

TWO NEW GENERA OF CALANOIDA AND A NEW ORDER OF COPEPODA, PLATYCOPIOIDA, FROM MARINE CAVES ON BERMUDA

AUDUN FOSSHAGEN & THOMAS M. ILIFFE

SARSIA



FOSSHAGEN, AUDUN & THOMAS M. ILIFFE 1985 12 30. Two new genera of Calanoida and a new order of Copepoda, Platycoptoida, from marine caves on Bermuda. - *Sarsia* 70:345-358. Bergen. ISSN 0036-4827.

The new copepods were taken in inland marine caves. *Erebonectes nesioticus* is a calanoid and considered to belong to the Epacteriscidae and characterized by a 27-segmented 1st antenna of the female, essentially unmodified mouthparts and 3-segmented rami of all legs of both sexes, however, with strongly modified exopods of the 5th legs of the male. *Paracyclopia naessi* is a calanoid and belongs to the Pseudocyclopiidae and resembles *Pseudocyclopia*, but has 24-segmented 1st antennae of the female, a different setation of the endopods of the 1st legs, and simple uniramous 5th legs of the male.

Antrisocopia prehensilis is a platycopiid with geniculate 1st antennae on both sides of the male, with both sexes having essentially similar 5th legs and 5-segmented urosomes. *Platycoptia* and *Antrisocopia* are considered to represent a new order, the Platycoptoida, separate from the Calanoida within the gymnoplean lineage.

Antrisocopia and *Erebonectes* can be regarded as 'living fossils,' and it is possible that specific caves serve as refugia for rare or less competitive species.

Audun Fosshagen, Department of Marine Biology, University of Bergen, N-5065 Blomsterdalen, Norway. - Thomas M. Iliffe, Bermuda Biological Station for Research, Ferry Reach 1-15, Bermuda.

INTRODUCTION

In recent years unexpectedly rich and diverse biological communities have been found in totally submerged marine caves accessible primarily through cave diving and several groups of high taxonomic value have been discovered. A new class of Crustacea, Remipedia, has been found in caves in the Bahamas and Canary Island (YAGER 1981; ILIFFE & al. 1984). In the limestone caves on Bermuda, Mictacea, a new order of Peracarida (BOWMAN & ILIFFE 1985), and Atlantasellidae, a new family of Isopoda (SKET 1979), have been recorded.

SKET & ILIFFE (1980) reported more than 100 species of macroinvertebrates, including several copepods, from the inland marine caves on Bermuda. More than one third of these were new species. The possible routes by which these cavernicoles reached Bermuda were discussed by ILIFFE & al. (1983). Two calanoids, *Ridgewayia marki* ESTERLY, 1911 and *Miostephos leamingtonensis* YEATMAN, 1980, have previously been reported and described from caves in Bermuda (YEATMAN 1969 and 1980).

I the present investigation, copepods were found inhabiting almost all of Bermuda's marine caves and several new species were discovered. Three of the

most conspicuous new copepods, all belonging to new genera, are described in this paper.

MATERIAL AND METHODS

The copepods were mostly obtained using advanced diving techniques. They were caught when seen or accidentally taken when dragging a fine-meshed net (> 100 µm) through the water. The localities from which they were taken are shown in Fig. 1. All type material is kept in the American Museum of Natural History (AMNH), New York.

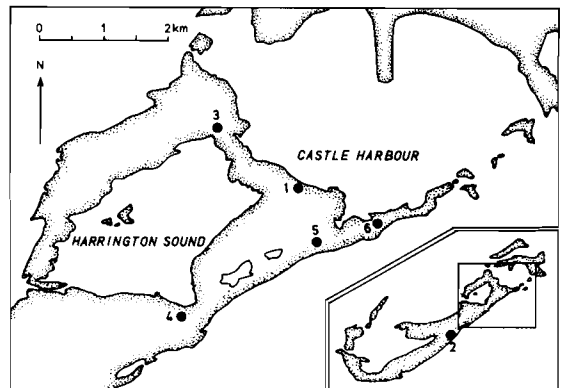


Fig. 1. Map of Bermuda showing the sampling area. 1. Christie's Cave. 2. Devonshire Cave. 3. Roadside Cave. 4. Chalk Cave. 5. Southdown Cave. 6. Tucker's Town Cave.

THE SPECIES

Order Calanoida Sars, 1903

Family Epacteriscidae FOSSHAGEN, 1973 (emend.).

The family consists of three genera: *Epacteriscus* FOSSHAGEN, 1973, *Enantiosis* BARR, 1984, and *Erebonectes* gen. n.

Prosoma with all 5 pedigers free. Urosome 3–4-segmented in female and 4–5-segmented in male. Female genital segment produced ventrally with genital openings close together.

Rostrum bifurcate, bearing filaments. 1st antenna of female 24–27-segmented; right antenna of male geniculate. Mouthparts may be reduced. Endopod of mandible reduced or absent, gnathobase may bear ventral process. Endopod of 1st maxilla elongate. Strong spinous setae on endopod of 2nd maxilla and maxilliped. All legs of female with 3-segmented rami. 5th legs of male modified, particularly in the exopods, into a complex grasping organ in *Enantiosis* and *Erebonectes* gen. n., only slightly modified in *Epacteriscus*.

Erebonectes FOSSHAGEN gen. n.

Urosome 4-segmented in female and 5-segmented in male. Both female and male left 1st antenna 27-segmented. Endopod of 2nd antenna longer than exopod. Endopod of mandible 2-segmented, reduced. Maxilliped with 5-segmented endopod. All legs of female bear 2 outer spines on third segment of exopod. Male 5th legs form a complex grasping organ with highly modified exopods.

Erebonectes nesioticus FOSSHAGEN gen. et sp.n.

Material. The species was obtained at only two localities; Christie's Cave, Hamilton Parish, 24 November 1982 (1 ♀) and 30 August 1984 (1 ♂) and Devonshire Cave, Devonshire Parish, 12 September 1984 (1 ♀). Both caves are located c. 50 m from open water.

Holotype. Adult male, total length 1.75 mm, from Christie's Cave 30 August 1984, taken at a depth of c. 4 m. Four slides deposited in AMNH Cat. No. 11 312.

Paratypes. Adult female, total length 1.90 mm, from Christie's Cave, 24 November 1982. Ten slides. One adult female total length 1.73 mm from Devonshire Cave 12 September 1984 taken at a depth between 6 and 10 m. One vial. Deposited in AMNH, Cat. No. 11 313.

Etymology. From Erebus (G) – place of nether darkness, nektos (G) – swimming, and nesioticus (G) – belonging to an island, referring to the dark caves on Bermuda where the species can be seen swimming.

Description

Adult female

(Figs 2, 3, 4A–B)

The total length of 2 individuals was 1.73 and 1.90

mm respectively. The body is robust. In dorsal view the prosoma is broad, with the last segment rounded posteriorly. The prosoma is about three times the length of the urosome. The urosome is 4-segmented. The genital segment is produced posteroventrally; 2nd and 3rd segments are finely striated at posterior margins; the anal segment is short with a smooth posterior margin. The caudal rami bear 6 plumose setae. The second from innermost apical seta is very long, reaching nearly the total length of the body. The rostrum is directed downwards, bifurcate and with filaments.

The 1st antenna is 27-segmented, extending backwards to the posterior end of the prosoma. Proximal segments bear short pointed setae. Particularly long setae are present on segments 5, 9, 14, and 20. The distal segment is very short.

The 2nd antenna has a well-developed endopod about twice the length of the exopod. The exopod is 8-segmented with 11 setae.

The mandible has 4 setae along the inner margin of the basipod; endopod short, 2-segmented; exopod strongly developed. The gnathobasis bears 4 strong rounded bicuspid teeth on ventral part, more pointed and spinous teeth on dorsal part.

The 1st maxilla is well-developed with shape commonly found among calanoids, but with elongate, slender endopod.

The 2nd maxilla bears strong spinous setae especially on the distal part. The first endite of the basipod bears 6 setae.

The maxilliped has a 5-segmented endopod with several strong spinous setae. One apical seta is twisted.

The legs are generally unmodified with 3-segmented rami. All legs have 2 outer spines on the third exopodal segment. The outer spines on the exopod of 1st leg are long and slender. The outer margin of the second basipod on all legs is armed, in 1st, 4th, and 5th legs with a small seta, in 2nd and 3rd legs with a strong spine. The 5th legs have a small seta on the inner margin of the first exopodal segment.

Adult male

(Fig. 4C–E)

The total length of the single specimen was 1.75 mm. It differs from the female in its 5-segmented urosome, the geniculate right 1st antenna, and the 5th legs.

The right 1st antenna is 23-segmented. Segments 2–4 are partly fused. There is a distinct geniculation between segments 18 and 19. A weak suture separates segments 19 and 20. Segment 20 has a

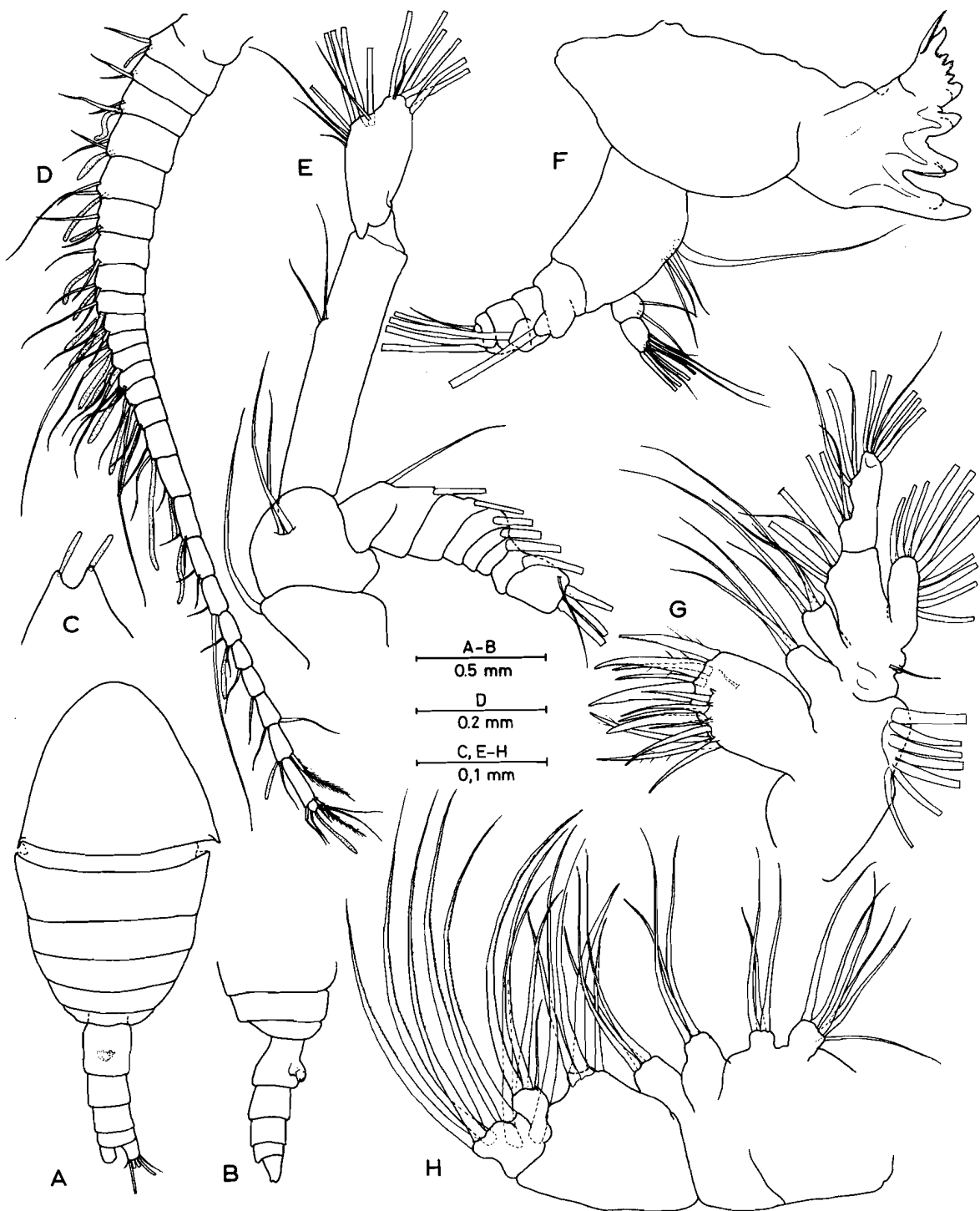


Fig. 2. *Erebonectes nesioticus* gen. et sp.n., ♀. A. Dorsal view. B. Urosome, lateral view. C. Rostrum. D. 1st antenna. E. 2nd antenna. F. Mandible. G. 1st maxilla. H. 2nd maxilla.

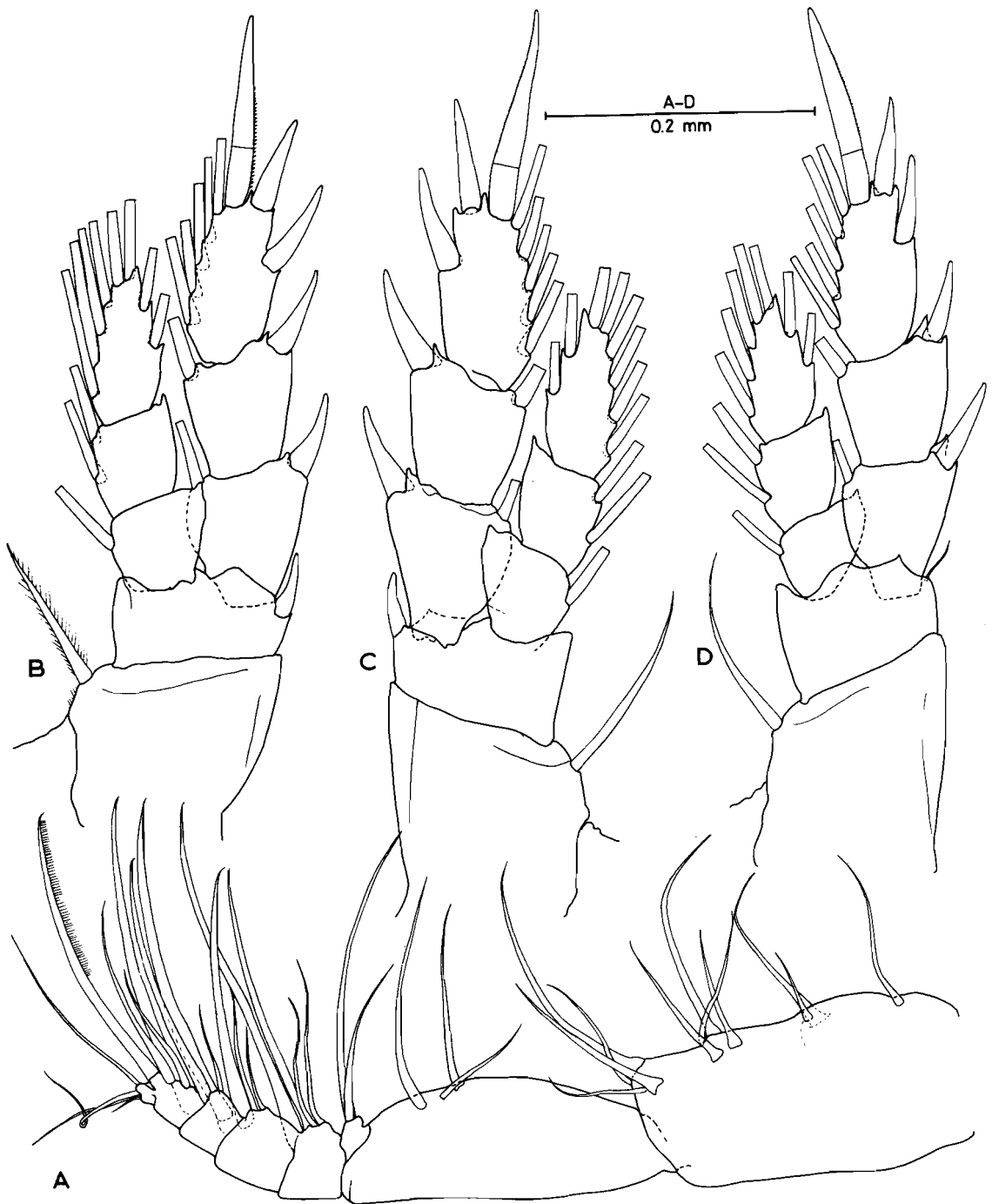


Fig. 3. *Erebonectes nesioticus* gen. et sp.n., ♀. A. Maxilliped. B. 2nd leg. C. 3rd leg. D. 4th leg.

pointed process distally, and segment 21 a stylet-like spine in the same position.

The 5th legs have 3-segmented rami with highly

modified exopods. The endopods are only slightly modified, very similar to those of the female except for a dense hairy patch along the outer side of the

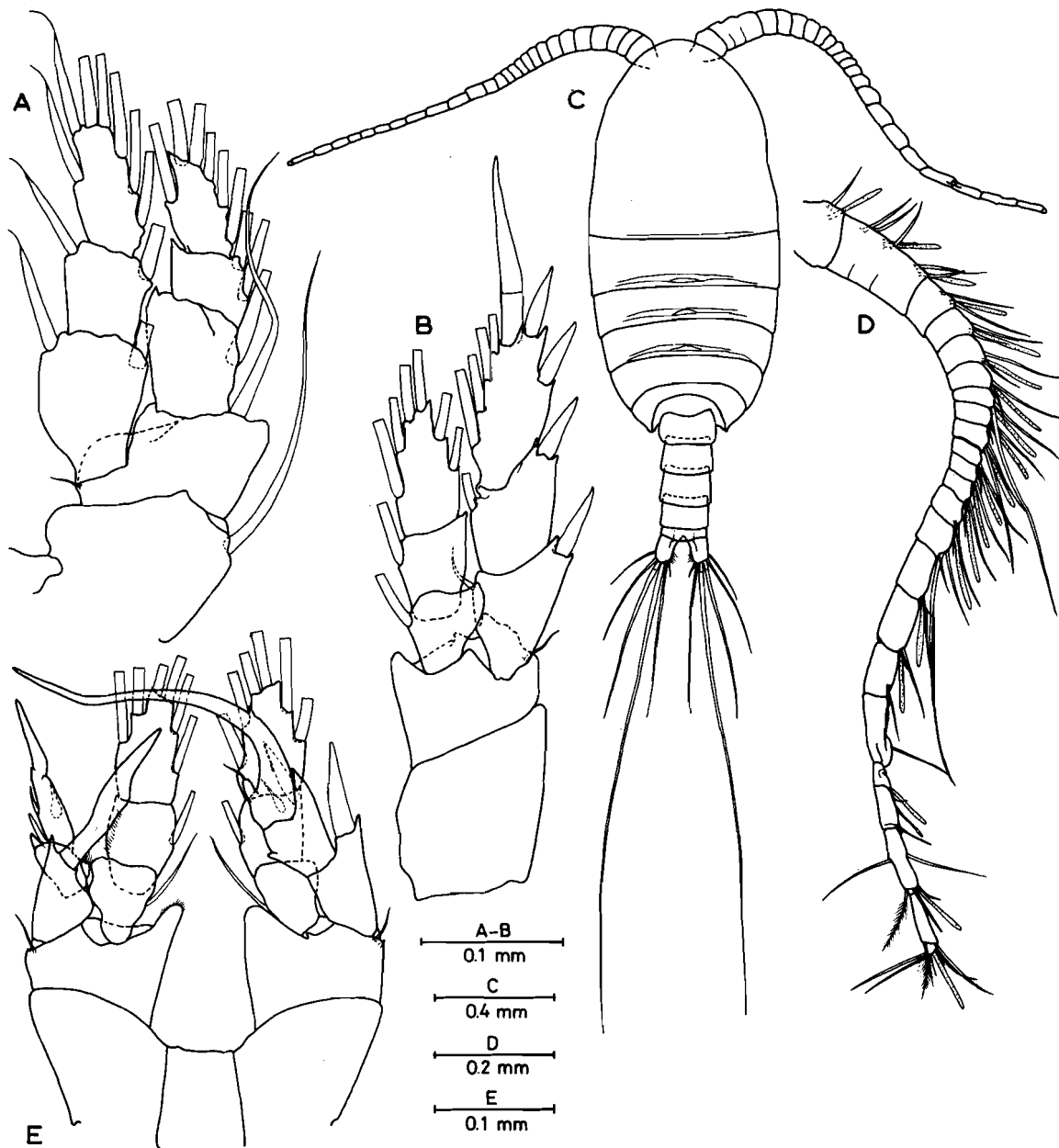


Fig. 4. *Erebonectes nesioticus* gen. et. sp.n., A-B ♀, C-E ♂. A. 1st leg. B. 5th leg. C. Dorsal view. D. Right 1st antenna. E. 5th legs, anterior view.

second segment of the left leg. The second basipods each have a small seta near the outer distal corner. The inner distal corner of the left leg is produced into a rounded process with fine hairs. The left exopod bears a large irregular unflanged spine on first segment. Second segment is short with an

angular process and an unflanged spine on the outer margin and a lappet-like structure bearing setules on the medial margin. The third segment is long and pointed distally. About one third along the segment there are 2 styliform spines, one on each side. About halfway along the segment there are 2 notches. The

right exopod in most parts can be compared with the left one. The first and second segment each bear a strong spine, weakly serrate along its distal inner margin; the spine on first segment is somewhat stronger than that on second segment. Second segment has a strong pointed process on outer distal margin, and a notch about halfway along inner margin. The third segment ends in a very long recurved spine with a distinct notch laterally about one third its length. On the posterior side near the base of the third segment a styliiform spine is situated. Proximally, the inner margin bears a rounded process or tubercle carrying distally a seta-like structure.

Remarks

The two caves in which *E. nesioticus* was found are about 5 km apart. Both caves are only remotely connected with the sea as evidenced by their clear waters and lack of normal littoral fauna.

In both caves, the common cavernicolous calanoid *Ridgewayia marki* was observed. Our specimens of *E. nesioticus* were collected from depths between 4 and 10 m. The single male from Christie's Cave was seen swimming in the free water-masses at a depth of c. 4 m, and was caught in a jar. The living animal was whitish with no visible eye spot. In the laboratory, the male swam slowly at an even pace with the 1st antennae directed forward with an angle of approximately 120° between them. The 2nd maxillae and maxillipeds were in a downward position, forming a basket-like structure, probably used for catching its prey. At times the animal turned over, swimming with its dorsal side down.

Discussion

Erebonectes nesioticus shows many similarities to *Epacteriscus* FOSSHAGEN, 1973 and *Enantiosis* BARR, 1984. There can be little doubt that *E. nesioticus* belongs to the Epacteriscidae, and that it is most closely related to *Enantiosis*.

It is reminiscent of *Enantiosis* in the 1st antenna, with modified setae in proximal part and extra long setae on corresponding segments, in the reduced endopod and similar teeth of the mandible, in the elongate endopod of the 1st maxilla, and in the spinous setae of the 2nd maxilla and maxilliped.

Erebonectes has the least-modified mouthparts in the family and the highest number of setae or spines on them. *Epacteriscus* is the most transformed with its serrate process on the mandible and the reduced 1st maxilla. The structure of the mouthparts may indicate different degrees of development of a

predaceous lifestyle, with *Erebonectes* the least and *Epacteriscus* the most voracious.

All legs of female epacteriscids have 3-segmented rami. *E. nesioticus* has one spine less than the other species on the outer margin of the last exopodal segment of 3rd–5th legs, but is armed with a seta or spine on the outer margin of the second basipod of all legs. The degree of modification of the male 5th legs in epacteriscids differs greatly, very slight in *Epacteriscus* and strong in *Enantiosis*. It is most pronounced in the exopods, where both *Erebonectes* and *Enantiosis* have a prehensile terminal segment on the right side.

Erebonectes may be considered one of the most primitive of known calanoids, with its 27-segmented 1st antenna, 8-segmented exopod of 2nd antenna, and the 3-segmented swimming legs.

Family Pseudocyclopiidae Sars, 1902 (emend.)

The family consists of two genera: *Pseudocyclopia* T. SCOTT, 1892 and *Paracyclopia* gen. n.

Body compact. Cephalosome and 1st pediger as well as 4th and 5th pedigers fused. Urosome 4-segmented in female and 5-segmented in male. Rostrum strong and pointed. 1st antenna short, sometimes with fused segments proximally, not reaching beyond 1st pediger. There may be a slight sexual dimorphism. Endopod of 2nd antenna imperfectly separated from basipod, of same length or longer than the exopod. Mouthparts normally developed. A strong and spinous seta present on inner margin of first basipodal segment of 2nd–4th legs. 5th legs of female simple and short. 5th legs of male uniramous, asymmetrical, sometimes with complex structure, right leg longer and more slender than left leg.

Paracyclopia FOSSHAGEN gen.n.

In dorsal view prosome broadest at about one third from posterior end. Posterior margins of urosomal segments, except anal segment, finely striated. 1st antenna reaches about half length of prosome, 24-segmented in female, 23-segmented on right side of male. Exopod and endopod of 2nd antenna of equal length. Mandibular blade with fine hyaline teeth. Endopod of 1st leg with 4 setae. A long strong spine, flanged distally, on inner distal margin of first basipodal segment of 2nd–4th legs. 5th legs 2-segmented in female, ending distally in two points; in male, simple, slender, asymmetrical with right side longer.

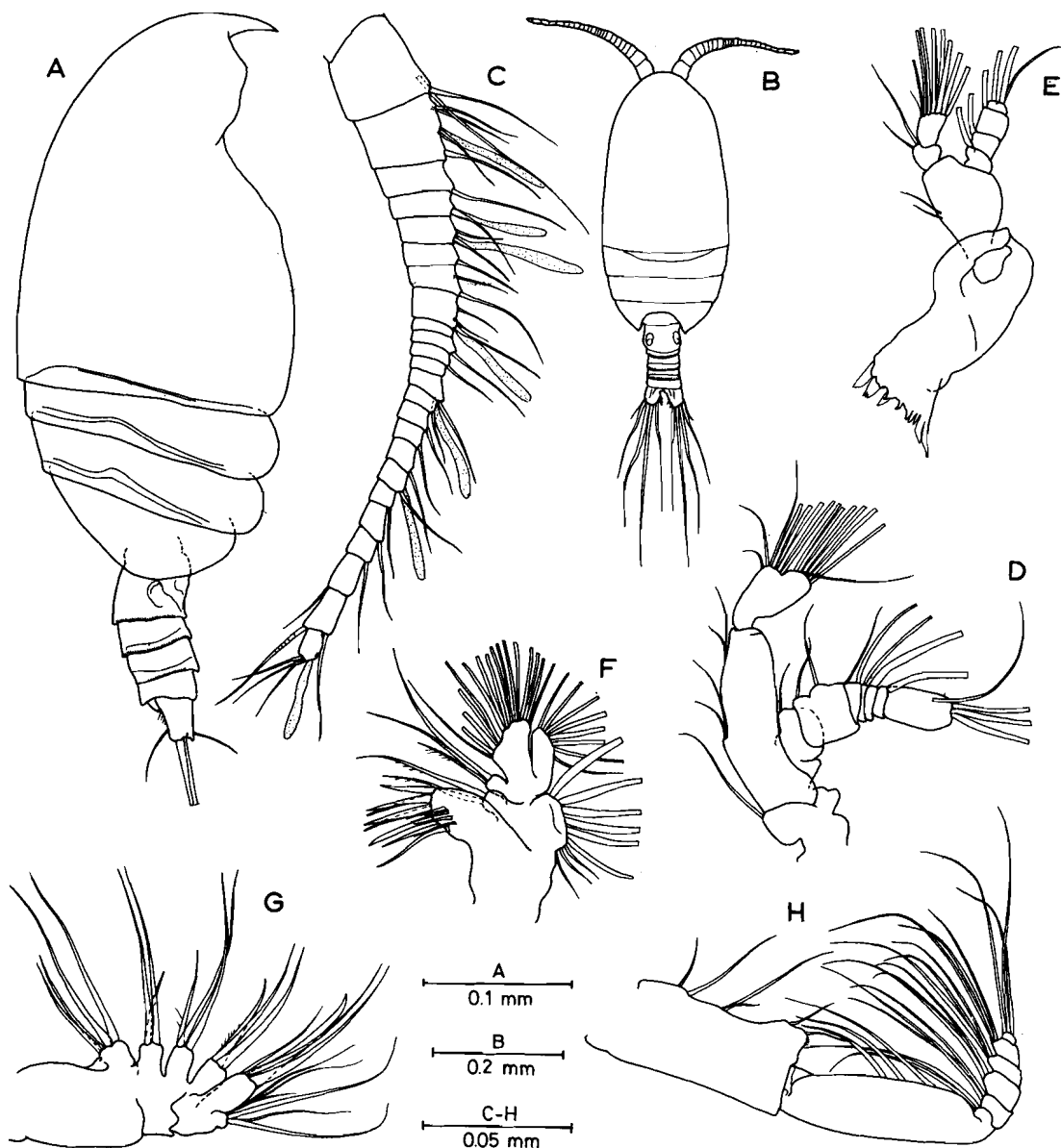


Fig. 5. *Paracyclopia naessi* gen. et sp.n., ♀. A. Lateral view. B. Dorsal view. C. 1st antenna. D. 2nd antenna. E. Mandible. F. 1st maxilla. G. 2nd maxilla. H. Maxilliped.

Paracyclopia naessi FOSSHAGEN gen. et sp.n.

Material. This species has been collected at 6 localities: Chalk Cave, Smith's Parish, 31 August 1982 (1 copepodid); Christie's Cave, Hamilton Parish, 1 September 1982 (1 ♂, 4 ♀♀, 3 copepodids) and 28 November 1983 (1 ♀, 1 copepodid); Devonshire Cave, Devonshire Parish, 12 September 1984 (12 ♀♀, 4 ♂♂, 33 copepodids); Roadside Cave, Hamilton Parish, 27 September 1984 (1 ♀); Southdown Cave, St. George's Parish, 10 September 1984 (1 ♂, 3 ♀♀, 3 copepodids); Tucker's Town Cave, St.

George's Parish, 11 February 1982 (1 copepodid) and 8 September 1982 (1 ♀).

Holotype. Adult female, total length 0.51 mm from Devonshire Cave 12 September 1984 at a depth of c. 0.5 m. One vial deposited in AMNH, Cat. No. 11 314.

Paratypes. Adult male, 0.50 mm, from the same locality and date as the holotype. Three slides. One male, 0.47 mm, and one female, 0.51 mm, from Christie's Cave, 1 September 1982, 0-1.5 m depth. Mounted on 5 and 7 slides respectively. AMNH, Cat. No. 11 315.

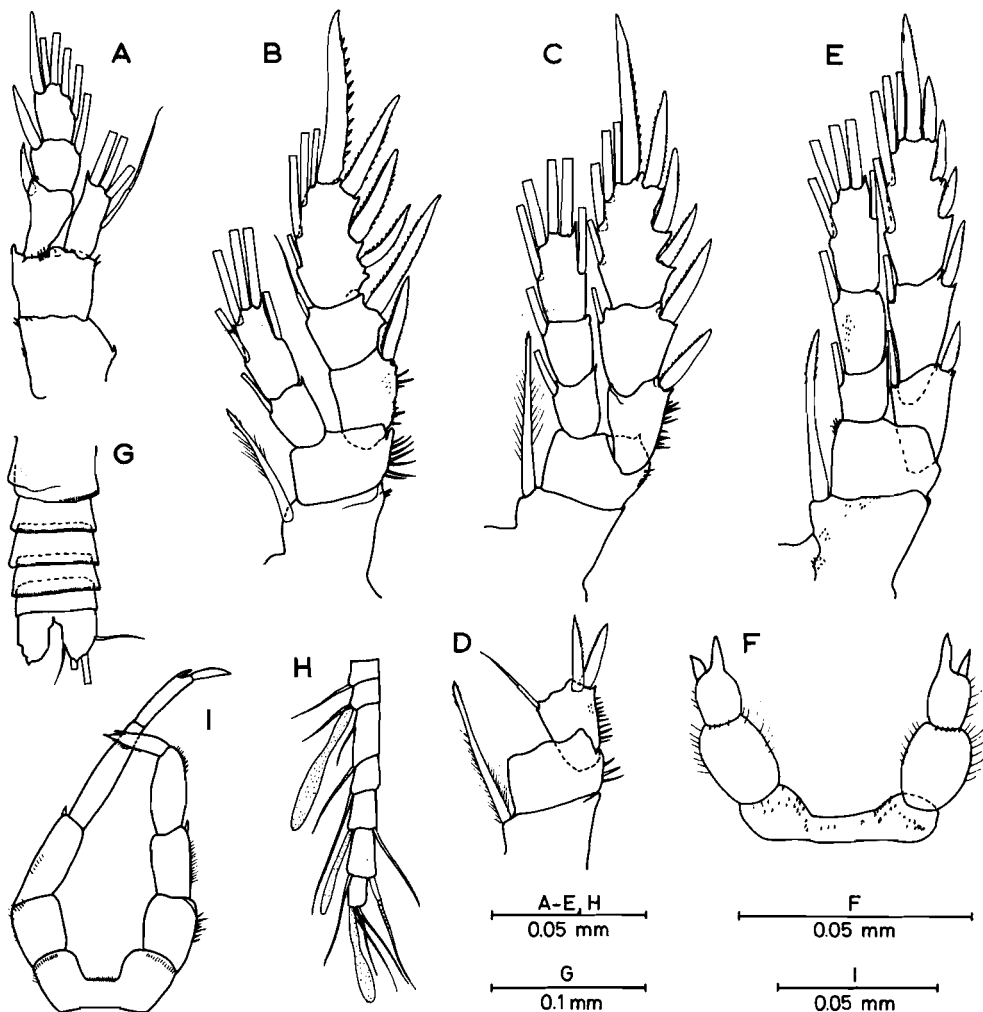


Fig 6. *Paracyclopia naessi* gen. et sp. n., A-C ♀, D♂, E-F ♀, G-I ♂. A. 1st leg. B. 2nd leg. C. 3rd leg. D. 3rd leg with basipod and first segment of exopod. E. 4th leg. F. 5th legs. G. Urosome, dorsal view. H. 1st antenna, distal part of right side. I. 5th legs.

Etymology. The generic name refers to the similarity to *Pseudocyclopia*, para (G) – beside. The specific name is in honor of Dr h.c. Erling Dekke Næss, a longtime trustee of Bermuda Biological Station.

Description

Adult female
(Figs 5, 6A-C, E-F)

The total length of 9 individuals ranged between 0.50 and 0.53 mm, with an average of 0.52 mm.

The body is laterally compressed, robust and ovoid. The cephalosome and 1st pediger and the 4th and 5th pedigers are fused. The urosome is 4-segmented with a finely striated posterior margin on

the first 3 segments. The genital segment has 2 distinct, widely separated seminal receptacles. There are 6 caudal setae; some of the apical setae are bent in more than one direction. The rostrum is strong, directed downwards and ending in a single point.

The 1st antenna is 24-segmented, slightly more than half the length of the prosome. Segments 9–12 are particularly short.

The rami of the 2nd antenna are subequal in length. The exopod is 7-segmented, and well equipped with setae along inner margin. The mandibular blade bears very thin and hyaline teeth in distal part.

The other mouthparts are of a normal shape and very similar to those of, for instance, *Pseudocyclopia*

stephoides THOMPSON, 1895. The endopod of the 2nd maxilla has some thin and treadlike setae. The maxilliped has long and slender setae on the endopod. The terminal segment has 4 setae; the outer margin of the endopod lacks setae.

The legs agree with the main features of those of *Pseudocyclopia*. They differ in some details as follows:

The endopod of the 1st legs has 3 apical setae and 1 seta in the middle of the inner margin.

The 2nd to 4th legs bear a very strong spine on the inner margin of the first basipodal segment, which is serrate distally.

The 2nd and 3rd legs have strong spinules along the outer margin of the second basipodal segment and the first exopodal segment. In several specimens the first exopodal segment of the 3rd legs has 2 outer spines.

The 5th legs are small and uniramous, with 2 segments of equal length. The first segment is broad, the second more slender, ending in a point, and with an outer ledge bearing a stout spine.

Adult male
(Fig. 6D, G-1)

The total length of 6 specimens ranged between 0.46 and 0.50 mm, with an average of 0.49 mm. The male differs from the female in the 5-segmented urosome, slightly in the 1st antenna, and in the 5th legs. The first urosomal segment is slightly asymmetrical with an extension on the left side.

The left 1st antenna is like that of the female; the right 1st antenna 23-segmented due to fusion of 2 segments equivalent to segments 19 and 20 in the female.

The 5th legs are simple and uniramous, with rows of stiff spinules, particularly on the outer margins. The right leg is 5-segmented, and slightly longer than the 4-segmented left leg. The right leg ends in a short, flattened and pointed segment, while the left leg terminates in 2 points, an outer short and slender point, and a distal gradually tapering point.

Remarks

The 6 caves containing *P. naessi* lack direct connections with the sea. Chalk Cave, Christie's Cave, and Devonshire Cave are located c. 50 m from open water. Roadside Cave is 110 m and Tucker's Town Cave 125 m away from the sea. For Roadside Cave, Southdown Cave, and Tucker's Town Cave the tidal range (in percentage of open water) and tidal lag (in minutes) are respectively, 57 and 80, 48 and 82, 62 and 58.

The copepod was found in small numbers except

in Devonshire Cave, where 49 specimens were obtained. Living animals are colourless. Some were observed swimming slowly along the substrate while the endopod of the maxilliped was vibrating rapidly stirring up particles from the bottom.

Until now the only records of the family are from the British Isles and Norway (SARS 1903 and 1921). SARS (op.cit.) collected the three Norwegian species of *Pseudocyclopia* on muddy bottoms from about 50–120 m depth. It is therefore of considerable biogeographical interest now to find a closely-related genus from the caves of Bermuda.

Order Platycopioidea FOSSHAGEN ordo n.

Major body division between pediger 5 and segment posterior to it. Urosome with the same number of segments in both sexes. 1st antennae of male symmetrical, nongeniculate or geniculate on both sides. 2nd–5th legs with two outer spines on first exopodal segment. 5th legs well-developed, symmetrical in both sexes, modified or not in male.

Family Platycopiidae SARS, 1911 (emend.)

The family consists of the two genera *Platycopia* SARS, 1911 and *Antrisocopia* gen. n.

Body compact with all pedigers free. Urosome 4- or 5-segmented. Rostrum pointed. 1st antennae short with proximal part thickened, with some 'jointed' aesthetascs. 2nd antenna biramous, with exopod longer than endopod. Mandibular blade slender with few and strong teeth, endopod 1-segmented. 1st maxilla with strong spines on first inner lobe and reduced number of setae on the other lobes. 2nd–5th legs flattened and strongly built. 5th legs modified in male of *Platycopia*, in *Antrisocopia* alike in both sexes.

Antrisocopia FOSSHAGEN gen.n.

Urosome 5-segmented in both sexes. 1st antenna greatly distended proximally, geniculate on both sides in male. Exopod of 2nd antenna slender, with 8 segments, of which some are partly fused. Exopod of mandible 5-segmented. First inner lobe of 1st maxilla with a reduced number of strong, simple spines. 2nd maxilla prehensile with 2 very strong claw-like spines distally. Maxilliped of usual shape, long and slender with reduced number of setae. Both rami of 1st leg 2-segmented. Exopods of 2nd–4th legs armed with strong spines along the outer margin, otherwise the legs furnished with setae, last segment of endopods of 2nd–4th legs with 7, 7, and 5 setae respectively. 5th legs of both sexes alike, slightly modified, with a strong spine on anterior surface of first endopodal segment.

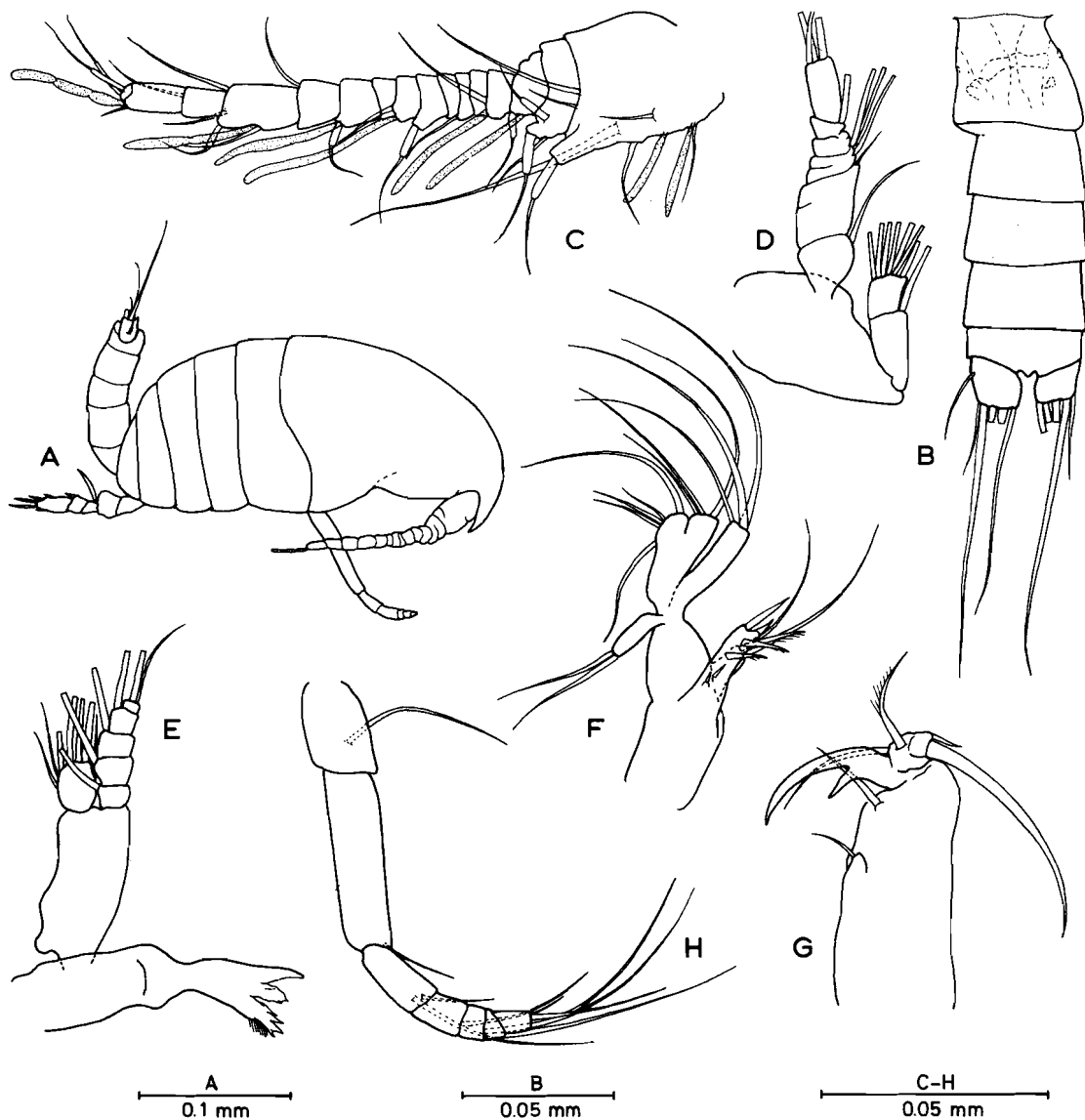


Fig. 7. *Antrisocopia prehensilis* gen. et sp.n., ♀. A. Lateral view. B. Urosome, ventral view (slightly pressed). C. 1st antenna. D. 2nd antenna. E. Mandible. F. 1st maxilla. G. 2nd maxilla. H. Maxilliped.

Antrisocopia prehensilis FOSSHAGEN gen. et sp.n.

Material. This species was obtained at only one locality: Roadside Cave, Hamilton Parish, 27 August 1982. It was caught with a long-handled dip-net at 0–1.5 m depth (3 ♀♀, 2 ♂♂, 2 copepodids).

Holotype. Adult male, total length 0.35 mm, from Roadside Cave 27 August 1982 at a depth of 0–1.5 m. One vial deposited in AMNH, Cat. No. 11 316.

Paratypes. Two adult females, both 0.37 mm, 1 adult male, 0.34 mm from the same locality and depth as the holotype. Mounted on 3, 11, and 7 slides respectively. Deposited in AMNH, Cat. No. 11 317.

Etymology. From antron (G.) – cave, isos (G.) – similar, kope (G.) – oar, and prehens (L.) – seized. The name refers to the cave-dwelling habits of the species which has similar feet of both sexes and a prehensile structure of both 1st antennae of the male.

Description

Adult female
(Figs 7, 8A–E)

The total lengths were 0.35, 0.37, and 0.37 mm. The body is slightly compressed dorsoventrally. The

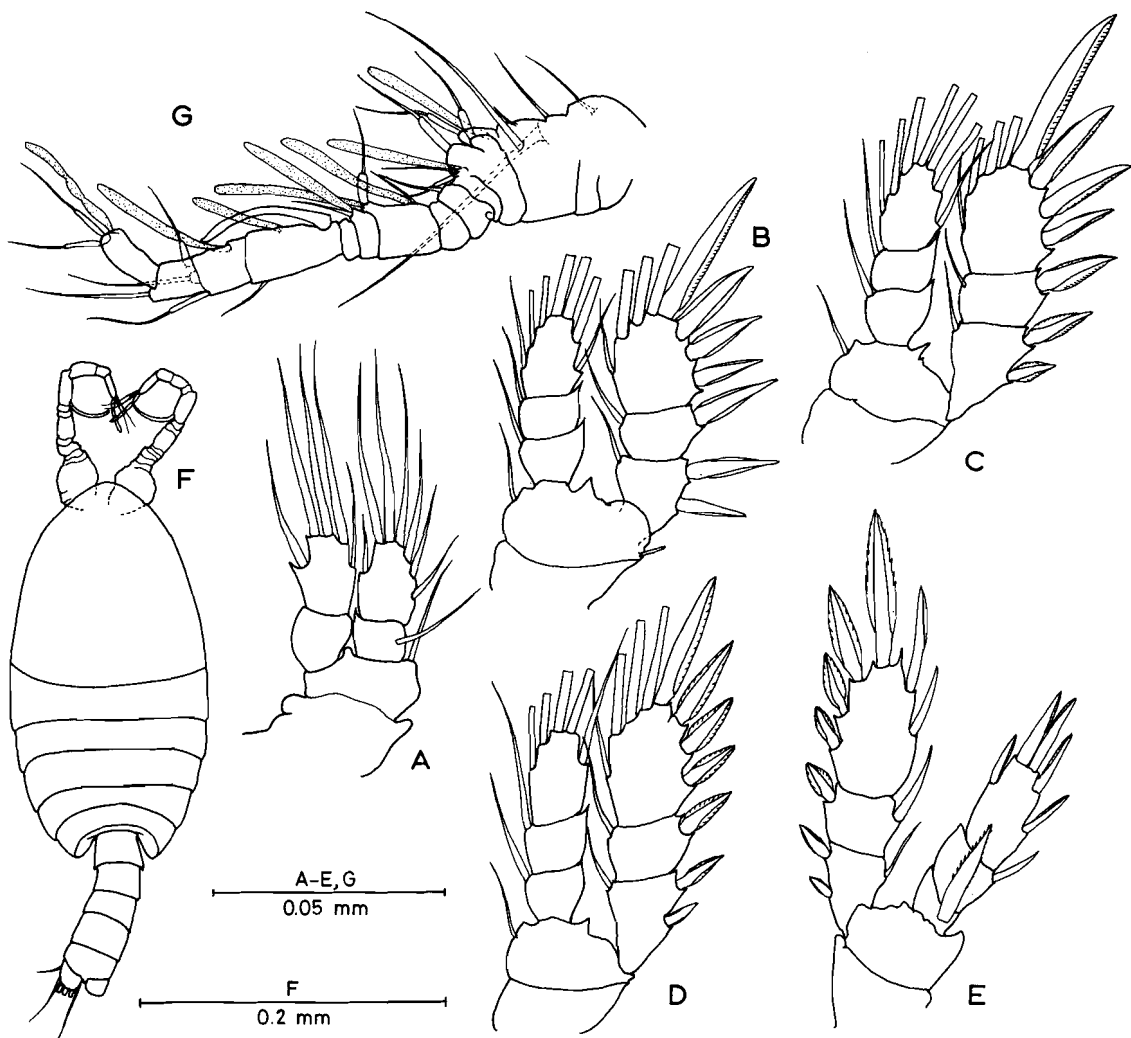


Fig. 8. *Antrisocopia prehensilis* gen. et sp.n. A-E ♀, F-G ♂. A. 1st leg. B. 2nd leg. C. 3rd leg. D. 4th leg. E. 5th leg. F. Dorsal view. G. 1st antenna.

prosoma is ovoid in dorsal view. All 5 pedigers are free; last pediger rounded. The urosome is 5-segmented, about half the length of the prosoma. The first segment is slightly swollen laterally. A weak transverse narrow plate is seen in the middle of the segment in cleared specimens, but a distinct genital apparatus was not discerned. The following 3 segments are subequal in length, the anal segment is shorter. The caudal rami are wider than long, with 6 setae.

The rostrum is strong, ending in a single point.

The 1st antenna extends backwards slightly beyond the cephalosome. Its proximal part is greatly thickened, consisting of several fused or partly fused segments. Beyond the distended part are 12 clearly

defined segments. Distally on the distended part some of the setae arise from elongate lobes. Two types of setae are present, one with a distended stiff proximal part, and the other of an ordinary shape of a gradually tapering seta. Delicate aesthetascs occur along most of the antenna. The most distal aesthetasc has 2 constrictions, 'joints', and at least a few others were observed with 1 constriction.

In the 2nd antenna the two rami are widely separated. The exopod is slender with 8 segments, some of which are partly fused. The endopod is 2-segmented, short, and bearing 7 long terminal setae on the last segment.

The anteromedial part of labrum is armed with 6-7 posteriorly directed spines.

The mandible has a slender 5-segmented exopod and a short 1-segmented endopod. The gnathobasis bears 3 prominent teeth, ventral tooth is smooth and pointed, dorsal tooth is coarsely serrate.

The 1st maxilla is similar to that of *Platycopia*, but with less-developed inner lobes. The first inner lobe bears about 7 simple spines of various lengths, the second inner lobe with 2 long setae. The exopod has 8 setae of various lengths.

The 2nd maxilla is strongly prehensile bearing distally 2 prominent claw-like structures, one long and slender, the other short and stout and armed proximally with a strong spine.

The maxilliped is slender, with a reduced number of setae and a 5-segmented endopod.

The exopod and endopod of the 1st leg bear 5 and 7 setae respectively on the last segment. The first segment of the endopod has a medial seta on the inner margin.

The 2nd–4th legs have the same segmentation as *Platycopia inornata* FOSSHAGEN, 1972, but the armament is less modified. The inner margin of the exopods generally has a higher number of setae and the spines on the endopods are replaced by setae in *A. prehensilis*, although not necessarily by the same number.

The 2nd and 3rd legs have very similar armament except for one spine less on the outer margin of the second basipod of the 3rd leg. Both legs have 4 setae along the inner margin of the last exopodal segments, though proximal seta is minute, and 7 setae on last segment of endopods.

The 4th leg differs from the 3rd mainly in bearing 5 setae on the last segment of the endopod.

In the 5th leg there is a reduction in armament on the inner margin of the last segment of the exopod, which bears 2 slender spines. The second segment has a spine on its inner margin. The endopod has the same armament as the 4th leg, but all setae have become spines. The first segment bears the strongest spine, which is serrate and directed dorsally.

Adult male (Fig. 8F–G)

The total lengths were 0.34 and 0.35 mm. The body is probably more dorsoventrally compressed than in the female. No distinct structure of the urosome and the 5th legs distinguishing male from the female was seen. The male differs from the female mainly in the geniculate 1st antennae on both sides.

In the 1st antenna there is a fusion leaving 9 free segments beyond the distended proximal part. Starting proximally from distal segment of thickened part, the third segment consists of fused ones. The following 2 narrow segments are the same as those

found in the female. The sixth segment is elongate and consists of 2 fused segments. It bears a very strong, curved blunt proximal spine which together with the tip of the antenna seems to form a prehensile apparatus.

Remarks

Roadside Cave from which *A. prehensilis* was obtained is located 110 m from Harrington Sound (Fig. 1), but has no visible connection with the sea or other caves. Tides in the pool are 57 % of those in the open ocean with a lag of 80 minutes. The water is very clear with no visible particles.

All specimens were obtained in one sample collected in 1982 with a long-handled dip-net from open water as well as close to the bottom, the net stirring up the gravelly sediments. Repeated sampling from the same locality two years later produced no additional specimens. Also present in the cave is another new platycopiid genus, a new genus of a misophrioid (BOXSHALL & ILIFFE in press), and the peracarid order Mictacea. Thus, this cave may serve as a refugium for rare and probably less competitive species.

Discussion

A. prehensilis combines characters from both *Gymnoplea* and *Podoplea*. The position of the prosome-urosomal articulation indicates that it belongs to the *Gymnoplea*.

It is related to the aberrant genus *Platycopia* which comprises five species from 60 to 120 m in southern Norway, and from shallow water in Maine and the Bahamas (FOSSHAGEN 1972).

A. prehensilis has to be included in the family Platycopiidae because of the two spines on the outer margin of the first segment of the exopods, a character found only in *Platycopia* hitherto. Further resemblance to *Platycopia* is found in the 1st antenna with its distended proximal part and jointed aesthetascs, and in similarities of the mandible and the 1st maxilla.

Unique characters of *A. prehensilis* are 1) the 1st antenna of the male geniculate on both sides, the only sexual dimorphism, 2) well-developed 5th legs similar in both sexes with 3-segmented rami, and 3) a 5-segmented urosome in both sexes.

Symmetrical 1st antennae which are geniculate on both sides of the male is a podoplean character, not found among calanoids. In *Platycopia inornata* the male 1st antennae are symmetrical with fused segments, but without any indication of a geniculation.

The 1st antennae of *A. prehensilis* are reminiscent of some misophrioids, for instance *Misophria pallida*

BOECK (SARS 1911). Also the 'jointed' aesthetascs are present in this podoplean group as illustrated in *Benthomisophria* SARS by BOXSHALL & ROE (1980).

Bilateral, geniculate 1st antennae of male podopleans seem to be combined with simple, symmetrical and similar 5th legs of both sexes. The 5th legs of *A. prehensilis* are, however, better developed than among podopleans, and they differ little from those of female *Platycopia* except for a particularly strong and dorsally directed spine on the first endopodal segment. This is an unusual modification and not present in female calanoids.

Also the urosome of *A. prehensilis* deviates from that of calanoids, being 5-segmented in both sexes and with no recognizable sexual difference. Similarity of the urosome between the sexes is also found in *Platycopia*, but the number of segments of both sexes is four. In misophrioids, however, the number of urosomal segments posterior to the 5th legs is five in both sexes. In this group, 6th legs or traces of such a limb are found (BOXSHALL 1983). A possible explanation of the transverse structure seen in the first urosomal segment of *A. prehensilis* in both sexes might be traces of an intercoxal sclerite of the 6th legs. This has to be verified with more material.

A. prehensilis shows many plesiomorphic characters although it has specialized mouthparts. Most certainly it is a raptorial feeder and a bottom-dweller. Such a way of life, rather than a planktonic one, is considered by several authors, for instance MARCOTTE (1982) and NOODT (1971), to be original for a copepod.

A. prehensilis agrees in many ways with the description made by BOXSHALL, FERRARI & TIEMANN (1984) of a theoretical ancestral copepod, having the same number of body segments, and with bilateral, geniculate 1st antennae in the male as the only sexual dimorphism.

It may be considered that *Antrisocopia* has retained more ancestral characters than *Platycopia*. This supports the view of GURNEY (1931) who suggested that geniculate 1st antennae on both sides might be a primitive feature in gymnopleans. Thus during evolution loss of geniculation seems to be compensated for by a differentiated or complex structure of the 5th legs in some males, as revealed in *Platycopia*.

LANG (1948) suggested placing Platycopiidae in its own suborder, Progymnoplea. This suggestion now gains support with the discovery of *Antrisocopia*.

The establishment of a new order, the Platycopioidea, may be a more natural grouping for the genera *Platycopia* and *Antrisocopia* than within the Calanoida. The Platycopioidea is the sister group of the rest of the gymnopleans (the Calanoida) and occupies an

analogous position to the Misophrioida, the sister group to the rest of the podopleans. The similarities between the platycopioids and misophrioids represent characters retained from the common ancestral stock of all copepods.

ACKNOWLEDGEMENTS

This study was supported by the Bermuda Biological Station through an EXXON fellowship to A. Fosshagen and by a National Science Foundation Grant (BSR-821672) to T.M. Iliffe. Travel expenses for A. Fosshagen were granted by Premieobligasjonsfondet, University of Bergen, Norway. - We thank Paul Hobbs, Robert Power, and Mary van Soeren for cave-diving assistance, and Drs Thomas E. Bowman, David M. Damkaer, and Geoffrey A. Boxshall for critically reading the manuscript.

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Accepted 27 September 1985.