

ZOOLOGISCHE MEDEDELINGEN

UITGEGEVEN DOOR HET

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN

(MINISTERIE VAN CULTUUR, RECREATIE EN MAATSCHAPPELIJK WERK)

Deel 55 no. 12

4 maart 1980

A NEW SPECIES OF *EUCHIRELLA* (FAM. AETIDEIDAE) FROM THE "DANA"-COLLECTIONS (COPEPODA, CALANOIDA)

by

J. C. VON VAUPEL KLEIN

Afdeling Systematische Dierkunde van de Rijksuniversiteit, p.a. Rijksmuseum van
Natuurlijke Historie, Leiden, The Netherlands

With 9 text-figures and 2 plates

SUMMARY

Euchirella paulinae spec. nov. is described and illustrated in extenso; various structures are outlined in detail for the first time. The external morphology of the new species is discussed with reference to the other species of the genus. Some brief remarks are made about the anatomical terminology of the mouthparts of Copepoda, and on the necessity to always describe new species really scrutinously.

INTRODUCTION

In the course of a revision of the aetideid genera *Euchirella* Giesbrecht, 1888 and *Pseudochirella* G. O. Sars, 1920, an undescribed species of *Euchirella* was found in the material originating from the Danish "Dana" Expedition 1928-30.

The new species will be reported upon separately in the present paper. Its tentative relationships with the other species of the genus will be dealt with in a forthcoming study on *Euchirella*, while detailed accounts of the taxonomic value of several morphological structures, e.g., of the oral field, of the various mouthparts, and of the genital field, are in preparation.

All specimens are preserved in 70% alcohol (ethanol), while dissected appendages have been mounted on slides in Berlese's Fluid. Observations on specimens in situ were made both under dissecting microscope and compound microscope, with the specimens in mono-ethylene-glycol. Preparations for the scanning electron microscope were made by air-drying after transfer through 96% alcohol and by sticking the parts on stubs provided with double-sided adhesive tape. The scan preparations were coated with

one thin layer of gold only. Ultrasonic cleaning was applied to fouled specimens, if necessary.

Drawings were made with the aid of a camera lucida and measurements were taken with an ocular micrometer to the nearest 0.05 mm. Total length has been taken from the anteriormost point of the head to the middle of a line connecting the posteriormost corners of the furcal rami, with the copepod in dorsal view. The respective lengths of the cephalothorax and urosome have been taken up to the intersegmental suture separating these two body regions.

Thanks are due to Mr. H. Heijn for inking some of the author's pencil originals and for the arrangement of figures and photographs, to Mr. E. F. de Stoppelaar for operating the S.E.M., to Mr. A. 't Hooft for printing the scanning electron micrographs, and to my wife, Pauline M. von Vaupel Klein-Epping, for typing the manuscript. Part of this study has been made possible by a grant from the Netherlands Organization for the Advancement of Pure Research (Z.W.O. grant no. 87-31).

DESCRIPTION

Euchirella paulinae spec. nov. (figs. 1-9, pls. 1-2)

Material examined. — 1 ♀, total length 4.05 mm (holotype), "Dana" Exped. sta. 3904^v, 5°18' N 90°55' E, 18-xi-1929, 17.45 h, water depth 3340 m, 1500 m wire out, net S 150 (i.e., straminipose conical, ϕ 150 cm);

19 ♀♀, total lengths 3.80-4.10 mm (paratypes), "Dana" Exped. sta. 3904^v, data same as above;

3 aberrant ♀♀ (see Discussion), total length 3.90 mm for all, "Dana" Exped. sta. 3904^v, data same as above;

15 ♀♀, total lengths 3.80-4.10 mm, "Dana" Exped. sta. 3904ⁱⁱ, 5°18' N 90°55' E, 18-xi-1929, 17.45 h, water depth 3340 m, 3000 m wire out, net S 150.

The holotype will be deposited in the Universitetets Zoologiske Museum, København, Denmark. The specimen has been dissected and the appendages have been mounted on slides; the body is being preserved separately in alcohol. Five of the paratypes will be deposited in the same museum; these specimens are preserved in toto in alcohol. The remaining 14 paratypes are kept in the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands, under no. Crust. F 800. Eleven of these are in alcohol, while one or more appendages of several specimens are on slides. Three paratypes have been dissected and mounted on S.E.M.-stubs.

Diagnosis. — A medium-sized *Euchirella*, with a slightly pointed forehead and two stout spines on the first basipodal segment of the female fourth swimming leg. The genital somite is slightly asymmetrical in dorsal view, being developed somewhat more strongly on the left side. In lateral

aspect this somite shows a conspicuous, bulbous swelling dorsally; the ventral margin is likewise of a rounded, more or less bulbous appearance, resulting in a caudo-ventral orientation of the genital field.

The male is unknown.

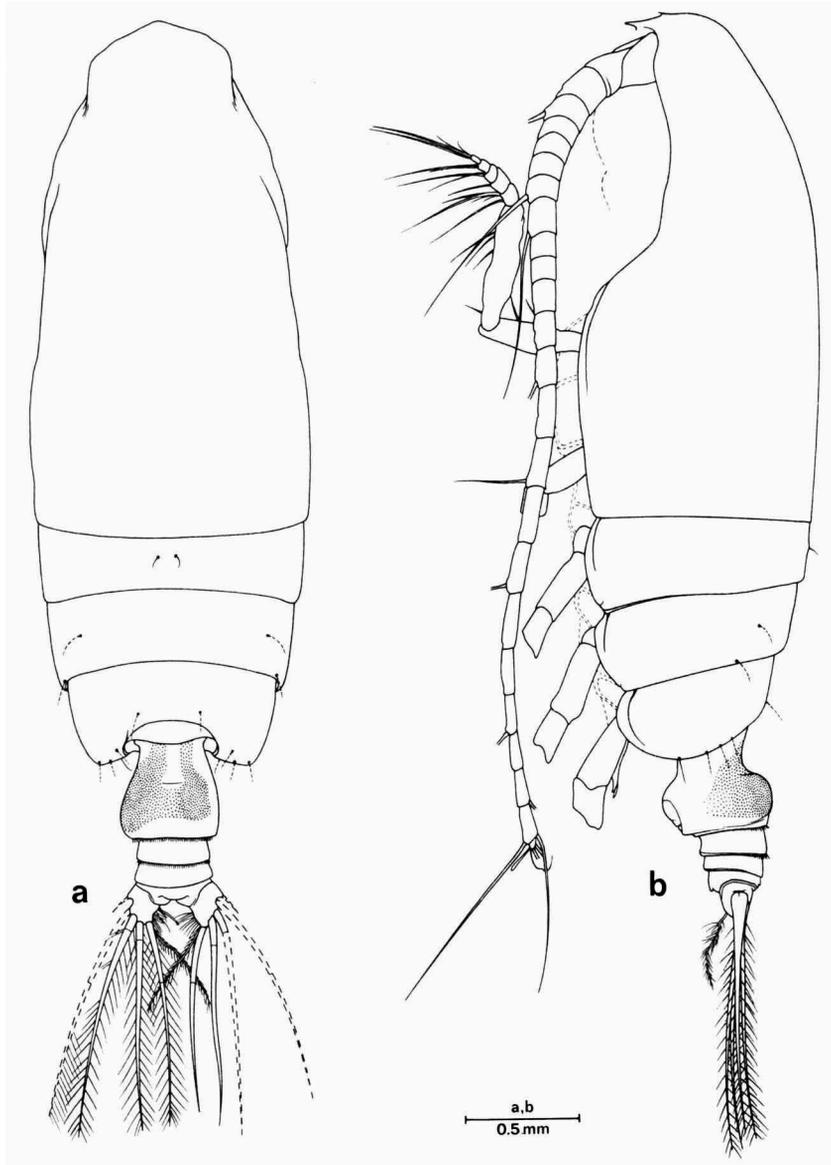


Fig. 1. *Euchirella paulinae* spec. nov., ♀ holotype. a, whole specimen in dorsal view; b, lateral view from the left.

Description of the female. — Body robust, yet moderately slender; total length 3.80-4.10 mm. Cephalothorax (fig. 1a-b) subcylindrical, tapering slightly to the anterior and posterior ends. Greatest width and height of the body measuring 1.30-1.40 mm and 1.30 mm respectively, and occurring approximately at the former segmental boundary between the cephalic somite and thoracic somite 1.

The cephalic outline is smooth, no trace of a crest being present; the forehead is slightly depressed in lateral aspect, whereas the anteriormost end of it is slightly produced into a blunt, rounded-off point, which may be observed with the copepod in lateral as well as in dorsal view. The ventral margin shows several smooth curves.

The rostrum (fig. 2e-f) is normally developed: of moderate size, rather acute, single-pointed, and slightly curved.

The frontal organ consists of a pair of semi-tubular outgrowths (pl. 1a), situated on the extreme anterior tip of the head (fig. 2e-f), the distal ends of which are of a shallow, concave shape, and provided with one rather short and thin central hair each. These hairs are directed rostro-ventrally. Moreover, situated just ventrally to these structures, a small, semi-spherical elevation is to be observed, which shows a slit-shaped opening in its central part (pl. 1a).

The fusion of the cephalic somite with the first thoracic somite is complete, no indication of the former line of fusion being discernable anymore. The fused C-Th1 complex makes up by far the largest part of the cephalothorax. Thoracic somites 2 and 3 are free, about equal in size, with sublinear lateral margins in dorsal view, and broadly rounded ventral margins when observed from lateral.

Somites 4 and 5 of the cephalothorax are completely coalesced. The caudo-lateral corners of this combined somite (fig. 2a-c) are broadly rounded in lateral, and bluntly angled in dorsal aspect. They bear no spines or spinules. The relative lengths of the somites of the cephalothorax are:

$$\frac{C+Th1}{69} + \frac{Th2}{7} + \frac{Th3}{10} + \frac{Th4+5}{14} = 100$$

The cephalothoracic integument is equipped with several short and thin, smoothly curved, hair-like setae (fig. 1a-b) (see also Discussion), viz., two placed dorsally on somite 2, close to the copepod's longitudinal axis; a total of four on somite 3, viz., two halfway the somite, near the lateral margins, and two placed on the caudo-lateral margin; and a total of ten on the combined somites 4+5, viz., two dorsally, just anterior to the articulation of the urosome, and four each along the left and right caudo-lateral margins.

Some of these setae were broken-off in the holotype, but the sites where they had formerly been inserted could still be determined; their shape was reconstructed by examination of the same setae in the paratypes, and has been indicated by broken lines in figs. 1a-b, 2a-c. The arrangement of all these setae is symmetrical.

The urosome (fig. 2a-c) is composed of four somites and the furcal rami, the relative lengths of which are:

$$\frac{1+2}{50} + \frac{3}{14} + \frac{4}{14} + \frac{5}{10} + \frac{\text{furca}}{12} = 100$$

The total length of the urosome is contained 3.96 times in that of the cephalothorax.

The structure of the genital somite is characteristic, the anterior half being rather straight and cylindrical, the posterior half, on the contrary, being quite strongly developed. In dorsal aspect the segment is asymmetrical, being produced somewhat more heavily on the left side, in a caudo-lateral direction. When seen in lateral view, a large, bulbous swelling becomes manifest, the dorsal outline of which arises steeply from the anterior part of the somite, and then shows a smoothly curved continuation to the somite's caudal edge. The ventral outline is likewise bulbously produced, be it to a lesser degree. The place of the ventral swelling results in a caudo-ventral orientation of the genital field. The structure of the genital field proper appears from fig. 2d and pl. 2e. There is a fringe of densely set, short hairs along the dorsal and dorso-lateral hind edge of the somite (pl. 1e), which reaches halfway the somite in ventral direction. The ratio greatest length : greatest width of the somite as a whole, was measured as 0.94.

Somites 3 and 4 of the urosome are short and subcylindrical, and of approximately the same lengths. Somite 3 is, just like the genital somite, fringed with hairs along its dorsal and dorso-lateral posterior margins. The hind edge of somite 4 is naked.

The anal somite is short and compressed. The anal operculum is smoothly rounded. This somite bears two short, broad furcal rami, set rather latero-caudally on the segment. The inner surface of the rami is beset with a brush of long, thin hairs. Each ramus is equipped with four strong, articulating, plumose setae of about equal lengths; the second one counted from the external lateral margin slightly overreaches the three others. Three setae are plumose over their full lengths, the outer one, however, only so on its inner face, the external margin being largely naked, and bearing only hairs in its extreme distal part. Each seta has a 'breaking plane', situated rather proximally in the middle ones and at approximately one-third of the length

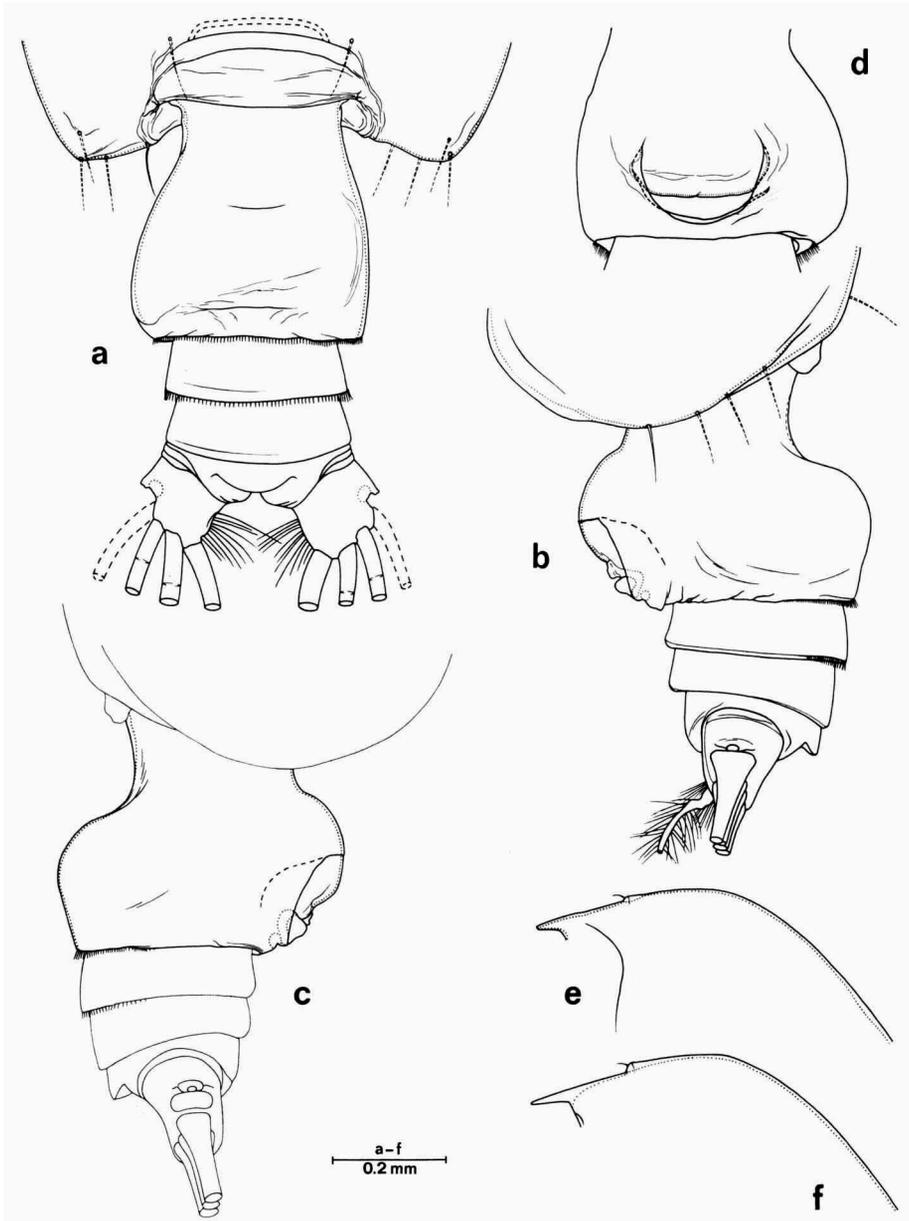


Fig. 2. *Euchiarella paulinae* spec. nov., ♀ holotype, unless indicated otherwise. a, urosome, dorsal view; b, idem, lateral view from the left; c, genital somite, lateral view from the right, outline of urosome indicated; d, genital field from ventral; e, frontal region of head and rostrum, lateral view from the left; f, idem, ♀ paratype.

in the inner and outer setae. Asymmetrical development on the left and right rami was not observed. The fifth, outermost seta on the edge of each ramus is small and spiniform. Setae that were broken-off in the holotype have again been indicated by broken lines, deduced from observations on the paratypes. The ventral sides of the rami bear one slender, curved, plumose seta each, about half the length of the large articulating setae.

As has been stated above, the detailed structure of the oral field will be discussed in a separate paper.

The antennules (fig. 3a-b) are of moderate length, reaching just beyond the genital somite when fully stretched backwards (fig. 1b). They are composed of 24 free segments, the nos. 8 and 9 being fully coalesced; the fusion of segments 24 and 25 is intimate, but not quite complete. The relative lengths of the segments of the antennula are:

1	2	3	4	5	6	7	8+9	10	11	12
92	+ 44	+ 26	+ 22	+ 23	+ 24	+ 23	+ 46	+ 28	+ 32	+ 28
13	14	15	16	17	18	19	20	21	22	23
43	+ 45	+ 60	+ 52	+ 62	+ 58	+ 63	+ 52	+ 41	+ 44	+ 39
24	25									
39	+ 14									
= 1000										

Thus, the proximal segments, i.e. up to and including segment 12, are rather short and more compactly built, whereas the distal segments 13 to 24 are rather long and slender; the terminal segment is minute.

Large setae are present on segments nos. 3, 7, 8+9, 14, 16, 18, and 21, in each case one only, all placed distally along the frontal edges; on segments 22 and 23, one only, distally on the caudal edge; on segment 24, one distally on the frontal and one distally on the caudal edge; and on segment 25, two setae placed terminally; all large setae are smooth, with the exception of the caudal seta on segment 24, which may be plumose to some extent. The remaining setal armature of the antennule is as follows: segment 1, three slender setae, two of which are plumose; segment 2, six slender setae, some of which may be plumose; three small setae are present on segment 8+9; two small setae are found on each of the segments 4, 5, 6, 11, 12, 13, 15, 17, and 19; one small seta only is present on each of the segments 3, 10, 14, 16, 18, 20, 22, and 23; all smaller setae are situated along the segments' frontal edges; finally, segment 25 bears subterminally one slender, plumose seta, one small seta, and one very small, spiniform seta; no small setae are found on segments 21 and 24. A single aesthetask may be observed on each of the following segments: 5, 8+9, 12, 14, 19, and 25.

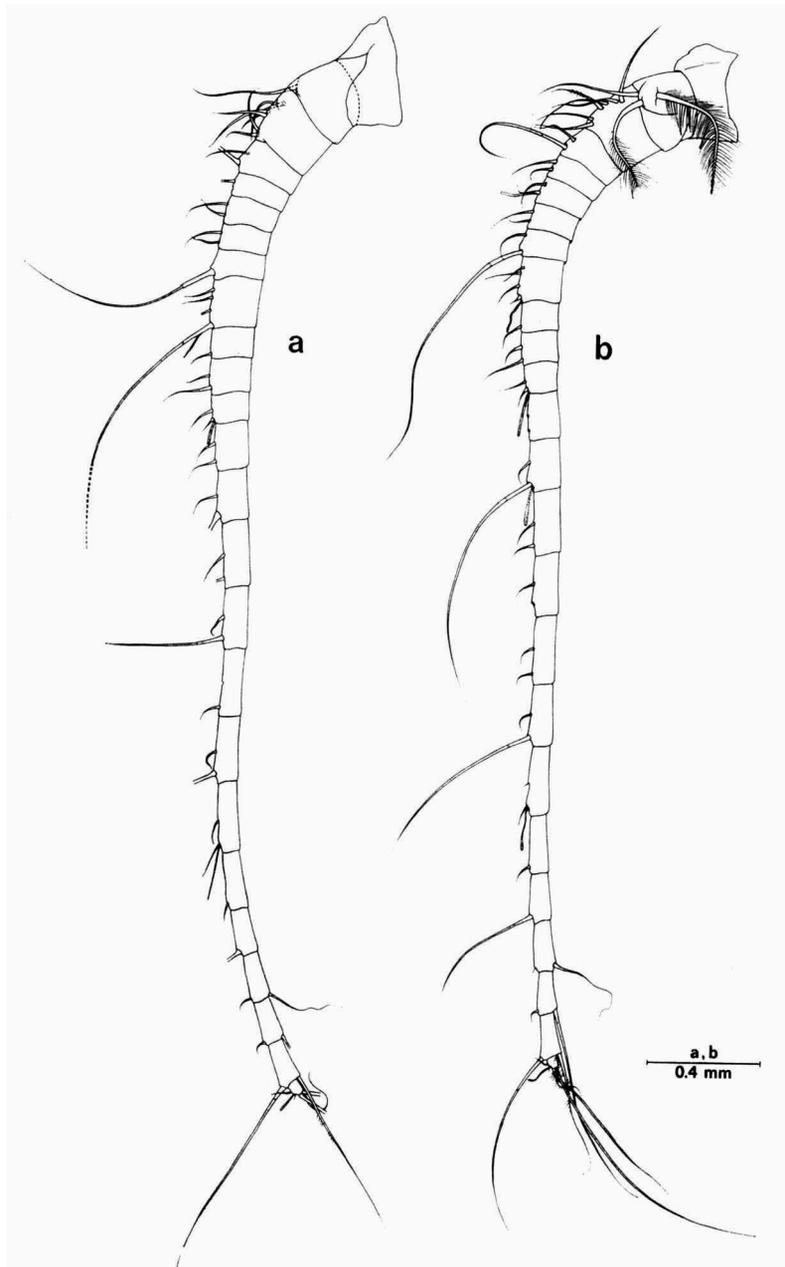


Fig. 3. *Euchirella paulinae* spec. nov., ♀ holotype. a, left antennule, lateral view; b, right antennule, medial view.

The antennae (fig. 4a-b) have the small endopodite characteristic of the genus; in this species it is reduced to about $1/3$ the length of the exopodite and reaches to approximately $2/3$ the length of exopodal segment 1+2. The first and second basal segments may show some degree of fusion, since the separation of the two segments does not appear as clear-cut along all of its circumference, especially not so on the medial side. Basal segment 1 bears a single, strongly plumose seta, and shows a large, rounded-off outgrowth on the medial side; this rather heavy lobe is equipped with two dense brushes of long, thin hairs. The second basal segment is swollen; it bears one small, naked seta only, inserted at the articulation with the endopodite.

The small endopodite is composed of two segments, which are definitely, though faintly, divided. The first endopodal segment bears one small, nude, subapical seta. The second segment is produced into a proximal and a terminal lobe; the proximal lobe bears a total of six slender setae, the lengths of which increase gradually from proximal to distal; except for the smallest two setae, i.e., the most proximal ones, these setae are plumose. The apical lobe of the second endopodal segment shows a short comb of four to six very short, spiniform setae subterminally, and bears on its distal edge a row of six slender, plumose setae of moderate length.

The exopodite is developed normally. It is composed of six free segments, the segments 1 and 2 being completely coalesced to form a long, cylindrical structure; the site of fusion is indicated by a blunt angle in the anterior outline of the combined segment (not being produced into a lobular outgrowth, however), while in some instances faint indications of the former line of fusion may be discernable. This segment bears no setae. The segments 3 to 6 of the exopodite are compactly built, annular structures; the nos. 3 to 5 about equal in length, segment 6 being slightly longer. All four of these intermediate segments are equipped with one large, plumose seta each, situated rostro-medially. The terminal seventh segment is again long and cylindrical, and bears three likewise long and gently curved, plumose setae apically; there is no appendicular seta halfway the length of the segment.

The hairs on the setae of the exo- and endopodite have been omitted in fig. 4a-b.

The gnathobasis of the mandibles (fig. 4c-d, f-h) is a heavily chitinized, powerful structure. There is a wide proximal portion, narrowing rather abruptly about halfway the corpus, to continue as the more cylindrical distal part. The masticatory edge (fig. 4g, pl. 1b) is composed of a total of five distinct groups of teeth. There is a multicuspitate molariform complex proximally, in the apical part of which one large, spinulose setiform tooth

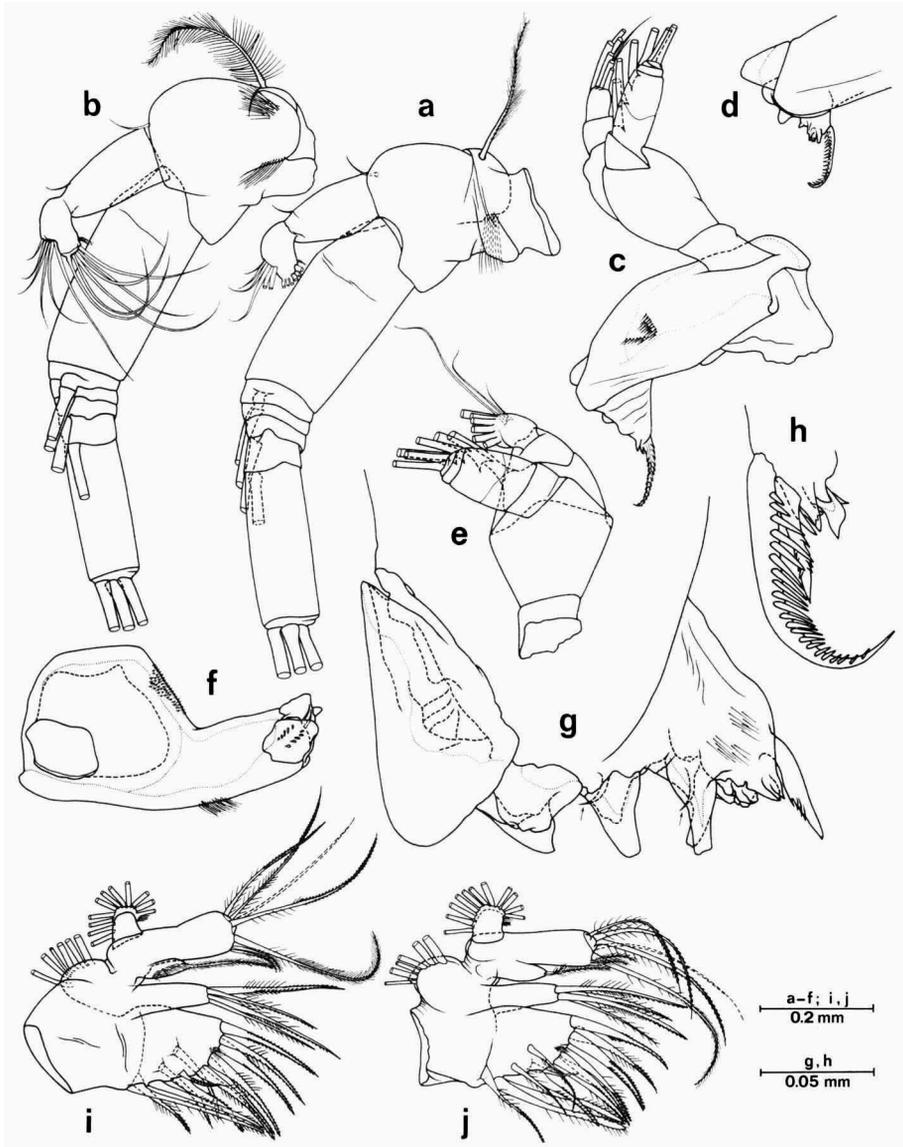


Fig. 4. *Euchirella paulinae* spec. nov., ♀ holotype, unless indicated otherwise. a, left antenna, lateral view; b, right antenna, medial view; c, right mandible, general view from antero-ventral; d, idem, detail of chewing plate, anterior view (smaller setiform tooth broken-off); e, palp of left mandible; f, gnathobasis of left mandible, ventral view, ♀ paratype; g, detail of chewing plate of right mandible, anterior view, ♀ paratype (larger setiform tooth broken-off; setiform protrusions in the two smaller bicuspidate molariform complexes indicated by arrows, see also text); h, detail of proximal multi-cuspidate molariform complex of right mandible, posterior view, with both setiform teeth in situ, ♀ paratype; i, left maxillule, anterior view; j, right maxillule, posterior view.

and one smaller, serrate setiform tooth are included. Next, there are two smaller and one larger bicuspidate molariform complexes intermediately; in the two smaller ones, a single curved, spiniform outgrowth forms a part of the complex, placed in its middle portion, between the two large, sharp points of the teeth (fig. 4g and pl. 1b, indicated by arrows). Finally, an extremely heavy, moncuspidate molariform tooth terminates the distal portion of the toothed edge. The rostral face of the corpus bears a single brush of hairs about midway along its length; furthermore, there is a field of fine spinules present on the steep sloping medial face of the gnathobasis (fig. 4f, pl. 1c-d).

A distinct asymmetry between the left and right counterparts could not be established. Along the corpus of the mandible's gnathobasis, several distinct rows of pores may be observed. These, however, have not yet been studied in detail, and will be dealt with elsewhere.

The palp (fig. 4c, e) is normally developed and shows a slightly swollen second basal segment fitting by an annular, secondary sclerite (cf. the "sclerite ring ... (of) the basis", Heegaard, 1947: 197, see Discussion) to the socket hole on the ventral surface of the gnathobasis; the basal segment of the palp is devoid of setae. The two segments of the endopodite are small; the proximal one bears no setae, the distal segment is equipped with nine slender setae along its apical edge: three nude, shorter ones, consecutively increasing in length, and a row of six long, curved, plumose setae. The exopodite, originally five-segmented, exhibits incomplete fusion of segments 1 and 2, as well as segments 2 and 3, respectively; the small fourth and fifth segments are both free. The exopodite bears a total of six long and slender, plumose setae, three of which correspond with the former segments 1, 2, and 3 respectively, then one seta on segment 4, and two on the terminal segment 5.

The maxillulae (fig. 4i-j) are of the type ordinarily met with in *Euchirella*. The basal segments are completely coalesced. The moderately heavy first inner lobe is equipped with a total of nine setae along its internal margin: the two proximal ones are comparatively long and slender, with rounded-off tips, and sparsely spinulose; the remaining seven setae are stout and powerful, tapering to more acutely pointed tips, and provided with strong, double serrations along their distal parts. These latter setae are placed alternately on the anterior and posterior sides of the lobe's edge, starting with a posteriorly placed distalmost seta, then followed by an anteriorly placed penultimate one, and so on. Thus, there are a total of four setae along the posterior side of the margin, which are serrate only, as stated above; the three setae placed anteriorly are likewise serrate, but, moreover, also

sparsely spinulose in their medial portions. There is one smaller, serrate seta situated submarginally on the anterior face of the first inner lobe, and a total of three combined serrate-spinulose setae have been observed on the lobe's posterior surface. I found one small brush of hairs only at the apical edge of this particular lobe.

The second inner lobe is rather slender, and shorter than the first inner one. It bears four setae apically, which are set closely together, and which are rather long, but apparently stiff as well. Three of these setae are serrate distally, and sparsely spinulose along most of their lengths; one seta is spinulose only. The second inner lobe overreaches the small and only partly free third inner lobe; this latter lobe is reduced and bears two weakly developed setae apically: a longer, plumose one, and a very short, slender seta, sparsely plumose as well. There is a long-drawn brush of thin hairs along this lobe's anterior surface.

The second basal segment is relatively long and slender, exhibiting a length : width ratio of about 3 : 1. It bears a total of three setae apically, one long and slender, plumose and partly spinulose, and two small, plumose setae. The extremely minute endopodite bears four setae, all of which are slender, serrate in their distal parts, and sparsely spinulose. In the holotype, one of these latter setae was broken-off on the maxillules of both sides, but the site where it had been attached could still satisfactorily be determined. The endopodite is only weakly defined from the second basal segment, suggesting some degree of fusion.

The exopodite, apparently well-articulating with basal segment 2, bears a semi-circular row of eleven slender, smoothly curved setae, all strongly plumose. The four distalmost setae are definitely smaller, increasing gradually in length from distal to proximal; the next six setae are rather long and of about equal length, whereas the proximalmost seta is, again, slightly shorter. On the distal edge of this segment, a small brush of hairs was found to be present.

The first outer lobe of the maxillula, finally, is of a rounded shape. It is equipped with a total of six long and slender, strongly plumose setae, the first one of which, and, even more markedly so, the third one, both counted from proximal, are reduced in length as well as in thickness. The remaining four setae are of about equal size.

The maxillae (fig. 5a-c) are composed of a fused basal complex bearing four endites, a second basal segment being produced into a single endite, and a small endopodite (cf. Heegaard, 1947; see Discussion). The possibility of completely free articulation between the basal complex and the second basipodal segment may be questioned. The lateral outline of the basal segment is strongly arched in its proximal part.

The basalmost endite is rather small, the second to fourth endites are about equally developed, and the fifth endite is slightly shorter. All endites bear a total of three apical setae. These are of about equal length and devel-

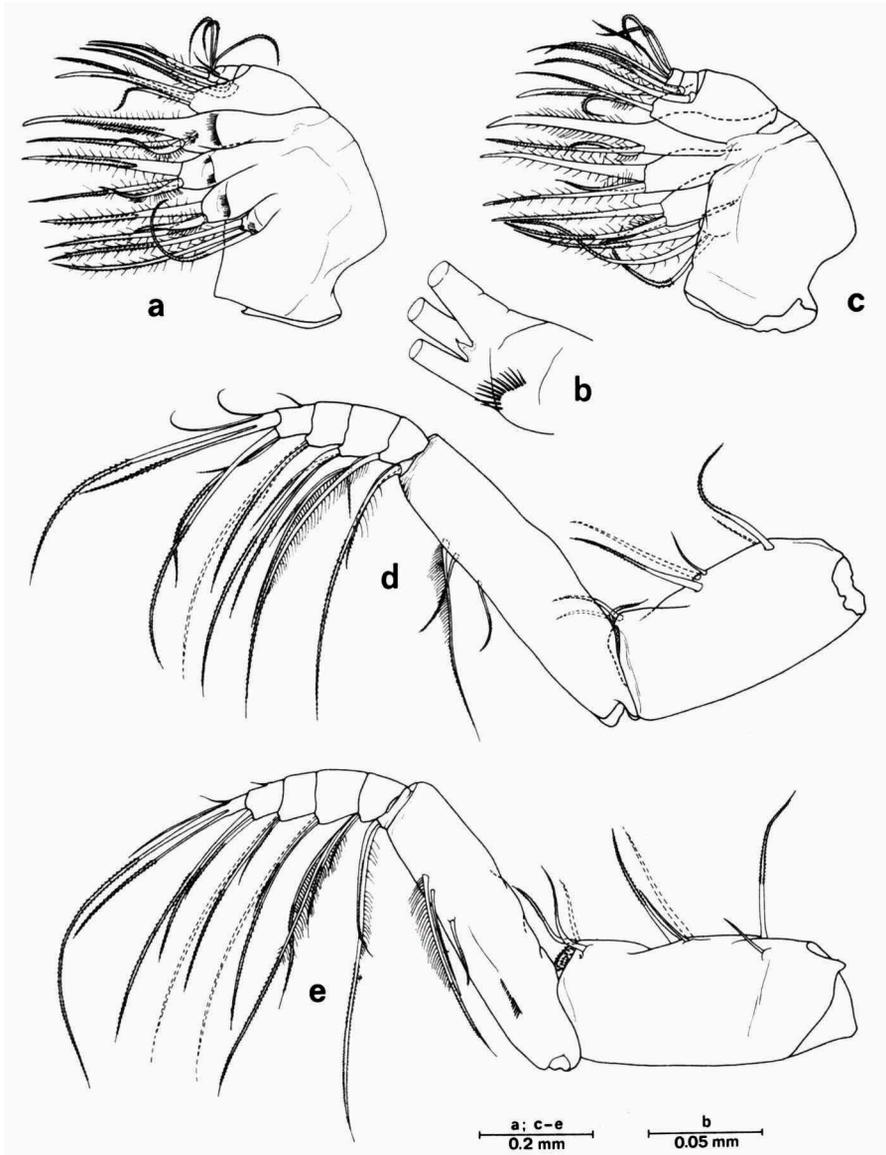


Fig. 5. *Euchirella paulinae* spec. nov., ♀ holotype. a, left maxilla, posterior view; b, idem, detail of terminal part of first endite; c, right maxilla, anterior view; d, left maxilliped, lateral view; e, right maxilliped, medial view.

opment in the case of endite 1, be it that one of them is characteristically curved. On each of the endites 2 to 5, one very heavy, apparently stiff and slightly curved seta is present; moreover, there is one equally long, but more delicate seta; and, finally, one short and thick, but curved seta. All these setae are doubly serrate in their distal parts, and all but two are sparsely spinulose along the better part of their lengths, viz., the curved seta of endite 1 and the heavy seta of endite 5 being serrate only. Moreover, the heavy, powerful setae of the fourth and fifth endites are confluent with the respective segments, while the one on endite 4 is the most strongly developed, and by far the largest seta of the maxilla. The first endite terminates distally in a small, but acutely pointed outgrowth, situated between the bases of the three apical setae (fig. 5b).

The caudo-medial surface of endites 1 to 4 is equipped with a comb-like row of long and sharp spinules; the row on endite 1 is reduced, being composed of some 6-18 spinules only, and situated subapically, whereas the rows on the second to fourth endites consist of some 22-25 spinules (extremes: 20-27), and are placed transversely on the endites, about halfway the lengths of the latter. Besides, in some specimens, e.g., the holotype, an additional group of some 2-16 spinules may be observed subapically on endite 4.

The endopodite apparently is composed of three segments, the two proximal ones of which bear one large, serrate and spinulose seta and one small, finely serrulate seta each; the terminal segment bears one larger, serrate and spinulose seta, and three smaller, smoothly curved ones which are serrate only.

The maxillipedes (fig. 5d-e) are strongly developed, and curved in the way characteristic for *Euchirella* and most other aetideid genera. The first basal segment is large and of subrectangular shape; it bears a total of eight setae along its anterior margin: a larger, doubly serrate one and a smaller, smooth one proximally; two larger, doubly serrate setae and one smaller, smooth one about midway its length; and a similar trio on its antero-distal corner. The latter corner of the segment, moreover, is provided with a rather extensive field of fine spinules (pl. 2a) and, on the distal face proper, with a brush of fine hairs.

The second basipodal segment is slightly longer than the first one, and considerably more slenderly built. Its anterior outline shows some smooth curves in its proximal half. This segment bears a total of five setae: three situated at about $1/2$ to $2/3$ the length of the segment along its posterior margin, viz., one large, slender seta, doubly serrate in its distal part and spinulose in its proximal portion; and two smaller setae of unequal length,

both doubly serrate. The remaining two setae are inserted at the segment's extreme postero-distal tip: one large and one smaller, both doubly serrate distally and the larger of the two also spinulose proximally. On the medial surface of the second basal segment, a longitudinal row of some 23-25 (extremes: 19-26) sharp, closely set spinules is found at about $1/3$ the length of the segment; these spinules decrease in length from proximal to distal (pl. 2b).

The endopodite (cf. Heegaard, 1947; see Discussion) is composed of five free segments. Segment 1 is equipped with a group of four setae in its postero-distal corner, consisting of a very large, relatively heavy seta, one slightly smaller and more delicate seta, and two even smaller setae of unequal lengths. All these setae are doubly serrate in their distal parts; moreover, the two larger setae are spinulose proximally. The segments 2 to 4 are all equipped with a group of three setae in their respective postero-distal corners, being composed similarly as the group described for segment one, but lacking the smallest of the four setae present on that segment; besides, none of the setae on segments 2 to 4 are spinulose, all are doubly serrate only. Segment 4 of the endopodite also bears one very small, spiniform, nude seta on its anterior edge. The terminal fifth segment is small and delicate. It bears a group of four terminal setae, composed similarly as the group described above for segment 1, be it, that the two smallest setae in this case are smooth along their whole lengths, and that the two larger setae are not spinulose, and are confluent with the segment, here.

Since some of the setae of the maxilliped were broken-off in the holotype (fig. 5d-e), part of the description of these structures has been based on observations of the paratypes.

The left and right first segments of the basipodites of all four pairs of swimming legs are firmly connected in the midline by the intercoxal plates. The numbers of segments of the respective exopodites/endopodites of the legs are: 1st leg, 2/1; 2nd leg, 3/1; 3rd and 4th leg, 3/3. Fifth legs are absent. The shape of the various segments of the legs appears from figures 6 to 8; details of the armature of the legs are described below. The patterns of glandular pores on the anterior surface of all four pairs of legs will be discussed in a separate paper.

The details of the segments of the first legs (fig. 6a-d) are as follows. First basipodal segment (Ba1): one medial brush of long hairs. Ba2: one medial brush of hairs, and the specialized, curved seta inserted on the rostral surface at the basis of the endopodite.

Exopodal segment 1 (Re1): two short outer spines, one at $2/3$, one apical,

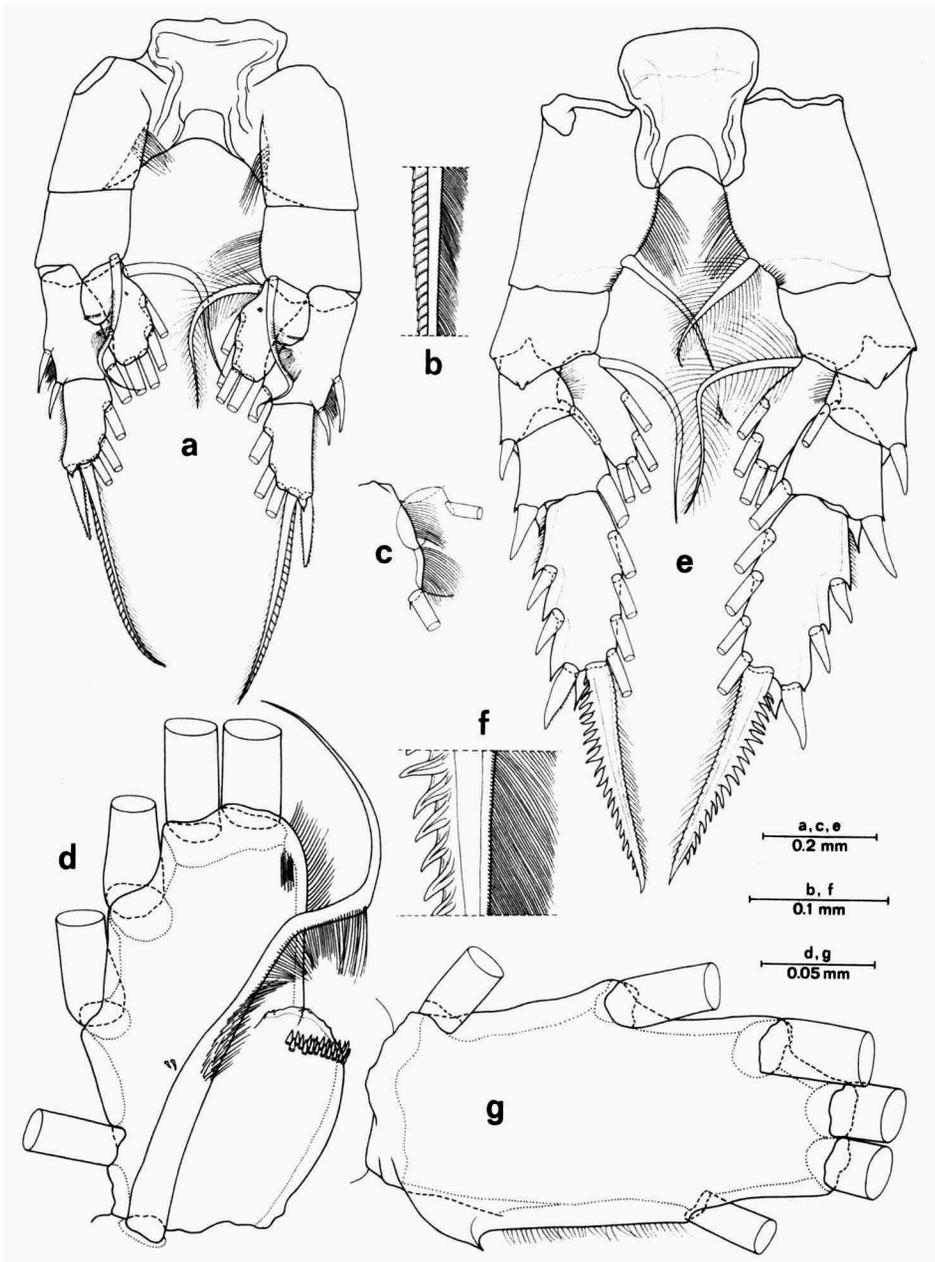


Fig. 6. *Euchirella paulinae* spec. nov., ♀ holotype. a, first pair of legs, anterior view; b, idem, detail of terminal spine of exopodite of right leg; c, idem, detail of medial margin of 1st exopodal segment of right leg; d, idem, detail of endopodite of right leg; e, second pair of legs, posterior view; f, idem, detail of terminal spine of exopodite of left leg; g, idem, detail of endopodite of left leg, posterior view.

with a marginal row of hairs between them; two separate rows of long, fine hairs, i.e., one each on both the proximal and distal portions of the slightly biconvex inner margin; and one long, plumose inner seta, sub-apically. Re₂: a row of short hairs along the outer margin, an outer apical spine provided with fine hairs, and with a short, acute, subtriangular outgrowth of the segment at its base; three long, plumose inner setae; and one long, terminal seta, plumose along the internal margin and with an external serrate edge, composed of some 55 densely set, denticular structures which gradually diminish in size distally.

Endopod (Ri₁) (fig. 6d, pl. 2c-d): well-developed rostro-lateral tubercle with about 22-26 cone-shaped spinules in two separate, subterminal and slightly alternating rows; two to four small central hairs, directed obliquely to the segment's longitudinal axis; an outer marginal row of hairs not connected with the small, circular brush of thin-walled, terminal hairs; three long, plumose inner setae, the proximal one of which strongly curved; and one subterminal as well as one terminal such seta. The detailed nomenclature of the structures on the endopodite of leg 1 has been explained in an earlier paper (Von Vaupel Klein, 1972).

The second swimming legs (fig. 6e-g) have the following structural details on the various segments. Ba₁: a brush of hairs and one plumose seta, medially. Ba₂: smooth and unarmed. Re₁: one outer terminal spine, one inner brush of hairs, and one rather feeble, plumose inner apical seta. Re₂: one outer terminal spine accompanied by a shorter, triangular spini-form outgrowth; and one long, plumose inner apical seta. Re₃: three short outer spines, the third one situated apically and being finely hairy; the marginal sections of the segment, proximal to these spines, are acutely protruding; between basis of segment and 1st outer spine, a marginal row of hairs; apical outer spine flanked by acutely triangular outgrowth; four long, plumose medial setae; terminal spine of segment heavy, flattened, deeply serrate along its outer margin with 18-20 sharp teeth, inner margin of same with a row of hairs all along its length (for detail see fig. 6f). Ri₁ (fig. 6g): one lateral, plumose seta, not very strongly developed; one long, plumose inner seta basally, which is strongly curved; two inner and two terminal long, plumose setae; the outer edge of the segment is proximally produced into a single acute, denticular outgrowth; the outer margin may be finely hairy.

The morphological details of the third pair of swimming legs (fig. 7a-d) are characterized as follows. Ba₁ and 2: same as in second legs. Re₁, 2, and 3: as in second legs, with an exception in Re₂, where there is an outer marginal row of hairs (naked in leg 2). Ri₁ (fig. 7b): one long, plumose

medial seta, which is strongly curved; lateral edge of segment produced into double, acute points. Ri2: one long, plumose medial seta; outer edge of segment finely hairy; disto-lateral corner of segment produced into an acute, spiniform outgrowth (fig. 7d). Ri3: one rather weak, plumose outer seta; two medial and two terminal long, plumose setae; a marginal row of hairs is present along the outer edge between the segment's basis and the insertion of the lateral seta.

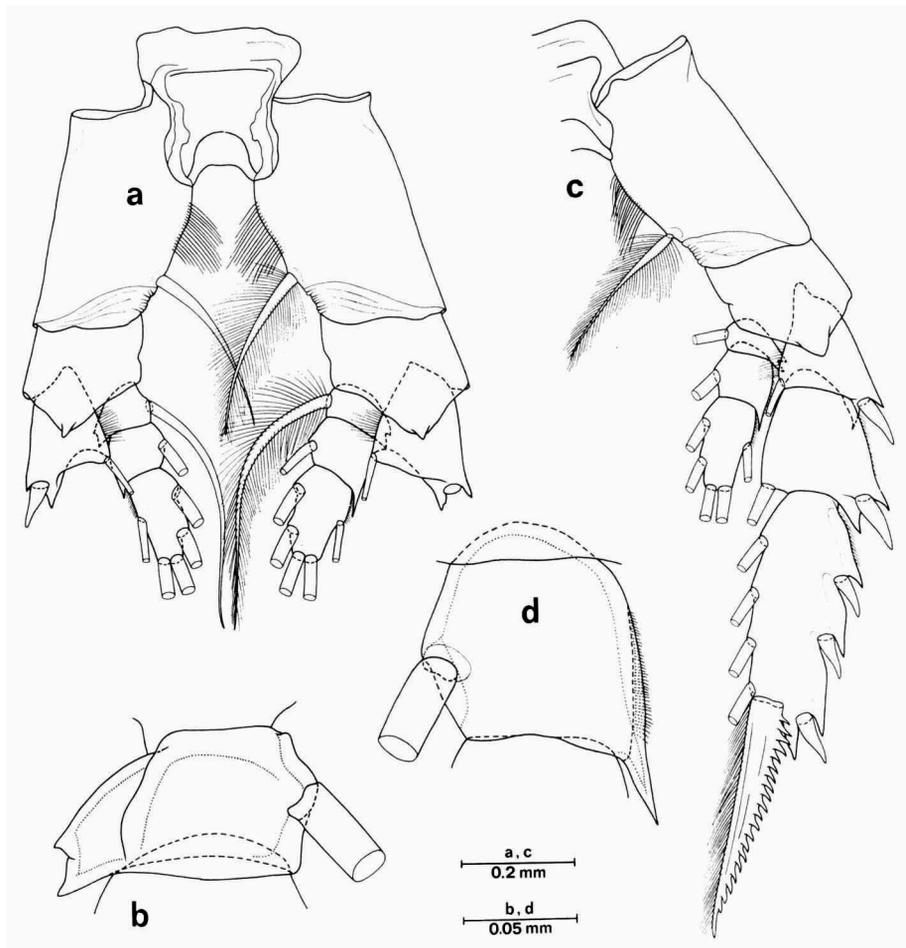


Fig. 7. *Euchirella paulinae* spec. nov., ♀ holotype, unless indicated otherwise. a, third pair of legs, posterior view, incomplete; b, idem, detail of 1st endopodal segment of left leg; c, right third leg, posterior view, ♀ paratype; d, idem, detail of 2nd endopodal segment, ♀ paratype.

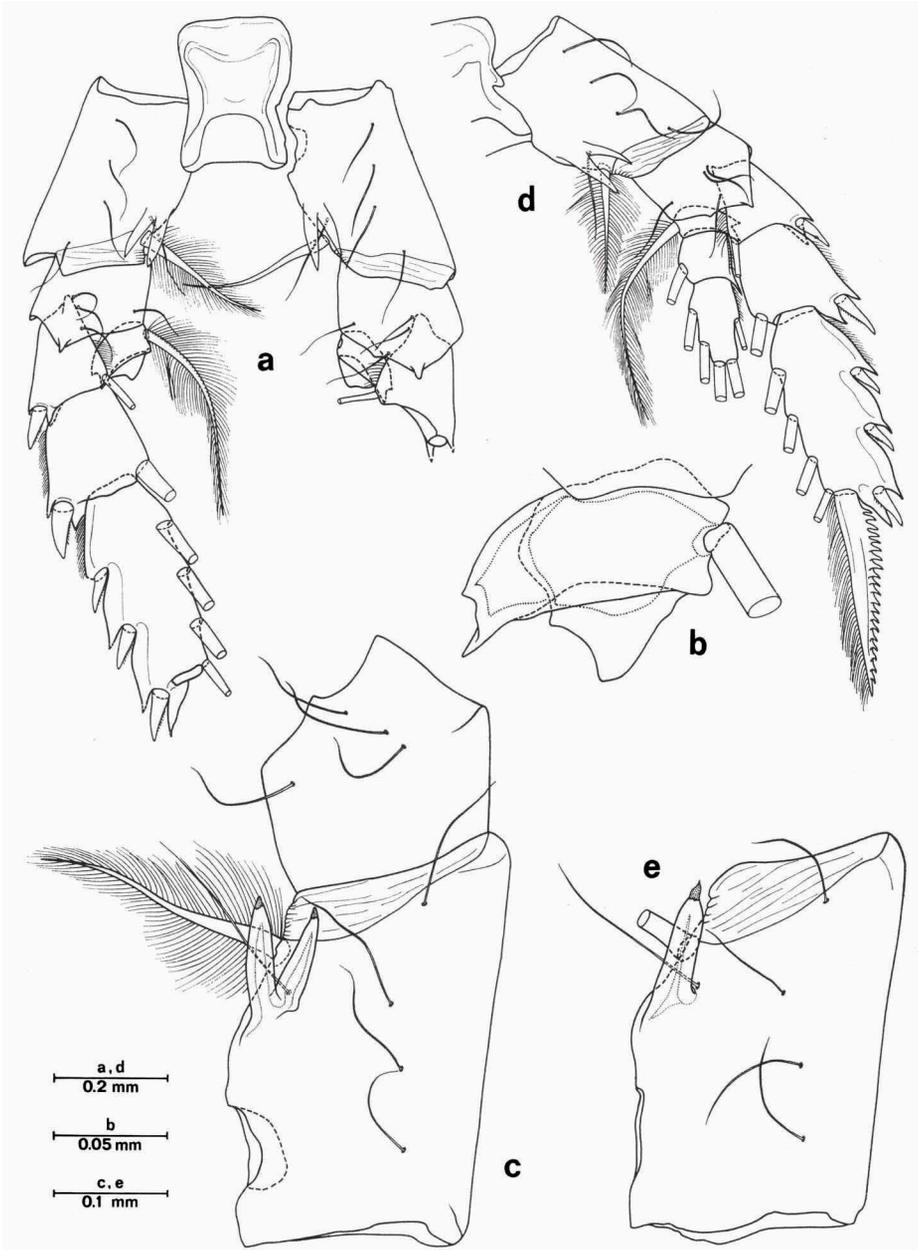


Fig. 8. *Euchirella paulinae* spec. nov., ♀ holotype, unless indicated otherwise. a, fourth pair of legs, posterior view, incomplete and slightly distorted; b, idem, detail of 1st endopodal segment of left leg; c, idem, detail of basipodal segments 1 and 2 of left leg; d, right fourth leg, posterior view, ♀ paratype; e, detail of 1st basipodal segment of left fourth leg, posterior view, aberrant ♀ from "Dana" Exped. sta. 3904v, with only one spine present.

The fourth swimming legs (fig. 8a-d) strongly resemble the legs of the third pair in the structure of the exopodite and the endopodite; however, they exhibit distinct differences with the third legs as regards the basipodal segments. Ba1: no medial brush of hairs; one strong, plumose seta in the medio-distal corner of the segment, inserted just at the anterior side of the medial margin; there are two strong spines on the posterior surface, near the medio-distal corner (one of these spines may be absent, see Discussion), the outer one of which seems to be slightly weaker than its medial companion; there are one and four long and thin, nude setae, respectively inserted at the basis of the two stout spines, and distributed in a widely spaced, longitudinal row on the segment's posterior surface (fig. 8c). Ba2: four or five long and thin, nude setae, (arranged as in fig. 8c), are present on the segment's posterior surface.

Some of the segments of the third and fourth swimming legs were broken-off in the holotype, viz., Re2 and 3 of the third legs, and Ri2 and 3 as well as the terminal spine of Re3 of the fourth legs. The structure of these segments has been examined in the paratypes.

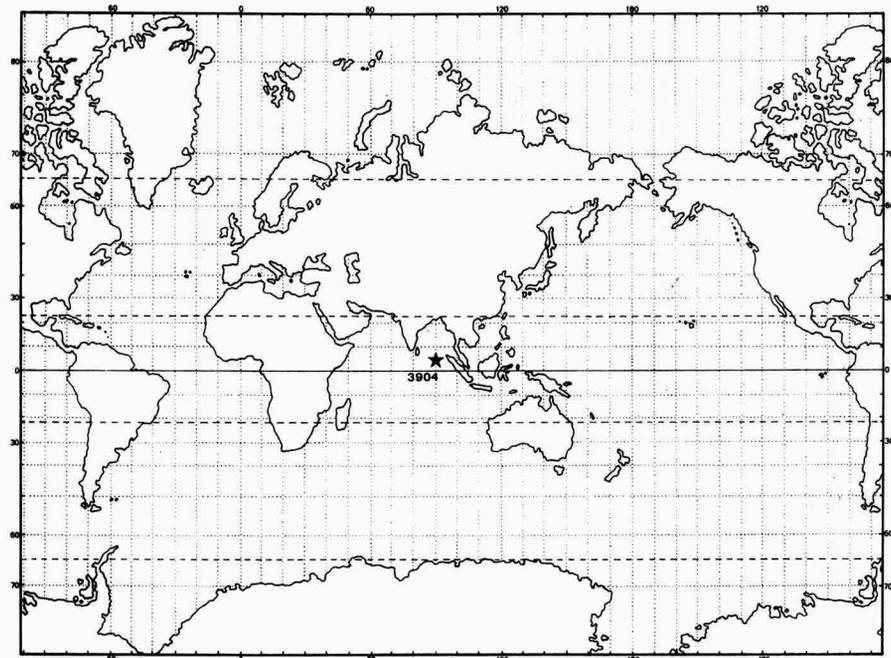


Fig. 9. The type locality of *Euchirella paulinae* spec. nov., "Dana" Expedition sta. 3904, 5°18' N 90°55' E, in the Indian Ocean.

Geographical distribution. — The new species so far is known exclusively from the type locality, 5° 18'N 90° 55'E, in the Indian Ocean (fig. 9).

Vertical distribution. — Though no exact conclusions about the true fishing depth of the gear can be drawn on the basis of the information provided in the station list (Jespersen & Vedel Tåning, 1934), the new species very probably is a bathypelagic organism confined to the deeper strata, i.e., occurring below 500 m depth.

Etymology. — I name this new species in honour of my beloved wife, Pauline. Her Christian name was latinized to form Paulina, whereby the epitheton specificum *paulinae* is a noun (gender: feminine) in the genitive singular.

DISCUSSION

Euchirella paulinae spec. nov. neatly fits the definition of the genus *Euchirella* as primarily outlined by Giesbrecht (1892: 22-23), and profiliated more accurately later on by the addition of supplementary diagnostic elements, contributed by Sars (1920), Sewell (1929), and Verwoort (1957):

The fusion of the cephalic somite with the first thoracic somite is complete, while thoracic somites 4 and 5 are also fully coalesced. The posterior corners of the combined fourth and fifth thoracic somite are smoothly rounded and bear no spines. The rostrum is entire. The small setae inserted on the external posterior corners of the furcal rami, are short and spiniform.

The antennal endopodite is less than half the length of the exopodite; the exopodal segments 1 and 2 of this appendage are fused completely, and exopodal segment 7 lacks a proximal seta; both segments of the endopodite are partly fused.

The maxillula shows an elongate second basal segment, 3 to 4 times as long as wide, which slightly overreaches the first inner, masticatory, lobe and which bears a total of three terminal setae. The minute endopodite, characteristically not (completely) fused with the second basipodal segment, is equipped with only four setae. The second inner lobe is distinctly larger than the third one. The first outer lobe has one seta of reduced length, viz., the third one counted from proximal, corresponding to the situation found in species with a larger total number of setae on this particular lobe, in which it is usually the fifth seta that is reduced in length.

The numbers of segments on the exopodal/endopodal branches of the swimming legs are also as usual, i.e., 1st leg, 2/1; 2nd leg, 3/1; 3rd and

4th legs, 3/3; the fusion of the endopodal segments of the second leg being complete. The external sides of the first endopodite segments of legs 3 and 4 are produced into double points. The first basal segment of the fourth swimming leg bears a limited number of strong spines.

Euchirella paulinae may be distinguished from all other known *Euchirella* species by the following combination of characters: size, absence of a crest, six and six setae respectively on both lobes of the second endopodal segment of the antenna, two spines on basipodite segment 1 of the female leg 4, and the characteristic shape of the female genital somite.

The new species appears to agree most closely in morphology with that group of species within *Euchirella* in which the females are likewise equipped with two spines on the first basipodal segment of the fourth leg, viz., the couple *Euchirella messinensis* (Claus, 1863) (s.s.) and *E. messinensis indica* Vervoort, 1949; *E. orientalis* Sewell, 1929, *E. pulchra* (Lubbock, 1856), *E. similis* Wolfenden, 1911, *E. speciosa* Grice & Hulsemann, 1968, *E. splendens* Vervoort, 1963, and *E. venusta* Giesbrecht, 1888.

In the detailed structure of the maxillula, *E. paulinae* resembles the above species in the presence on the first outer lobe of only six slender setae, the third of which is of reduced length, as well as in the number of setae on the second basal segment and on the endopodite of this mouthpart, viz., three and four, respectively. However, the condition of these characters of the maxillula could not be checked in the case of *E. speciosa*, since Grice & Hulsemann (1968) do not provide any information pertinent to the structure of the oral appendages of this species; *E. speciosa*, however, might eventually be referable to *E. venusta*, as suggested by Tanaka & Omori (1969b).

In all the above species but one, the outline of the female forehead is smoothly rounded, whereas only in *E. pulchra* it is rather acutely pointed. The shape of the head in *E. paulinae* appears to be intermediate between the smoothly rounded heads and the blunt angular shape of *E. pulchra*, the new species exhibiting a modestly, though definitely, pointed frontal region.

The size of *E. paulinae* apparently differs from those of the species mentioned, *E. pulchra*, on the average, being smaller (2.90-4.40 mm) the others generally being larger, viz., according to the following recorded total lengths: *E. messinensis* (s.l.), 4.05-5.55 mm; *E. orientalis*, 4.35-6.25 mm; *E. similis*, 4.70-5.30 mm; *E. speciosa*, 4.90 mm; *E. splendens*, 3.90-5.20 mm; and *E. venusta*, 4.05-5.00 mm; (cf. Grice & Hulsemann, 1968; Tanaka & Omori, 1969a; Vervoort, 1963; and personal observations).

As regards the number of setae present on the two lobes of endopodal

segment 2 of the antennae, i.e., six and six respectively, *Euchirella paulinae* shares this character only with *Euchirella bitumida* With, 1915, *E. galeata* Giesbrecht, 1888, *E. grandicornis* Wilson, 1950, *E. pseudopulchra* Park, 1976, and *E. pulchra* (Lubbock, 1856) (cf. Park, 1976; Tanaka & Omori 1969a; and personal observations); the same numbers of setae on the lobes in question have been reported for the specimen originally described by Omori (1965) as *E. tanseii*, which, however, was later on referred to *E. venusta* by Tanaka & Omori (1969b). All other species of *Euchirella* bear different numbers of setae on these particular lobes (cf. Grice & Hulsemann, 1968; Park, 1975; Vervoort, 1951; and personal observations), a full account of which will be given in a future paper.

So, *Euchirella pulchra* appears to be the only species of the group with two spines on Ba1 of the female leg 4, bearing also 6 + 6 setae on Ri2 of the antenna; however, body-size, shape of the forehead, and structure of the genital somite show by far enough differences to distinguish between this species and *E. paulinae*.

The differences with *Euchirella amoena* Giesbrecht, 1888, *E. bella* Giesbrecht, 1888, *E. curticauda* Giesbrecht, 1888, *E. latirostris* Farran, 1929, *E. maxima* Wolfenden, 1905, *E. pseudotruncata* Park, 1975, *E. rostrata* (Claus, 1866), *E. rostromagna* Wolfenden, 1911, *E. truncata* Esterly, 1911, and *E. unispina* Park, 1968, are clear-cut, and involve, a.o., size, shape of the body and/or of the forehead, structure of the female genital somite, number of setae on the lobes of the second endopodal segment of the antennae, number of spines on Ba1 of the female 4th leg, and details of the mouthparts. The same holds for *Euchirella bitumida*, *E. galeata*, *E. grandicornis*, and *E. pseudopulchra*, with the exception, of course, of the number of setae on the lobes of Ri2 of the antenna, as mentioned above.

Finally it may be stated, that, since the shape of the female genital somite of *E. paulinae* in fact is already diagnostic on its own, this structure may be used to discriminate between the new species and any of the other known species of *Euchirella*.

In general, individual variation proved to be very slight. Variation in total body length has already been mentioned above. Minor differences were noted in overall body shape, in the shape of the rostrum (fig. 2e-f) and in the shape of the genital somite, in particular in the steepness of the anterior slope of the dorso-caudal bulbous portion, when observed in lateral view. No variation was observed in the structure of the antennules, antennae, maxillules, and the swimming legs of the 2nd and 3rd pairs. Small differences in the presence of an additional patch of spinules on endite 4 of the maxilla, in the number of spinules composing the medial comb on

the 2nd basipodal segment of the maxilliped, and in the numbers of central hairs and of spinules on the endopodite of swimming leg 1, respectively, have been dealt with in the descriptive part of this paper. The variations in shape of the teeth on the mandible's masticatory edge have not yet been mentioned; these, however, can be attributed to wear.

However, the number of spines on the first basipodal segment of leg 4, generally considered as a species-specific character in *Euchirella*, proved to be variable in the new species: in the majority of specimens two spines were present, but in one specimen there was only one spine observed on this particular segment of both left and right legs, apparently representing the inner one of the two normally present (fig. 8e). In another specimen, one such spine only was present on the left leg, whereas the normal situation involving the presence of two spines occurred on the opposite leg. The reversed condition was observed in a third specimen. Variation in this particular structure should be taken good notice of, since a discriminative character is involved here.

The small hair-like setae present on the integument of thoracic somites 2 and 3, as mentioned in the description, are not a unique feature of the new species, though I have never met with a description of those in literature on *Euchirella*. In fact, I have examined by now nearly all species described so far in this genus, and every one of them does have these setae, arranged in quite a similar manner. However, I have not yet been able to check the situation in other aetideid genera, so I cannot possibly state at the moment whether or not the presence of these small setae is more widespread among the Aetideidae, though Sars (1924) depicts the two pairs of setae on Th3, perhaps more or less accidentally, in his figure of the male of *Gaidius affinis* G. O. Sars, 1905 (cf. Sars, 1924, pl. 15 fig. 14), but he does not mention these structures in his description (Sars, 1925: 47-48). Giesbrecht (1892) has figured similar setae in species of, e.g., *Calanus*, *Eucalanus*, and *Candacia*, but never depicted comparable structures in any of the genera referable to the Aetideidae.

The only recent account pertaining to similar 'hair sensilla' is that of Fleminger (1973), who describes the same structures in *Eucalanus*. Although in the latter genus these hairs are more numerous on thoracic somites 2 to 5, their places are discrete, and the hairs observed in *Euchirella* are directly referable to some of those found in *Eucalanus*. Evidently, the occurrence of these or comparable structures is not uncommon in the Calanoida, and an even more widespread occurrence will very probably be established when more calanoid families are checked for this particular character.

As regards the detailed structure of the frontal organ, the present account, to my knowledge, is the first to give an accurate description of it. Apparently, all observations up till now were made by light-microscopy only, which technique does not allow to discern more than the 'small elevation bearing one or two minute hairs' as most previous authors characterize this particular organ. The possibility to do scanning electron microscope observations now has revealed the organ's true morphology. More extensive S.E.M.-observations among the Calanoida will have to establish the possible usefulness of the frontal organ as a taxonomic character. As a matter of fact, the status of the organ in the other species of *Euchirella* and those of *Pseudochirella* is being examined at the moment.

Some morphological details which have been described above for *Euchirella paulinae*, and which have either not at all, or only incidentally been treated by previous authors, have not yet been screened among all the other species of *Euchirella*, so that intrageneric comparisons are not possible at this moment. They include, a.o., the detailed structure of the mandible's masticatory plate as well as the various groups of spinules and hairs on the corpus of the gnathobasis; the combs and groups of spinules on the maxillar endites; the apical field and the medial comb of spinules, respectively, on maxillipedal segments Ba1 and Ba2; the glandular pore patterns on the anterior faces of the four pairs of natatory legs; and the detailed morphology of the oral and genital fields. The taxonomic value of these structures, however, has yet to be assessed, and they will be dealt with in future papers.

There is, in descriptions of copepod morphology, still no universally applied terminology pertinent to the segments and branches of the mouthparts, although there is a set of names that can be designated as being in most general use. In the above description of *Euchirella paulinae*, however, the terms used for the basal segments of the mandible follow the suggestions of Heegaard (1947: 195-211) rather than the historically determined nomenclature, because Heegaard's arguments seem sound to me; in this case, by the way, the more common names require only slight alterations.

As regards the single free branches of the maxilla and the maxilliped, however, Heegaard's (1947: 195-211) nomenclatural propositions are quite drastic: what is generally denoted as second basipodal segment plus endopodite, should, according to Heegaard, be taken together and be called exopodite instead. In this case, I hesitate to follow all of Heegaard's suggestions: although most of his arguments seem rather convincing to me, his proof often consists of a few scattered examples only, mostly based purely

on data from older literature. So, I would rather check some of Heegaard's observations personally before I would decide to follow his radical change in nomenclature. Moreover, a broad census of these structures among all of the Copepoda should precede the acceptance of such a new terminology, because, in favour of nomenclatural stability, it is better to change a rather common set of names only once, if necessary, based on sound research, than to create a succession of relatively small changes, based largely on paradigmatic assumptions.

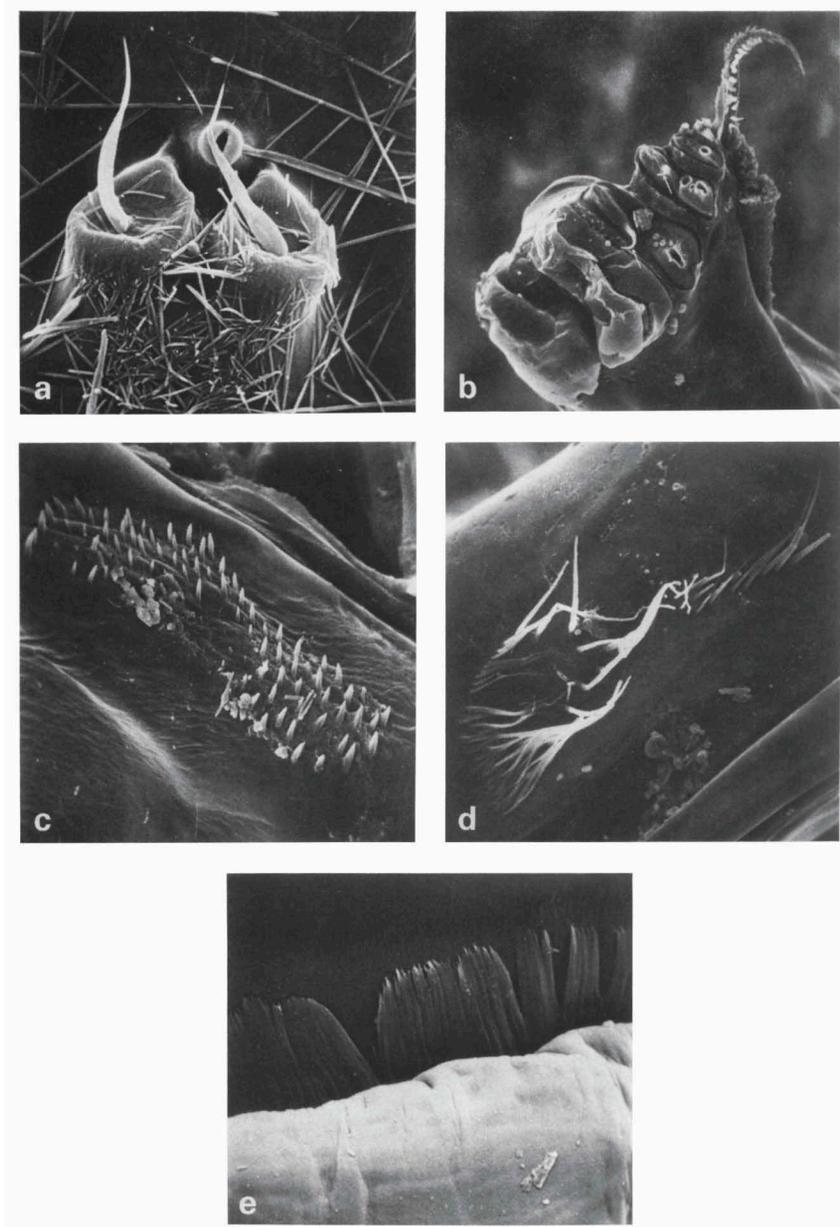
Though the conclusions of Heegaard (1947) have been rejected by Lang (1946, 1948), the criticism of this latter author is likewise ill-documented, and certainly needs the same critical evaluation as do the examples of Heegaard.

A final remark should be made about the rather extensive description of *Euchirella paulinae*, as given above. Though many recent authors have presented careful descriptions of new copepod species, among which species of *Euchirella*, many details have usually been omitted, which makes exact comparisons impossible, should one not be able to personally study material of the species in question. Therefore I have chosen to describe all morphological structures in extenso, since the fact that some important structural details in the genus *Euchirella* have apparently been overlooked during the past decades, presumably takes its origin from presenting all too condensed descriptions. Actually, morphological outlines of new species should be scrutinous enough to meet all demands for verifying minute details, many of which are really of importance in assessing the true status of certain species.

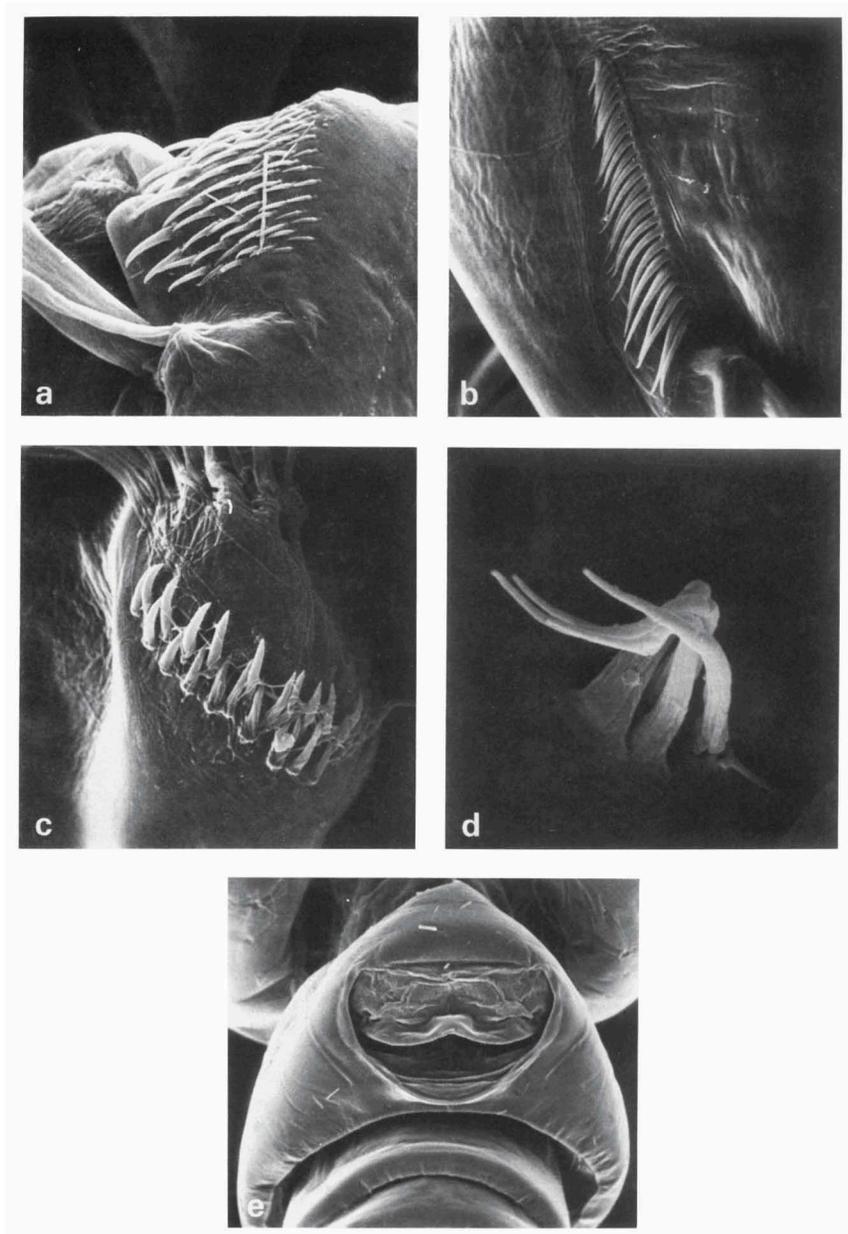
REFERENCES

- FLEMINGER, A., 1973. Pattern, number, variability, and taxonomic significance of integumental organs (sensilla and glandular pores) in the genus *Eucalanus* (Copepoda, Calanoida). — Fish. Bull. Fish Wildl. Serv. U.S., 71(4): 965-1010, figs. 1-22.
- GIESBRECHT, W., 1888. Elenco dei copepodi pelagici raccolti dal tenente di vascello Gaetano Chierchia durante il viaggio della R. corvetta "Vettor Pisani" negli anni 1882-1885 e dal tenente di vascello Francesco Orsini nel mar Rosso nel 1884. Nota II. — Atti Accad. naz. Lincei R., 4(2) (10): 330-338.
- , 1892. Systematik und Faunistik der pelagischen Copepoden des Golfes von Neapel und der angrenzenden Meeres-abschnitte. — Fauna Flora Golf. Neapel, 19: i-ix, 1-851, pls. 1-54.
- GRICE, G. D. & K. HULSEMAN, 1968. Calanoid copepods from midwater trawl collections made in the southeastern Pacific Ocean. — Pacif. Sci., 22: 322-355, figs. 1-74.
- HEEGAARD, P., 1947. Contribution to the phylogeny of the arthropods. Copepoda. — Spolia zool. Mus. haun., 8: 1-229, figs. 1-2, pls. 1-27.
- JESPERSEN, P. & A. VEDEL TÅNING, (eds.), 1934. Introduction to the reports from the Carlsberg Foundation's oceanographical expedition round the world 1928-30. — Dana Rep., 1: 1-130, figs. 1-2, pls. 1-7, frontispiece.

- LANG, K. G. H., 1946. A contribution to the question of the mouthparts of the Copepoda. — *Ark. Zool.*, 38A(5) : 1-24, figs. 1-25.
- , 1948. Copepoda "Notodelphyoida" from the Swedish west-coast with an outline of the systematics of the copepods. [Including] Appendix. Some remarks on two papers published by Heegaard in 1947. — *Ark. Zool.*, 40A(14) : 1-36 (App.: 28-35), figs. 1-17, pl. I.
- OMORI, M., 1965. A new species of *Euchirella* (Copepoda) from Sagami Bay, middle Japan. — *J. oceanogr. Soc. Japan*, 21(2) : 60-65, figs. 1-24.
- PARK, T., 1975. A new species of *Euchirella* and the male of *Euchirella splendens* Verwoort, with notes on *Euchirella truncata* Esterly (Copepoda, Calanoida). — *Crustaceana*, 28(3) : 292-297, figs. 1-4.
- , 1976. A new species of *Euchirella* (Copepoda, Calanoida) from the Pacific coast of North America, with notes on *Euchirella pulchra* (Lubbock). — *Crustaceana*, 31(2) : 208-212, figs. 1-2.
- SARS, G. O., 1920. Calanoidés recueillis pendant les campagnes de S.A.S. le Prince Albert de Monaco. (Nouveau supplément). — *Bull. Inst. océanogr. Monaco*, 377 : 1-20.
- , 1924-25. Copépodes particulièrement bathypélagiques, provenant des campagnes scientifiques du Prince Albert Ier de Monaco. — *Résult. Camp. scient. Prince Albert I*, 69 (planches) : 1-46, pls. 1-127, (1924) ; 69 (texte) : 1-408, (1925).
- SEWELL, R. B. S., 1929. The Copepoda of Indian Seas. Calanoida. — *Mem. Indian Mus.*, 10 : 1-221, figs. 1-81.
- TANAKA, O. & M. OMORI, 1969a. On *Euchirella* (Copepoda, Calanoida) collected chiefly by the U.S. steamer Albatross from the Pacific Ocean. — *Publ. Seto mar. biol. Lab.*, 17(1) : 33-65, figs. 1-10.
- , 1969b. Additional report on calanoid copepods from the Izu Region. Part 2. *Euchirella* and *Pseudochirella*. — *Publ. Seto mar. biol. Lab.*, 17(3) : 155-169, figs. 1-5.
- VAUPEL KLEIN, J. C. VON, 1972. A new character with systematic value in *Euchirella* (Copepoda, Calanoida). — *Zool. Meded., Leiden*, 47(41) : 497-512, figs. 1-5, pls. 1-6.
- VERVOORT, W., 1951. Plankton copepods from the Atlantic sector of the Antarctic. — *Verh. K. ned. Akad. Wet.*, (2) 47(4) : 1-156, figs. 1-82.
- , 1957. Copepods from antarctic and sub-antarctic plankton samples. — *Rep. B.A.N.Z. antarct. Res. Exped.*, (B, Zool. Bot.) 3 : 1-160, figs. 1-138.
- , 1963. Pelagic Copepoda part I. Copepoda of the families Calanidae up to and including Euchaetidae. — *Atlantide Rep.*, 7 : 77-194, figs. 1-23.



Euchirella paulinae spec. nov., scanning electron micrographs of paratype females. a, frontal organ in anterior view, top = ventral, bottom = dorsal; b, masticatory plate of right mandible, with setiform protrusions in the two smaller bicuspidate complexes indicated by arrows (see also text); c, right mandible, patch of spinules on medial face of corpus; d, left mandible, group of hairs on anterior face of corpus; e, detail of fringe of hairs on dorsal hind edge of genital somite. a and e, ca. 1200 X; b, ca. 300 X; c and d, ca. 600 X.



Euchirella paulinae spec. nov., scanning electron micrographs of paratype females. a, right maxilliped, field of spinules on antero-distal face of first basipodal segment, medial view; b, right maxilliped, comb of spinules on medial face of second basipodal segment; c, endopodite of right first swimming leg, spinules on rostro-lateral tubercle; d, endopodite of right first swimming leg, detail of central hairs on anterior surface; e, ventro-caudal view of genital somite, showing the morphology of the genital field.
 a, ca. 1200 X; b, ca. 1600 X; c, ca. 800 X; d, ca. 3200 X; e, ca. 120 X.