

# Copepods from intertidal interstitial water of Salvador, Brazil.

## I. *Cuipora janaina* gen. n., sp. n. & *Cyclopina caiala* sp. n. (Cyclopoida: Cyclopinidae)

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### Abstract

*Cuipora janaina* gen. n., sp. n., and *Cyclopina caiala* sp. n. are described from the interstitial water of a sandy beach in Salvador, Bahia (Brazil).

*Cuipora* is distinguished from all other genera of the subfamily Cyclopininae in having the endopodite of legs 1–4 2-segmented and the terminal segment armed with 4 setae.

*Cuipora* is compared to *Erythropolytes* Huys & Boxshall, 1990, *Herbstina* Huys & Boxshall, 1990, and *Cyclopina* Claus, 1862, with which it has most morphological similarities.

*Cyclopina caiala* sp. n. is distinguished by the structure of the leg 5 of the male and female and by a particular combination of characters of the mouthparts. Taxonomical problems involving *Cyclopina mediterranea* Steuer, 1940 are discussed.

### Résumé

On décrit *Cuipora janaina* gen. n., sp. n., et *Cyclopina caiala* sp. n., de l'eau interstitielle d'une plage de sable à Salvador, Bahia (Brésil).

*Cuipora* se distingue de tous les autres genres de la sous-famille des Cyclopininae par l'endopodite des pattes 1–4 bisegmenté et par le segment terminal armé de 4 soies.

On compare *Cuipora* à *Erythropolytes* Huys & Boxshall, 1990, *Herbstina* Huys & Boxshall, 1990, et *Cyclopina* Claus, 1862 – genres avec lesquels les similarités dans la morphologie sont les plus marquées.

*Cyclopina caiala* sp. n. se distingue par la structure de la patte 5 du mâle et de la femelle, ainsi que par une combinaison particulière de caractères des appendices buccaux. Sont discutés les problèmes taxonomiques concernant *Cyclopina mediterranea* Steuer, 1940.

### Introduction

Knowledge of the cyclopinids along the Brazilian coast is incomplete. Herbst (1955) provided the only records of these copepods in Brazil. He described two new species (*Cyclopinopsis braziliensis* and *Procyclopina polyarthra*) and identified some specimens of *Cyclopina* cf. *steueri* from samples taken from sandy beaches on Ilhabela, São Sebastião Island.

Bregari Beach in Salvador, Bahia, supports a very diverse interstitial fauna, as we could verify. Among the most abundant forms are several species of harpacticoid and cyclopoid copepod. Two new species of Cyclopininae Kiefer (1927) are described here. One belongs to the genus *Cyclopina* Claus, 1862. Since the other new species does not fit any of the 30 known genera (Huys & Boxshall, 1990), a new genus is proposed to accommodate it.

### Material and methods

The copepods were collected in the phreatic interstitial water (depth 20 cm below surface) on the sandy beach. Interstitial water collected in holes dug on the beach was filtered through a 200  $\mu$ m mesh, and animals retained were fixed in 4% formalin. Granulometric analysis was not carried out, but coarse sand and shell fragments were the main sediment components. *Amphioxus* (Cephalochordata) were found in the same samples.

Intact specimens were examined in 85% lactic acid and dissected parts were placed in slides sealed with Glyceel. The terminology applied to segmentation of the mouthparts follows that of Huys & Boxshall (1990).

### Taxonomic part

#### *Cuipora* gen n.

**Diagnosis.** – Cyclopininae. Pediger 1 partly fused to cephalosome. Antennule 9-segmented in female, 14-segmented in male. Exopodite of antenna represented by 1 seta. Mandible with 2-segmented endopodite and 4-segmented exopodite. Maxilla 6-segmented. Endopodite of maxilliped 4-segmented. Legs 1–4: endopodite 2-segmented; exopodite 3 with 4,4,4,3 spines and 4,5,5,5 setae; exopodite 1 and 2 with reduced inner seta; endopodite 2 with 4 setae. Leg 5 of male and female 2-segmented; exopodite with medial apical seta and 2 spines. Leg 6 of male with 2 setae and 1 spiniform projection.

**Type-species.** – *Cuipora janaina* sp. n.; by monotypy.

**Etymology.** – The generic name is derived from the Tupi-Guarani language, “cui” meaning sand and “pora” meaning inhabitant.

#### *Cuipora janaina* gen. n., sp. n (Figs. 1–15)

**Material examined.** – Bregari beach, Salvador, Brazil, 55 ♀ ♀ and 40 ♂ ♂, 4 Nov. 1985, C.E.F. Rocha col. The ♀ holotype and 20 paratypes are deposited in the collection of the Museu de Zoologia, Universidade de São Paulo (MZUSP 10737 and 10738, respectively).

**Description.** – Female. Body length 440–500 µm. Prosome : urosome ratio = 1.15:1. Pediger 1 apparently separated from cephalosome in dorsal view (Fig. 1), but more accurate examination reveals the somite being fused to the cephalosome laterally in distal corners (Fig. 2); lines persisting between cephalosome and pediger 1 interpreted as scars. Genital segment longer than wide, with 2 anterolateral protuberances, both conspicuously thickened and with 1 seta (Fig. 1).

Caudal ramus (Fig. 3) longer than anal somite and about 2.4 times longer than wide. Inner median

apical seta about 1.5 times longer than outer median apical seta, both spinulose proximally and plumose distally. Inner apical seta 1.5 times longer than outer apical seta. Lateral seta as long as outer apical seta, and apparently naked.

Antennule (Fig. 4) 9-segmented. Armament as follows (Roman numeral = segment; Arabic numeral = setae; sp = spine; ae = aesthetasc): I-3; II-5; III-7; IV-3 + sp; V-4; VI-2; VII-2; VIII-2 + ae; IX-7 + ae. Apical aesthetasc fused at base to adjacent seta.

Antenna (Fig. 5) 4-segmented. Segment 1 comprised of fused coxa and basis, armed with 1 inner seta distally and 1 outer seta representing exopodite. Endopodite 1 with 1 marginal seta, endopodite 2 with 5 setae, and endopodite 3 with 7 apical setae and row of 5 small lateral setae.

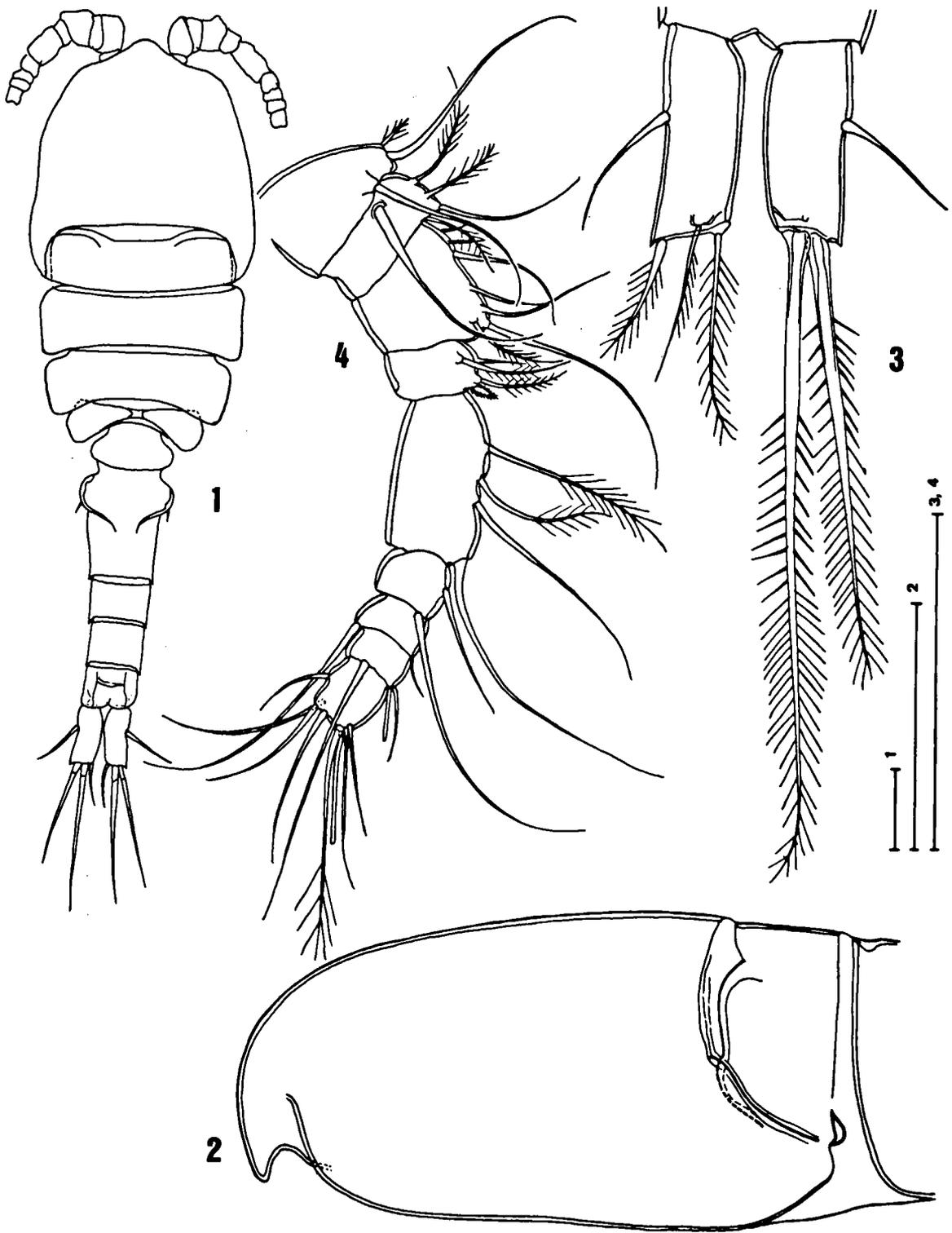
Mandibular palp (Fig. 6) consisting of wide basis bearing inner seta; endopodite 2-segmented, with 2 and 5 setae on basal and terminal segments; exopodite 4-segmented, with 1 seta on segments 1–3 and 2 setae on segment 4.

Maxillule (Fig. 7) with biramous palp. Coxa without outer seta representing epipodite. Basis with 2 setae on proximal endite and 1 seta on distal endite. Exopodite 1-segmented, with 4 setae on distal margin. Endopodite 1-segmented with 5 setae on distal margin and 2 setae on inner margin.

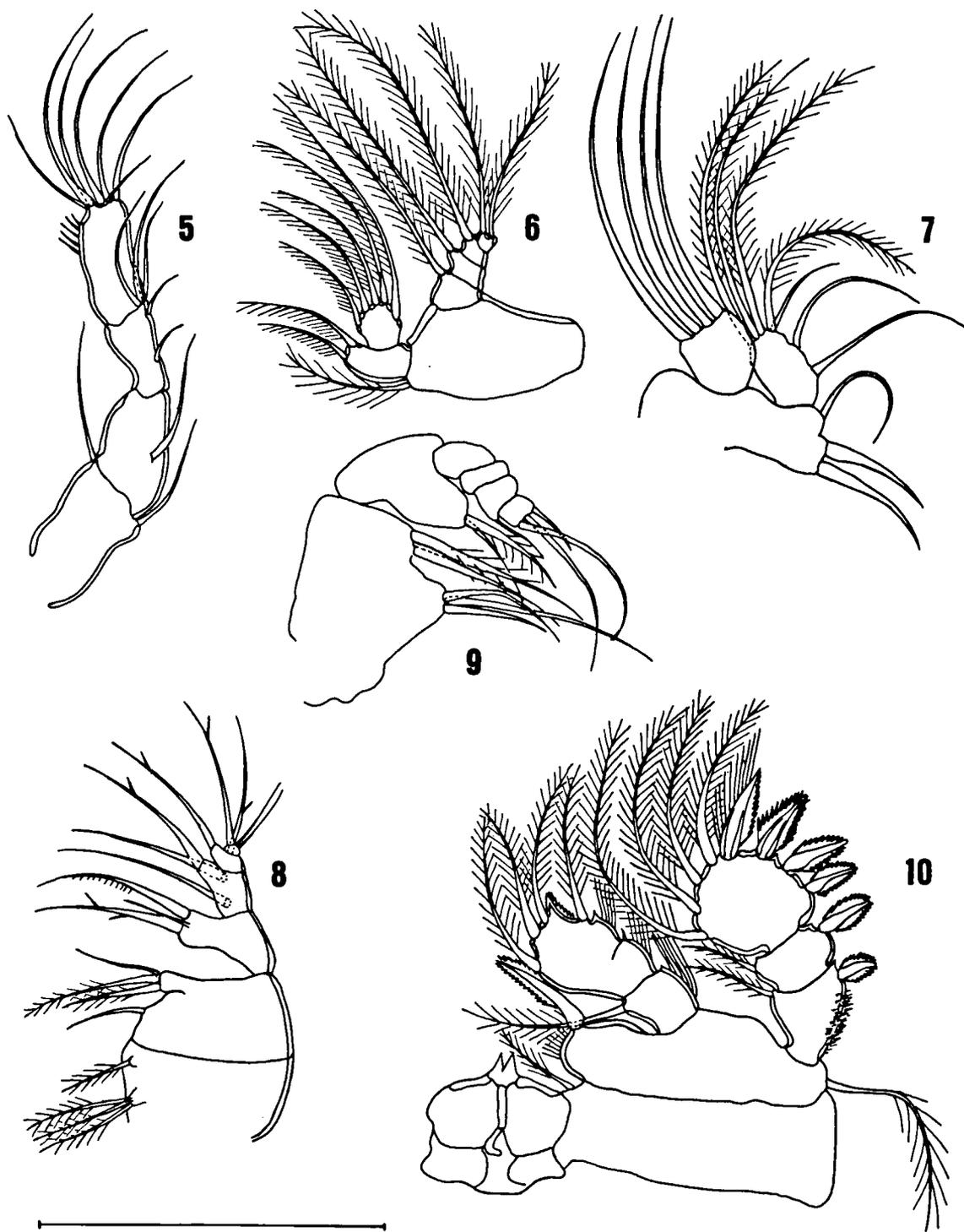
Maxilla (Fig. 8) 6-segmented, comprised of praecoxa, coxa, basis and 3-segmented endopodite. Praecoxa with proximal endite bearing 3 setae and distal endite with 1 seta. Coxa with 2 endites: proximal endite with 1 seta and distal endite with 3 setae. Basis bearing 2 broad setae and 1 very slender seta. Endopodite bearing 3, 2, and 3 setae on segments 1–3, respectively.

Maxilliped (Fig. 9) 6-segmented, comprised of syncoxa, basis and 4-segmented endopodite. Syncoxa with 2 endites; proximal endite with 3 setae and distal endite with 2 setae. Basis enlarged, armed with 2 setae. Endopodal segment 3 with short seta; segment 4 with 1 short and 2 long setae; other endopodal segments naked.

Swimming legs 1–4 (Figs. 10–12) having 2-segmented endopodite (scar of fusion between former endopodites 2 and 3 only visible in the outer side of endopodite leg 1) and 3-segmented exopodite; con-



Figs. 1–4. *Cuipora janaina* gen. n., sp. n., ♀ holotype: 1, habitus, dorsal; 2, cephalosome and first pediger showing the scars representing limits between both segments, left lateral; 3, caudal rami, dorsal; 4, antennule. Scale bars 50  $\mu$ m.



Figs. 5–10. *Cuipora janaina* gen. n., sp. n., ♀ holotype: 5, antenna; 6, mandibular palp; 7, maxillular palp; 8, maxilla; 9, maxilliped; 10, leg 1. Scale bar 50  $\mu$ m.

figuration of spines and setae as shown below. Leg 2 (not figured) differing from leg 3 in size and in having slender spines. Distalmost spine on leg 1 exopodite 3 with inner margin plumose and outer margin serrate. Inner and apical setae on leg 4 endopodite 2 reduced in length and densely plumose. Endopodite 2 of legs 1–4 with serrate hyaline membrane along margin distal to outer seta. The armament of legs 1–4 is as follows:

|    | COXA | BASIS | EXOPODITE       | ENDOPODITE |
|----|------|-------|-----------------|------------|
| P1 | 0-1  | 1-1   | I-1; I-1; IV-4  | 0-1; 1,2,1 |
| P2 | 0-1  | 1-0   | I-1; I-1; IV-5  | 0-1; 1,2,1 |
| P3 | 0-1  | 1-0   | I-1; I-1; IV-5  | 0-1; 1,2,1 |
| P4 | 0-1  | 1-0   | I-1; I-1; III-5 | 0-1; 1,2,1 |

Leg 5 (Fig. 13) composed of 2 segments, proximal segment with long outer seta, distal segment 1.6 times longer than wide and bearing 2 spines and 1 seta, outer spine small and with serrate lamella, inner spine twice as long as outer spine and naked. Median seta about 3 times as long as distal segment. Narrow intercoxal plate joining both 5th swimming legs.

Male (Fig. 14): Body length 415–490  $\mu\text{m}$ . Ratio prosome : urosome = 1.2 : 1. Antennule 14-segmented. Leg 5 (Fig. 15) similar to that of the female, except that both spines have a serrate lamella. Leg 6 (Fig. 15) represented by inner spiniform projection and 2 setae, outermost seta being twice as long as median seta.

**Etymology.** – The specific name honors Janaina, “spirit” of the Brazilian Candomblé and Yoruban pantheons, patroness of love and those who go to sea.

**Discussion.** – An up-to-date key for the genera of Cyclopininae was presented by Huys & Boxshall (1990). *Cuipora* gen. n. can be included in item 6 of this key as follows:

- 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* Huys & Boxshall, 1990
- Exp3. P1–P4 with 8,9,9,8 spines/setae; enp2. P1–P4 with 4,4,4,4 spines/setae; A1 female 9-segmented .....

- ..... *Cuipora* gen. n.
- 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

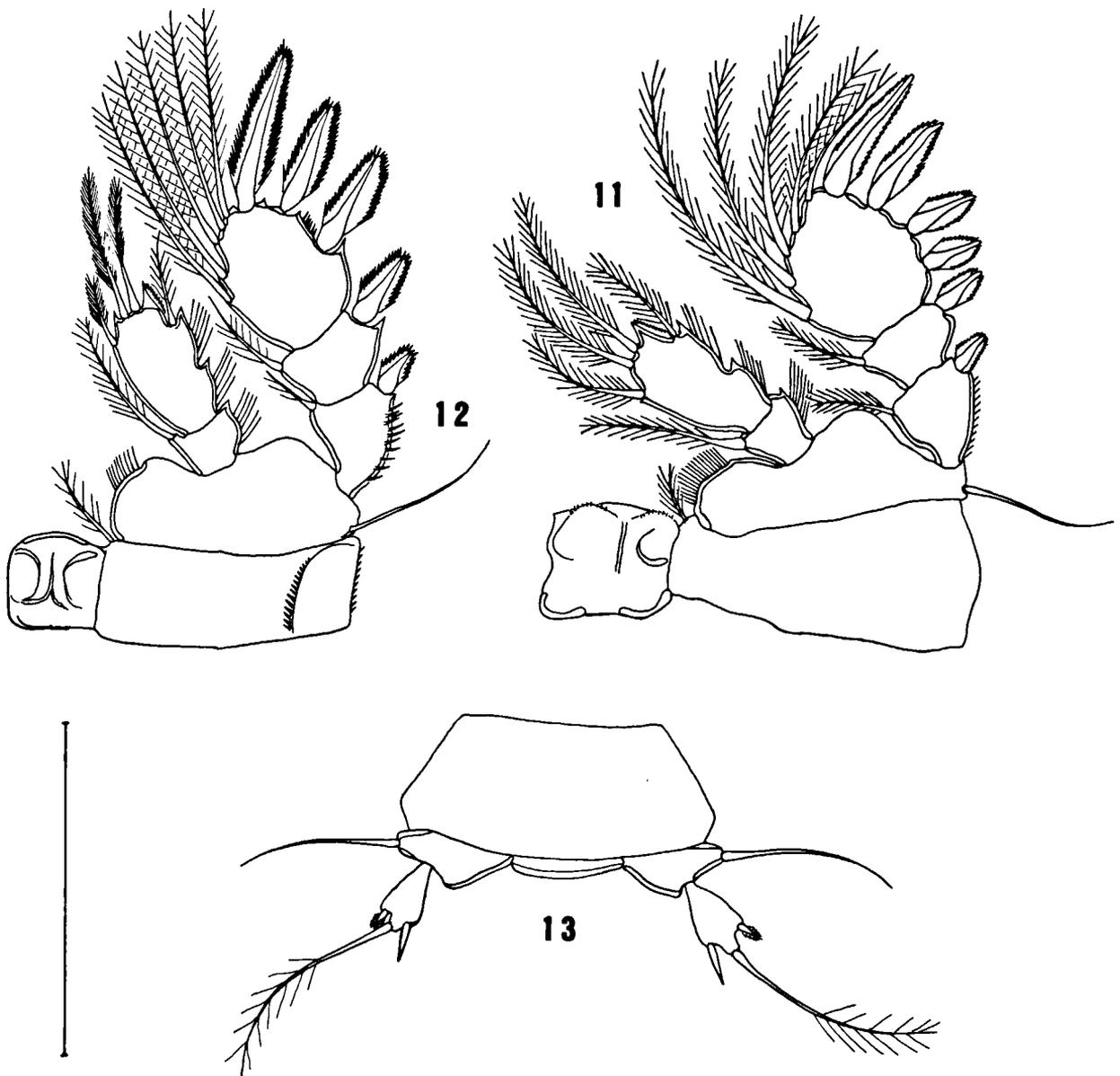
Most of the characters enumerated in the diagnosis of *Cuipora* gen. n. were established by Lindberg (1953, 1961) as a basis for the erection of a new genus of the Cyclopininae. Other characters were added following Huys & Boxshall (1990) to improve the diagnosis. *Cuipora* is distinguished by a combination of the states of these characters not found in any of the other genera.

Two-segmented endopodites in legs 1 to 4 are found in five other genera of this subfamily. Among them, *Indocyclopina* Wells, 1967, *Erythropolites* Huys & Boxshall, 1990, and *Herbstina* Huys & Boxshall, 1990 have 3-segmented exopodites in these legs. *Cuipora* is the only genus that has 2-segmented endopodites together with 4 setae on each distal segment of the endopodites of the swimming legs.

*Erythropolites* shares with *Cuipora* other characters than the segmentation of the swimming legs. These are the segmentation of the mandibular palp, the spine and setal formula of legs 1–4 exopodite segment 3, and the structure of leg 5 in the female. *Erythropolites* differs in possessing an 8-segmented antennule and a 3-segmented endopodite of the maxilliped, in lacking the seta representing the exopodite on the antenna, in possessing 5 setae on the endopodite of the maxillula and in bearing 4 elements in the distal article of the leg 5 of the male.

*Herbstina* shares with *Cuipora* the number of segments in the antennule and mandibular palp and the number of elements in leg 5 of the female. *Herbstina* differs in lacking the antenna exopodite, in having the maxilliped with 2-segmented endopodite, legs 1–4 exopodite segment 3 having spine and setal formula 3-3-3-3 and 5-5-5-5 respectively, and in having the exopodite of leg 5 with 6 setae and leg 6 with 3 elements in the male.

*Cyclopina* Claus, 1862 is another genus closely related to *Cuipora*. The body shape is similar in both genera. The structure of antenna and mouthparts in *Cuipora* is exactly as in *Cyclopina caiala* sp. n. (discussed below) except for the 6-segmented

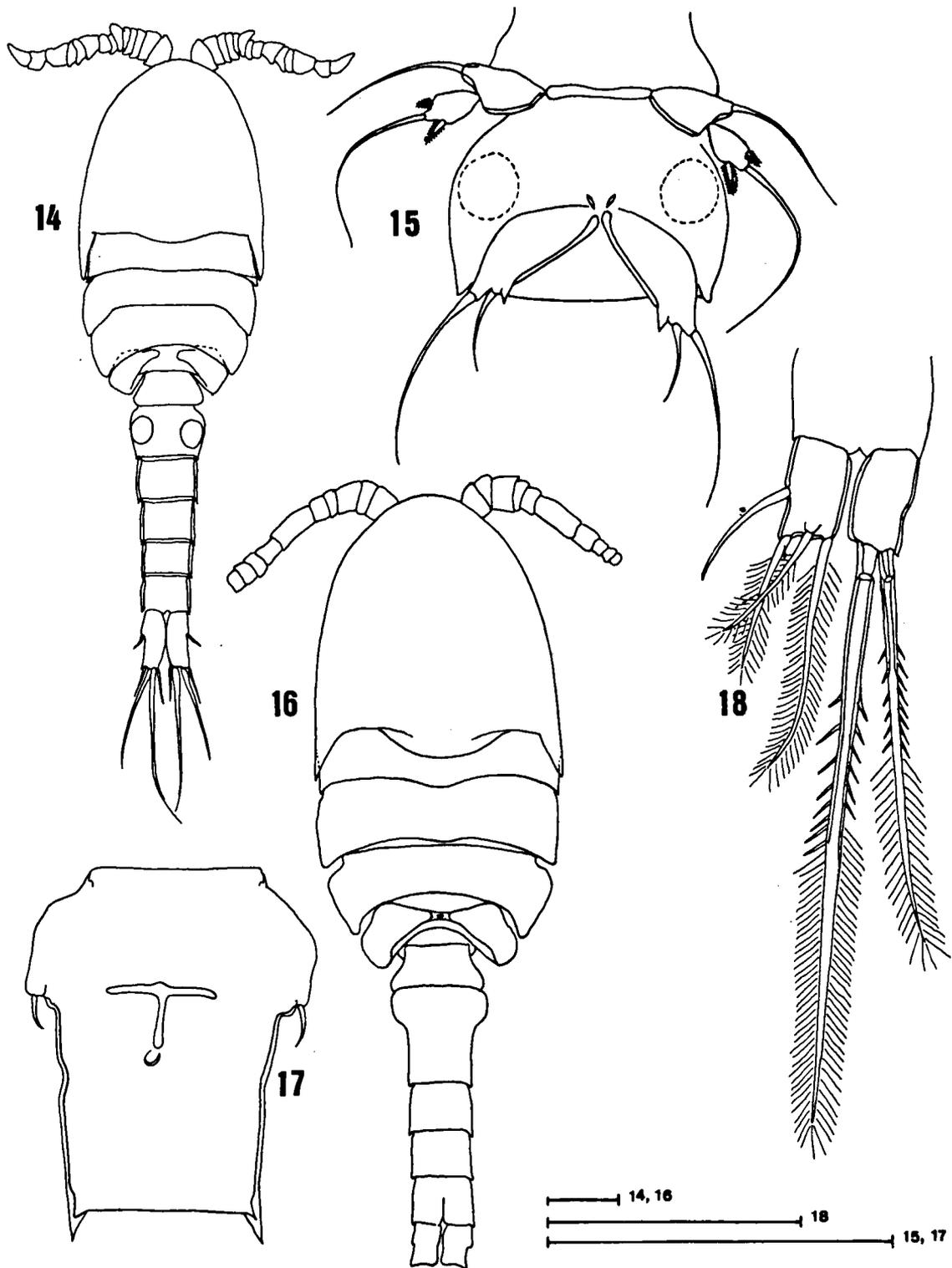


Figs. 11–13. *Cuipora janaina* gen. n., sp. n., ♀ holotype: 11, leg 3; 12, leg 4; 13, pair of leg 5. Scale bar 50 µm.

maxilla and the armament of the maxillipedal endopodite. The spine and setal formula of legs 1–4 exopodite 3 and the structure of leg 5 in the male and female described for *Cuipora* are widely found in species of *Cyclopina* and in other genera of Cyclopininae as well. However, the differences in the segmentation and armament of legs 1–4 and in the number of segments in the antennula necessitate the separation of this species in a new genus.

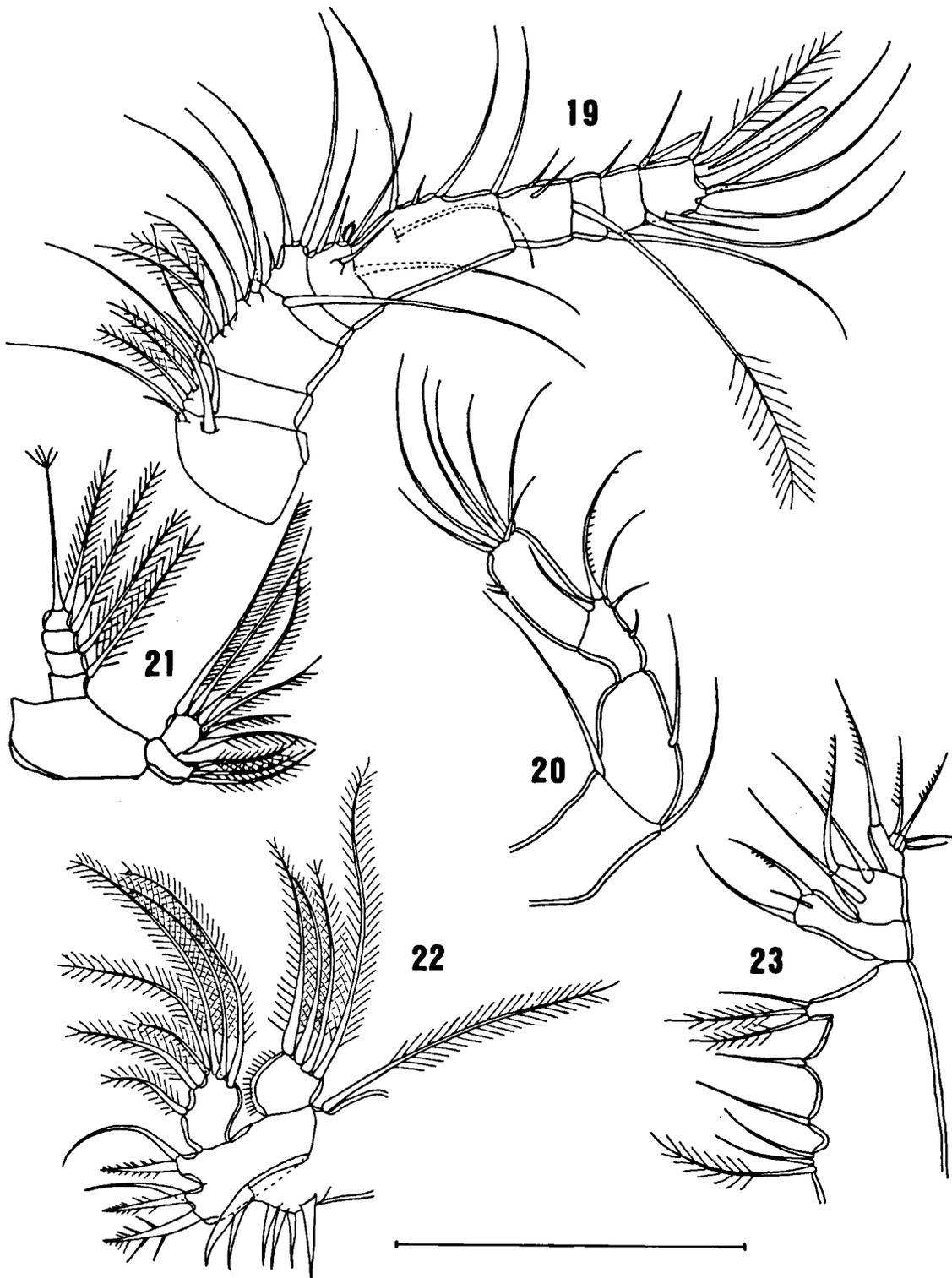
***Cyclopina caiala* sp. n.**  
(Figs. 16–30)

Material examined. – Bregari beach, Salvador, Brazil, 22 ♀♀ and 18 ♂♂, 4 Nov. 1985, C.E.F. Rocha col. The ♀ holotype and 12 paratypes are deposited in the collection of the Museu de Zoologia, Universidade de São Paulo (MZUSP 10739 and 10740, respectively).

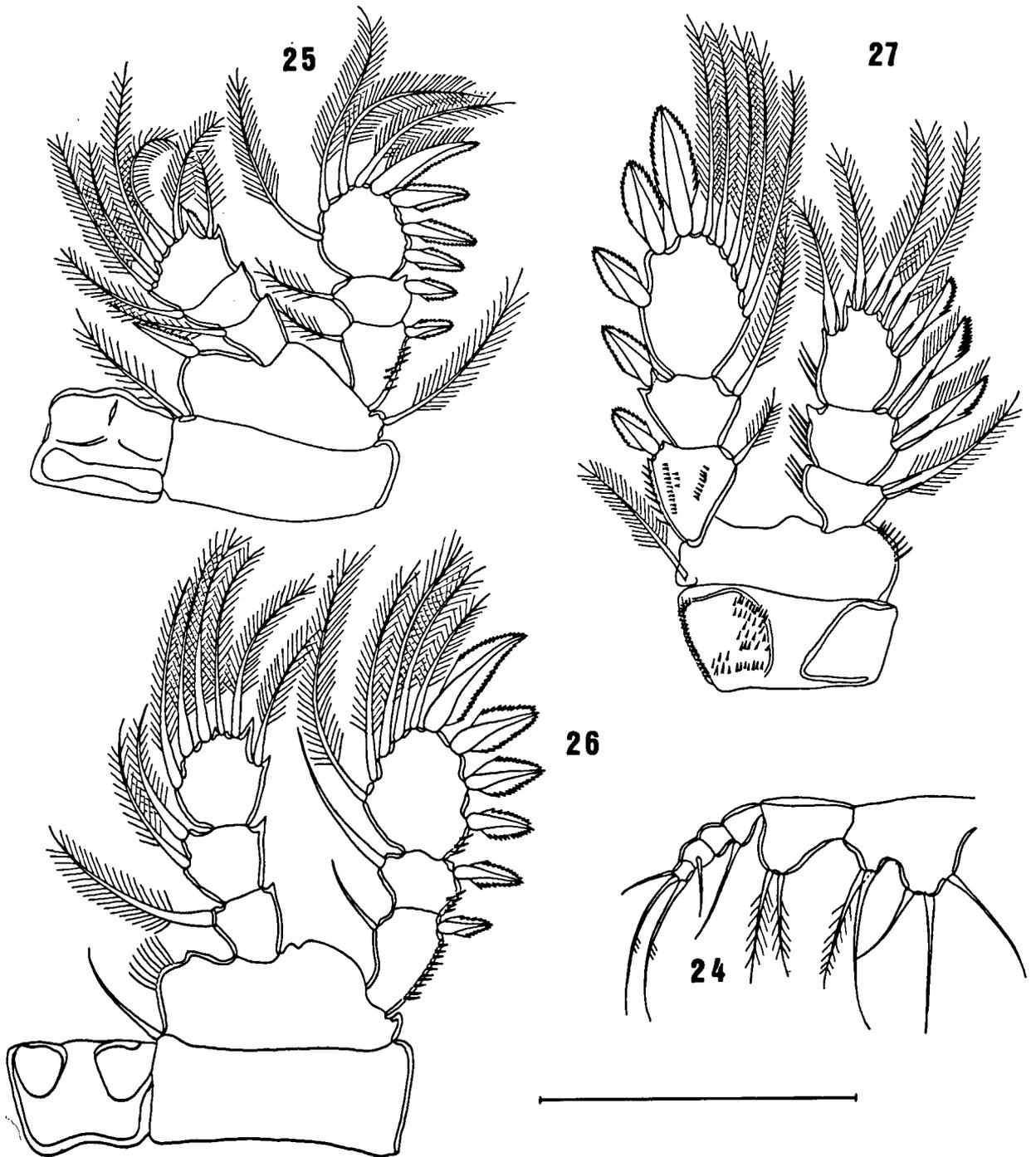


Figs. 14–15. *Cuipora janaina* gen. n., sp. n., ♂ paratype: 14, habitus, dorsal; 15, first urosomite and genital somite with pairs of leg 5 and leg 6, ventral.

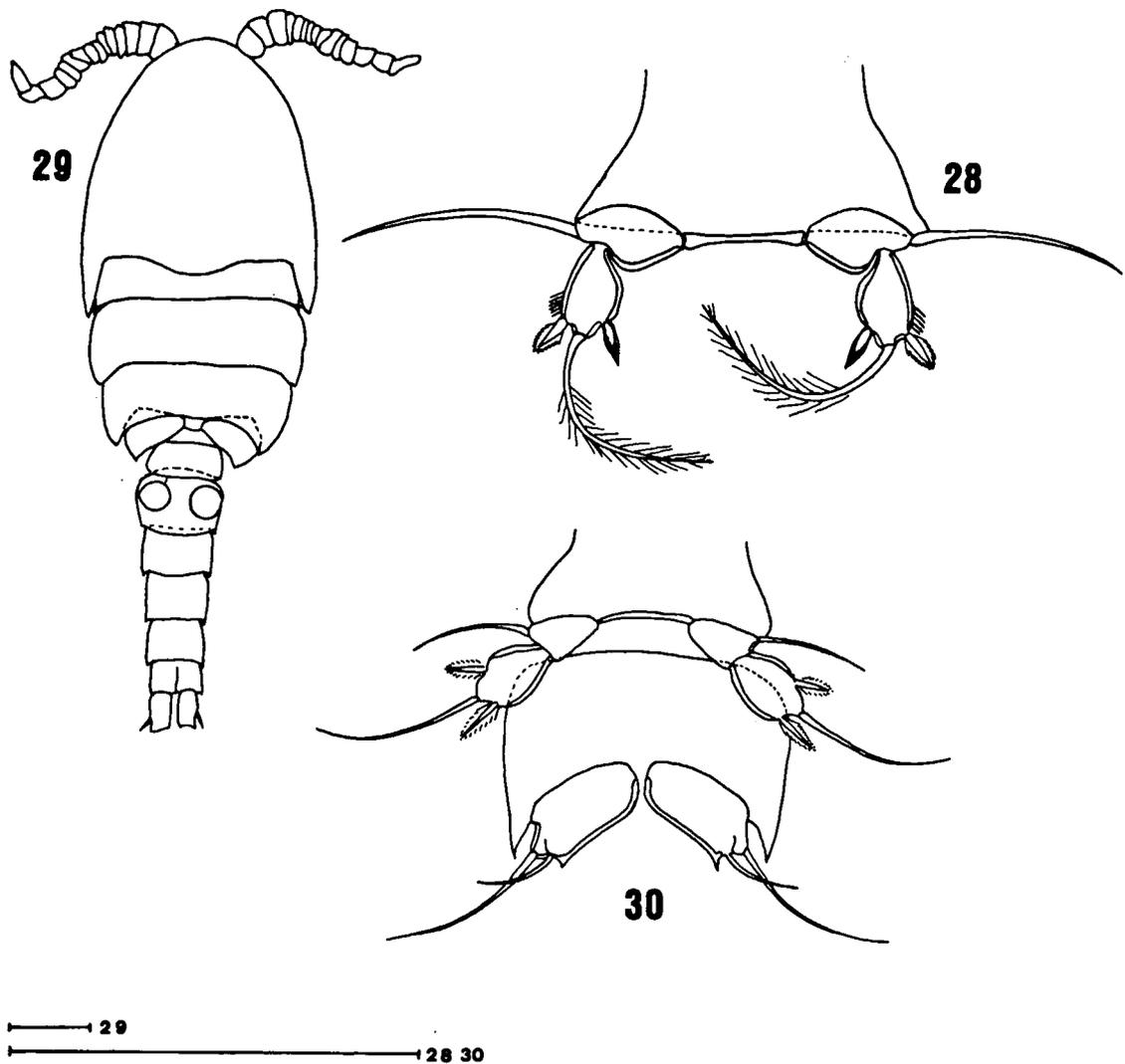
Figs. 16–18. *Cyclopina caiala* sp. n., ♀ holotype: 16, habitus, dorsal; 17, genital segment with seminal receptacle, ventral; 18, caudal rami, dorsal. Scale bars 50 μm.



Figs. 19–23. *Cyclopina caiala* sp. n., ♀ holotype: 19, antennule; 20, antenna; 21, mandibular palp; 22, maxillule; 23, maxilla. Scale bar 50  $\mu$ m.



Figs. 24–27. *Cyclopina caiala* sp. n., ♀ holotype: 24, maxilliped; 25, leg 1; 26, leg 2; 27, leg 4 (caudal face). Scale bar 50  $\mu$ m.



Figs. 28–30. *Cyclopina caiala* sp. n.; 28, first urosomite ♀ holotype with pair of leg 5, ventral; 29, habitus ♂ paratype, dorsal; 30, first urosomite and genital somite ♂ with pairs of leg 5 and leg 6, ventral. Scale bars 50 μm.

Description. – Female: Body length 430–520 μm. Ratio prosome:urosome = 1.3–1.5:1. Suture between cephalosome and pediger 1 more visible laterally than mediodorsally. Pediger 4 with cuticular thickening on tergite (Fig. 16). Genital segment (Fig. 17) expanded anteriorly and tapering posteriorly. Seminal receptacle anchor-shaped. Caudal ramus (Fig. 18) 1.7 times longer than wide. Inner median apical seta 1.6 times longer than outer median apical seta; both setae spinulose proximally and plumose distally. Lateral seta, dorsal seta and outermost apical seta similar in length; innermost api-

cal seta 1.7 times longer than outermost apical seta.

Antennule (Fig. 19) 10-segmented. Armament as follows (Roman numeral = segment; Arabic numeral = setae; sp = spine; ae = aesthetasc): I = 3; II = 5; III = 7; IV = 3; V = 5 + sp; VI = 5; VII = 3; VIII = 2; IX = 2 + ae; X = 7 + ae.

Antenna (Fig. 20) 4-segmented; major armament as in *Cuipora janaina*.

Mandibular palp (Fig. 21): endopodite 1 with 3 setae; endopodite 2 with 6 setae; exopodite 4-segmented, each segment with 1 seta, except distal segment with 2 apical setae, of which outermost

seta straight and tipped with tuft of hairs.

Maxillule (Fig. 22) with 2-segmented protopodite. Praecoxa fused to coxa; coxa and basis distinct. Praecoxal arthrite not clearly seen. Coxa with 1 outer seta representing epipodite. Basis with 2 endites: proximal endite with 3 setae and distal endite with 2 setae. Endopodite 1-segmented, with 5 setae on distal margin and 2 setae on inner margin. Exopodite 1-segmented, with 4 setae on distal margin.

Maxilla (Fig. 23) 5-segmented. Armed as in *Cui-pora janaina*, differing by having praecoxa and coxa fused.

Maxilliped (Fig. 24) 6-segmented; syncoxa with 3 setae on proximal endite and 2 setae on distal endite. Basis expanded into endite with 2 setae. Endopodite 4-segmented; segment 1 with 1 seta, segment 2 naked, segment 3 with 1 seta, and segment 4 with 3 setae.

Legs 1–4 (Figs. 25–27) with 3-segmented rami. Leg 3 (not figured) differing from leg 2 in size and in having broader spines on exopodite 3. Formula of spines for legs 1–4 exopodite 3 4-4-4-3 and of setae 4-5-5-5. Distalmost spine of exopodite 3 leg 1 plumose on inner margin and serrate on outer margin. Two setae of leg 4 endopodite 2 and proximalmost inner seta of endopodite 3 modified, spiniform, plumose on outer margin and with serrate hyaline lamella on distal half of inner margin; basipodites 1 and 2 and exopodite 1 bearing several rows of spinules on caudal face.

Leg 5 (Fig. 28) 2-segmented. Basal segment bearing long outer seta. Terminal segment twice longer than wide. Spines of terminal segment similar in length and about half length of segment. Ornamentation of these spines differing, outer spine bearing more conspicuous lamella. Apical seta about 5 times longer than spines. Narrow intercoxal plate joining both 5th legs.

Male (Fig. 29): Body length 390–415  $\mu\text{m}$ . Ratio prosome : urosome = 1.6 : 1. Antennule with 15 segments. Leg 5 (Fig. 30) differing from that of female in having outer spine shorter than inner spine and inner spine with more conspicuous lamella. Leg 6 (Fig. 30) represented by inner spiniform projection and 2 setae, outer seta twice as long as inner seta.

Etymology. – The specific name refers to “Caiala”, a local folkloric name given to the Siren “Queen of the Sea”.

Differential diagnosis. – *Cyclopina caiala* sp. n. is included in the group of species which possess reduced spines on the terminal segment of leg 5.

*Cyclopina caiala* sp. n. resembles *Cyclopina mediterranea* Steuer, 1940, *Cyclopina vachoni* Nicholls, 1939, and *Cyclopina oblivia* Monchenko, 1981 by the general structure of leg 5 in the female. The new species differs from the two latter species in the armament of the mandibular palp, maxillule, and maxilliped, the number of segments as well as the armament of the maxilla, and in having modified setae on endopodites 2 and 3 of leg 4. *Cyclopina caiala* can be distinguished from *Cyclopina mediterranea* in having no sexual dimorphism in leg 5, according to Steuer's (1940) description. In addition, Petkovski (1955) described the maxilliped of *Cyclopina mediterranea* as possessing 6, 3, 0, 0, 1, and 3 setae from the proximal to distal segments; *Cyclopina caiala* has a different formula for this mouthpart (5-2-1-0-1-3).

The terminal segment of leg 5 of *Cyclopina caiala* is very similar to that of the single female specimen from the Red Sea identified by Herbst (1964) as possibly *Cyclopina latipes mediterranea* Steuer, 1940. However, Herbst's specimen differs from *C. caiala* by the armament of the endopodites of the mandibular palp, maxillule, and maxilliped. Steuer (1940) presents an incomplete description of *C. latipes mediterranea*, mentioning only characteristics of the caudal ramus and leg 5 as differences from *C. latipes* Schäfer, 1936. Lindberg (1953) raised Steuer's (1940) subspecies to species level. Petkovsky (1955) redescribed *C. mediterranea* from specimens collected in Budva and Bar (Yugoslavia). The specimen identified by Herbst (1964) as possibly *C. latipes mediterranea* differs from Petkovsky's redescription in the general aspect of leg 5 of the female and the armament of the mandibular palp, maxillule, and maxilliped. To clarify this situation, it would be helpful to examine type-material of *C. mediterranea*. It is likely that Herbst's (1964) specimen represents a new taxon.

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