,4,4,3 spines and 4,5,5,5 setae; exopod segment 1 without inner seta in leg 1, with inner seta in legs 2 to 4, segment 2 with inner seta in legs 1 to 4; endopod segment 1 without inner seta in leg 1, with inner seta in legs 2 to 4, distal endopod segment with 2,5,5,5 setae in legs 1 to 4. Exopod of leg 5 with 4 setae in male. Leg 6 with 2 elements in male.

Type and only species: *Microcyclopina arenicola* PLESA, 1961.

Hemicyclopina HERBST is another ill-defined genus. It was established by HERBST (1953) to accommodate the type *Paracyclopina setifera* HERBST, 1952 and a new species *H. kliei.* The numerous differences in segmentation and armature of most of the appendages (see diagnoses) have prompted us to remove the latter species from *Hemicyclopina* and treat it as the type species of a new genus, *Glareolina* gen.nov. Diagnoses of both genera follow:

Glareolina gen.nov.

Diagnosis. Cyclopininae. First pedigerous somite incorporated into cephalothorax. Antennule 20-segmented in female. Exopod of antenna represented by 2 seta. Mandible with seta on basis. Endopod of maxillule with 6 setae. Endopod of maxilliped 4-segmented. Leg 1 without inner seta on exopod segment 1, with 5 setae on endopod segment 3. Leg 4 with 1 and 2 inner spines on endopod segments 1 and 2 respectively.

Type and only species: *Glareolina kliei* (HERBST, 1953) comb.nov.

Etymology: The generic name is derived from the Latin *glarea,* meaning gravel, and refers to the habitat where the species is likely to be found. Gender – feminine.

Hemicyclopina HERBST, 1953

Diagnosis. Cyclopininae. State of first pedigerous somite unconfirmed. Antennule 17-segmented in female. Exopod of antenna absent. Mandible without seta on basis. Endopod of maxillule with 4 setae. Endopod of maxilliped 5-segmented. Leg 1 with inner seta on exopod segment 1, with 4 setae on endopod segment 3. Leg 4 with 1 and 2 inner spines on endopod segments 1 and 2 respectively.

Type and only species: *Hemicyclopina setifera* (HERBST, 1952).

ACKNOWLEDGEMENTS

We are grateful to Mrs Rita Van Driessche for invaluable assistance with SEM. Part of this research was conducted under EC contract No ST2*0443 and under Research Grant 2.0009.81 of the Belgian Fund for Collective Fundamental Research. The RRS *Discovery* specimen was collected during cruise No.121, organised by Dr Martin Angel of the Institute of Oceanographic Sciences, NERC.

REFERENCES

Boxshall, G.A. 1983. Three new genera of misophrioid copepods from the near-bottom plankton community in the North Atlantic Ocean. – *Bulletin of the British Museum (Natural History), Zoology* 44: 103–124.

— 1985. The comparative anatomy of two copepods, a predatory calanoid and a particle-feeding mormonilloid. – *Philosophical Transactions of the Royal Society, London* (B) 311:303–377.

Boxshall, G.A. & T.M. Iliffe 1987. Three new genera and five new species of misophrioid copepods (Crustacea) from anchialine caves on Indo-West Pacific and North Atlantic Islands. – *Zoological Journal of the Linnean Society* 91:223–252.

Breemen, P.J. van 1908. Copepoden. – *Nordisches Plankton* 4:1–264, figs 1–251.

Claus, C. 1862. Untersuchungen über die Organisation und Verwandtschaft der Copepoden. – *Verhandlungen der Physikalisch-medizinischen Gesellschaft zu Wurzburg* 3:159–167.

Fosshagen, A. & T.M. Iliffe 1985. Two new genera of Calanoida and a new order of Copepoda, Platycopioida, from marine caves on Bermuda. – *Sarsia* 70:345–358.

Früchtl, F. 1924. Die Cladoceren- und Copepoden-Fauna des Aru-Archipels. Mit Beitragen zur Kenntnis der strukturellen Anomalien indo-pazifischer Plankton-Copepoden. – *Arbeiten aus dem zoologischen Institut der Universität Innsbruck* 2(2):1–114.

Giesbrecht, W. 1902. Copepoda. – In. *Resultats du voyage du S.Y. Belgica. Rapports scientifiques, Zoologie:* 1–49.

Herbst, H.V. 1952. Neue Cyclopoida Gnathostoma (Crustacea Copepoda) des Küstengrundwassers. – *Kieler Meeresforschungen* 9:94–111.

— 1953. Weitere Cyclopoida Gnathostoma (Crustacea Copepoda) des Küstengrundwassers. – *Kieler Meeresforschungen* 9:257–270.

— 1955. Cyclopoida Gnathostoma (Crustacea Copepoda) von der brasilianischen Atlantikkuste. – *Kieler Meeresforschungen* 11:214–229.

— 1964. Cyclopoida Gnathostoma (Crustacea Copepoda) aus dem Litoral und Küstengrundwasser des Roten Meeres. – *Kieler Meeresforschungen* 20: 155–169.

— 1974. Drei interstitielle Cyclopinae (Copepoda) von der Nordseeinsel Sylt. – *Mikrofauna des Meeresbodens* 35:1–17.

Hipeau-Jacquotte, R. 1986. A new cephalic type of presumed sense organ with naked dendritic ends in the atypical male of the parasitic copepod *Pachypygus gibber* (Crustacea). – *Cell and Tissue Research* 245:29–35.

Ho, Ju-shey. 1986. Phylogeny of Cyclopoida. – *Syllogeus* 58:177–183.

Ho, Ju-shey & V.E. Thatcher 1989. A new family of cyclopoid copepods (Ozmanidae) parasitic in the hemocoel of a snail from the Brazilian Amazon. – *Journal of Natural History* 23:903–911.

Huys, R. 1988a. A redescription of the presumed associated *Caligopsyllus primus* Kunz, 1975 (Harpacticoida. Paramesochridae) with emphasis on its phylogenetic affinity with *Apodopsyllus* Kunz, 1962. – *Hydrobiologia* 162:3–19.

— 1988b. *Boxshallia bulbantennulata* gen. et spec. nov. (Copepoda: Misophrioida) from an anchihaline lava pool on Lanzarote, Canary Islands. – *Stygologia* 4:138–154.

Kiefer, F. 1929. Crustacea Copepoda. II. Cyclopoida Gnathostoma. – *Das Tierreich* 53:1–102.

— 1954. Neue Cyclopoida Gnathostoma (Crust. Cop.) aus Madagaskar. I. Cyclopininae und Halicyclopinae. – *Zoologischer Anzeiger* 153:308–313.

Krishnaswamy, S. 1957. *Studies on the Copepoda of Madras.* – Thesis, University of Madras: 1–168.

Lang. K. 1946. Einige für die schwedische Fauna neue marine Cyclopoida Gnathostoma, nebst Bemerkungen über die Systematik der Unterfamilie Cyclopininae. – *Arkiv för Zoologi* (A) 38 (6):1–16.

Lindberg, K. 1953. La sous-famille des Cyclopininae Kiefer (Crustacées Copépodes). – *Arkiv för Zoologi* (B) 4:311–325.

— 1961. Une Cyclopinina nouvelle du sable de la côte Atlantique du Portugal. – *Kungliga Fysiografiska sällskapets i Lund forhandlingar* 31:127–132.

Mohammed, A.A. & V. Neuhof 1985. *Arctocyclopina pagonasta*. a new genus and species of the family Cyclopinidae (Cyclopoida. Copepoda) from the annual sea ice in the Canadian Arctic. – *Canadian Journal of Zoology* 63:2389–2394.

Monchenko, V.I. 1979. *Cryptocyclopina inopinata* gen. et sp.n. (Crustacea, Copepoda) from the interstitial zone of the Caspian sea. – *Zoologicheskii zhurnal* 58:1470–1477.

— 1981. *Cycloporella eximia* gen. et sp.n. (Crustacea, Copepoda) from the interstitial zone of the Black Sea. – *Zoologicheskii zhurnal* 60:984–990.

— 1989. The name *Cyclopinotus* instead of *Cycloporella* (Crustacea, Copepoda). – *Zoologicheskii zhurnal* 68:136–137.

Monniot, C. 1988. Variations morphologiques d'un Copépode Ascidicole en fonction des hôtes et des îles en Polynésie Française. – *Bulletin de la Société Zoologique de France* 111:149–157.

Nishida, S. 1985. Taxonomy and distribution of the family Oithonidae (Copepoda, Cyclopoida) in the Pacific and Indian oceans. – *Bulletin of the Ocean Research Institute University of Tokyo* 20:1–167.

— 1986. Structure and function of the cephalosome-flap organ in the family Oithonidae (Copepoda, Cyclopoida). – *Syllogeus* 58:385–391.

Plesa, C. 1961. New cyclopoids (Crustacea, Copepoda) of the interstitial fauna from the beaches of Ghana. – *Journal of the West African Science Association* 7:1–13.

— 1968. Un nouveau Cyclopoïde interstitiel de la mer de Chine: *Heterocyclopina vietnamensis* n.g., n.sp. (Crustacea. Copepoda). – *Vie et Milieu* (A) 19: 329–344.

Por, F.D. 1979. The Copepoda of Di Zahav Pool (Gulf of Elat, Red Sea). – *Crustaceana* 37:13–34.

Sars, G.O. 1913. Copepoda Cyclopoida. Parts I and II. Oithonidae. Cyclopinidae, Cyclopidae (part). – *An Account of the Crustacea of Norway*. 6:1–31, pls 1–16.

— 1918. Copepoda Cyclopoida. Parts XII and XIV. Lichomolgidae (concluded), Oncaeidae, Corycaeidae, Ergasilidae, Clausiidae, Eunicicolidae, Supplement. – *An Account of the Crustacea of Norway*. 6:173–225, pls 97–118.

Schäfer, H.W. 1936. Cyclopiniden (Crustacea Copepoda) aus der deutschen Nordsee. – *Zoologischer Anzeiger* 114:225–234.

Scott, T. 1901. Notes on gatherings of Crustacea, collected for the most part by the fishery steamer *Garland* and the steam trawler *St. Andrew* of Aberdeen, and examined during the year 1900. – *19th Annual Report of the Fishery Board for Scotland*, part 3:235–280, pls 22–25.

Smirnov, S.S. 1935. Zur Systematik der Copepoden-Familie Cyclopinidae G.O. Sars. – *Zoologischer Anzeiger* 109:203–210.

Steuer, A. 1940. Uber einige Copepoda Cyclopoida der mediterranen Amphioxussande. – *Note dell'Istituto Italo-Germanico di Biologia marina di Rovigno d'Istria* 2(17):1–27.

Vervoort, W. 1964. Free-living Copepoda from Ifaluk Atoll in the Caroline Islands. – *United States National Museum Bulletin* 236:1–431.

Wells, J.B.J. 1967. The littoral Copepoda (Crustacea) on Inhaca Island, Mozambique. – *Transactions of the Royal Society of Edinburg* 67:189–358.

Wilson, C.B. 1932. The copepods of the Woods Hole region. – *Bulletin. United States National Museum* 158:1–635.

Accepted 26 January 1990.