A New Genus of Copepods (Caligoida, Pandaridae) from a Thresher Shark in Madagascar

by

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A collection of copepods parasitic on the body surface of a thresher shark, *Alopias superciliosus* (Lowe), was sent to Dr. Arthur G. Humes by M. Alain Crosnier who collected the specimens at Majunga, Madagascar. The material was given to me to incorporate into a taxonomic study of the family Pandaridae (2). My sincere thanks are given to these persons for their contribution to this work.

These copepods represent a new genus and species described as follows :

Pagina n. gen.

—Female - Frontal plate distinctly separate. First thoracic segment fused with cephalon. Thoracic segments 2, 3, and 4 free. Second and third thoracic segments without dorsal plates. Fourth segment with a dorsal plate. Abdomen 2-segmented, each segment with a dorsal plate. Abdomen attached to the distal end of the genital segment and visible dorsally. Cephalic appendages of the typical pandarid type. Legs 1-4 biramose; the rami of leg 1 2-segmented, those of legs 2-4 3-segmented; all bearing plumose setae. Fifth and sixth legs present. Egg sacs long.

—Male - Body of the typical pandarid form. No dorsal plates present. Appendages with the same generic characters as the female.

—*Pagina*, from Latin, a page (alluding to the relationship of the abdominal plates to each other). Feminine gender.

Type species - *Pagina tunica* n. sp.

Pagina tunica n. sp.

Specimens studied - 21 specimens (18 females and 3 males) collected from *Alopias superciliosus* (Lowe) caught at Majunga, Madagascar. Holotype female, allotype male, and 8 paratype females in alcohol deposited in the United States National Museum, 3 paratype females in alcohol deposited in the collection of the Centre d'Océanographie et des Pêches de Nosy Bé, and the remaining paratypes in the author's collection.

—Female - Body form as in figures 1 and 2. Total length, based on an average of 4 specimens, including caudal rami but not the setae, 17.9 mm. Greatest width (measured at the widest point of the cephalon) 5.8 mm.

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Cephalon nearly round, slightly longer than wide, measuring 6.0 x 5.8 mm (measurements including marginal fringe). Posterior corners of cephalon projecting distally. First thoracic segment fused with the head. Second segment distinct with two lateral lobes extending to the posterior margin of the 3rd thoracic segment, thus incorporating the smaller 3rd segment within its posterior border. Fourth thoracic segment with the dorsal plate consisting of two conspicuous winglike lobes. The distal corners of this plate extend only slightly over the anterior corners of the genital segment. Genital segment large, its greatest length 4.6 mm and its greatest width at the posterior corners 3.8 mm. Posterior corners produced to form two short lobes. Abdomen 2-segmented; both segments possessing a conspicuous dorsal plate. From the dorsal aspect the abdominal plates covering the rest of the abdomen. Ventrally the first abdominal segment (fig. 6) as wide as long, measuring 1.5 x 1.5 mm. The dorsal plate of this segment extending over the rest of the abdomen and with a deep median sinus dividing it into two long lobes (see figs. 1 and 3). Second abdominal segment also as long as wide and measuring ventrally 2.1 x 2.1 mm. Its dorsal plate composed of only a single lobe and extending over the proximal ends of the caudal rami (see figs. 1 and 3). Caudal ramus (fig. 3) large, comprising almost one-fourth of the total body length. Each ramus about 4 times as long as wide, measuring 4.2 x 1.3 mm. The distal end of the ramus bearing 6 setae. The outermost and innermost small and naked, but the median 4 plumose and all nearly equal in length, the longest measuring 0.4 mm. The outer border heavily sclerotized while the inner only weakly so and often appearing wrinkled in preserved specimens.

Oral area as in figure 4. A single pair of adhesion pads near the base of the first antenna. First antenna (fig. 5) 2-segmented. First segment 0.77 mm long and bearing 23 stout setae along its anterior distal border all of which are covered with spinules. Four smaller finely plumose setae internal to the outer spines. Terminal segment 0.42 mm long and bearing 13 naked setae. Second antenna (fig. 7) 3-segmented. Terminal segment in the form of a stout, heavily sclerotized claw bearing 2 setae, one basal and the other median. No adhesion pad associated with this appendage. Mouth tube (fig. 8) about twice as long as its basal width with the labium extending beyond the tip of the labrum. The tip of the labrum somewhat expanded and weakly trilobed with a pair of subterminal processes projecting within the tube (fig. 9). The labium expanded at its tip and fringed as in figure 9. The mandible attached to the head near the base of the tube (see fig. 8) and bearing a long process which extends between the labrum and labium. Distal end of the mandibular process with an inner row of about 11 teeth (fig. 10). First maxilla (fig. 11) indistinctly divided into two segments. Proximal segment with a group of 3 setae near its base. Distal segment short and terminating as a blunt process. Second maxilla (fig. 12) of three segments. Second segment bearing a group of stout setules and a single seta at its inner distal corner. Third segment short, with two transverse rows of setules and bearing a claw ornamented on the proximal two-thirds of its concave margin with transverse rows of spinules and on its convex surface with longitudinal rows of spinules. Maxilliped (fig. 13) apparently 4-segmented. First segment bearing a pad-like process on its antero-ventral surface which undoubtedly serves as an adhesion pad. Third segment bearing a heavily sclerotized spine-like process opposed by the claw of the fourth segment, thus forming a chela. Fourth segment bearing a single seta near the base of the claw.

Legs 1-4 biramose, with the spine and setal formula as follows (the Roman numerals referring to spines, the Arabic numerals to setae) :

	leg 1		leg 2		leg 3		leg 4	
	exp.	end.	exp.	end.	exp.	end.	exp.	end.
1st seg.	I:0	0:0	I:1	0:1	I:1	0:1	I:1	0:1
2nd seg.	III:4	3	I:1	0:2	I:1	0:2	I:1	0:2
3rd seg.	-	-	III:5	6	III:5	4	III:5	3

Leg 1 (fig. 14) with both rami 2-segmented. First exopod segment outwardly greatly inflated and bearing a single outer spine. Last exopod segment with three outer spines and four inner setae. First endopod segment with no setae but the second segment bearing three setae. Basipodite bearing a short outer seta; its inner margin naked except for a short seta. No setae on the coxopodite.

Leg 2 (fig. 15) with both rami 3-segmented. First exopod segment with an outer spine and an inner seta. Second segment the same. Third segment with 3 outer spines and 5 terminal setae. First endopod segment with an inner seta. Second segment with 2 inner setae. Third segment with 6 terminal setae. Basipodite with only an outer seta; its inner margin with a row of hairs. Coxopodite seta stout and densely plumose. Leg 3 (fig. 16) with both rami 3-segmented. First and second exopod segments with an outer spine and an inner seta. Third segment with three outer spines and 5 terminal setae. The outer margin of the exopod segments serrated. First endopod segment with an inner seta. Second segment with 2 inner setae. Third segment with 4 terminal setae. Basipodite and coxopodite armed as in leg 2. Leg 4 (fig. 17) with both rami 3-segmented. First and second exopod segments with an outer spine and an inner seta. Third segment with 3 outer spines and 5 terminal setae. First endopod segment with an inner seta. Second segment with 2 inner setae. Third segment with 3 terminal setae. Inner portion of the basipodite expanded with a marginal fringe as in the figure. No seta on the coxopodite. All setae on legs 1-4 plumose and all spines fringed. Leg 5 located on the ventral surface near the posterior corner of the genital segment (see fig. 5), and composed of a single isolated outer seta and an inner sclerotized process bearing 3 naked spines. Leg 6 modified to form a hook-like process which holds the spermatophores in place (see fig. 5). Egg strings long, 1.5 times as long as the body.

— Male - Body form as in figure 18. Total length, based on an average of 2 specimens, including caudal ramus but not the setae, 11.7 mm. Greatest width 4.6 mm measured at the widest part of the cephalon. Cephalon nearly round somewhat wider than long (4.6 x 4.2 mm) with its posterior corners projecting. Lateral dorsal edge of segment 2 bearing on each side a clear membrane which extends posteriorly to the fourth segment. Fourth segment with only a suggestion of the wing-like plate found in the female. Genital segment (fig. 19) 2.6 x 2.1 mm somewhat longer than wide. Spermatophores visible through the posterior half of the genital segment. Abdomen 2-segmented, without dorsal plates. First segment measuring 0.88 x 0.88 mm. Second segment longer than wide (1.4 x 1.08 mm) with its widest part in the distal portion of the segment. Caudal ramus armed as in the female; about 4 times as long as wide (1.9 x 0.49 mm). Its inner margin bearing a row of short hairs.

Oral area as in the female. First antenna like that of the female. Second antenna (fig. 20) 4-segmented. Second segment with striated areas as shown in the figure. Claw shorter and stouter than in the female and composed of 2 segments. (In the female these segments are fused to form one). Other oral appendages like those of the female. Maxilliped (figs. 21 and 22) heavily sclerotized with a chela at its tip. When the chela is closed the claw of the last segment fits into a bifurcation on the tip of the spine-like process on the penultimate segment. A bossed area present between these claws. In addition to the claw the last segment bearing a single seta (see fig. 22). Adhesion process near the base of the maxilliped as in the female.

Legs 1-4 as in the female except for the last endopod segment of leg 3 (fig. 23). The ventral surface of this segment bearing a heavily sclerotized process which extends out over an embossed area near the edge. (This seems to be modified for holding, but the exact function is as yet unknown). In addition to the ventral process, a more weakly sclerotized dorso-lateral process. Leg 5 (fig. 24) located ventro-laterally in the middle of the genital segment (see fig. 19) and bearing four setae, three plumose and one fringed with spinules. Outer seta not greatly displaced from the other three, as in the female. Leg 6 (fig. 25) located internal to the distal corner of the genital segment and consisting of a small process bearing three short setae.

— Discussion - The genus *Pagina* is closely related to the genus *Dinematura* Latreille, 1829, of which there are three known species. These two genera have the following characteristics of the female in common : a wing-like dorsal plate on the fourth thoracic segment; a 2-segmented abdomen, each abdominal segment bearing a dorsal plate the first of which is bilobed and the second is a single lobe; and legs 1-3 similair and relatively unmodified. The genus *Pagina* can be separated from *Dinematura* by the fact that in *Dinematura* the fourth leg is broad and conspicuously lamelliform, whereas the fourth leg of *Pagina* is unmodified.

Pagina is unlike all other known genera of this family in having the rami of legs 2-4 3-segmented.

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Explanation of figures

All figures were drawn with the aid of a camera lucida. The letter after each explanation refers to the scale at which it was drawn.

RESUME

L'auteur décrit *Pagina tunica*, nouveau genre et nouvelle espèce de Copépode caligoïde parasite d'un requin, *Alopias superciliosus*, du nord-ouest de Madagascar. Ce genre pandaride est près de *Dinematura*, mais il en diffère notablement en ayant la quatrième patte non modifiée.

Plate 1

Pagina tunica n. gen. , n. sp. , female

Fig. 1 - Dorsal (A)

Fig. 2 - Lateral (A)

Fig. 3 - Caudal ramus (C)

Fig. 4 - Oral area, ventral (D)

Fig. 5 - First antenna (E)

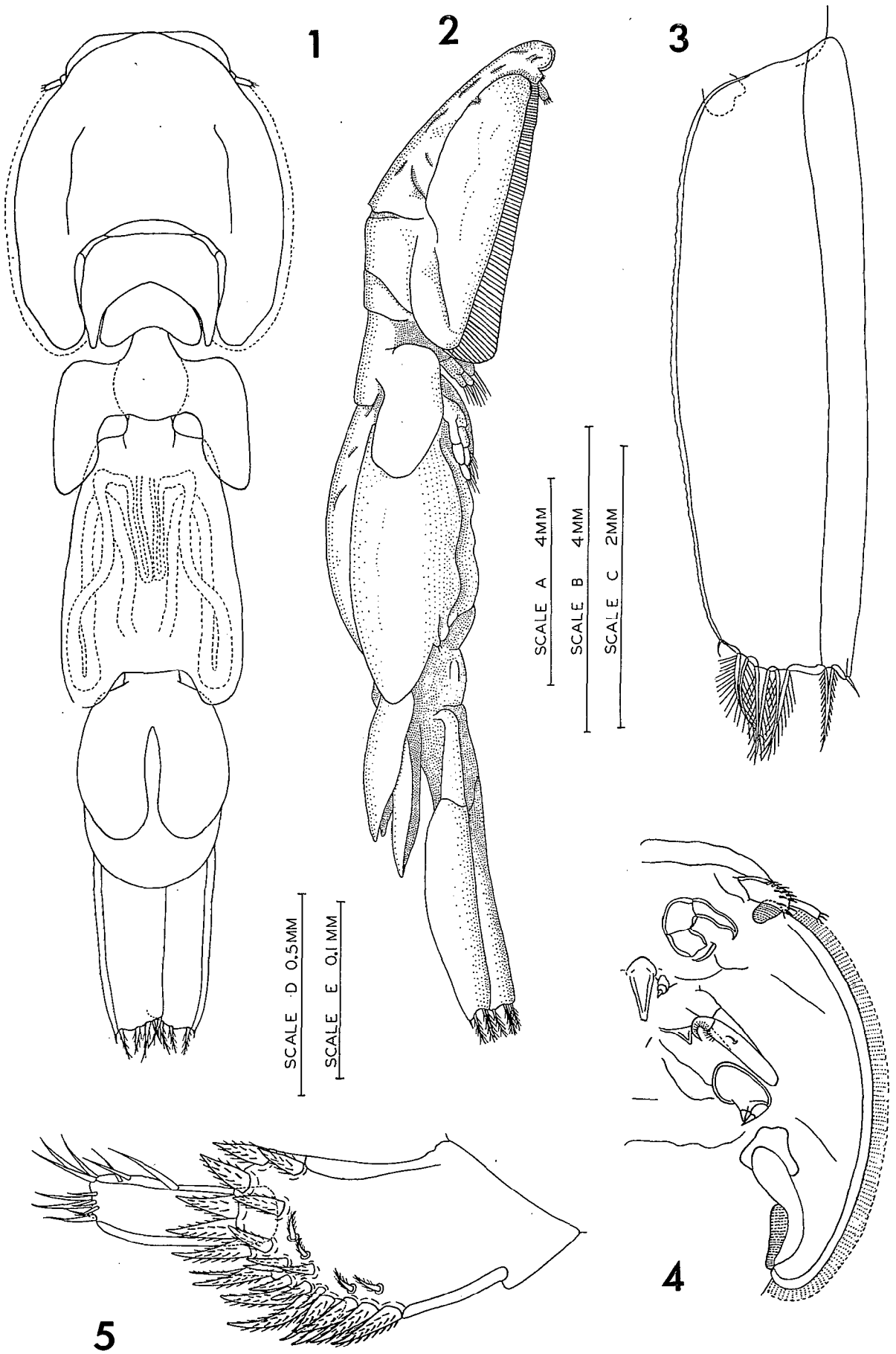
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Plate 2

Fig. 6 - Posterior end of genital segment and abdomen, ventral (B)

Fig. 7 - Second antenna (E)

Fig. 8 - Mouth tube and adjacent appendages, postero-dorsal (E)

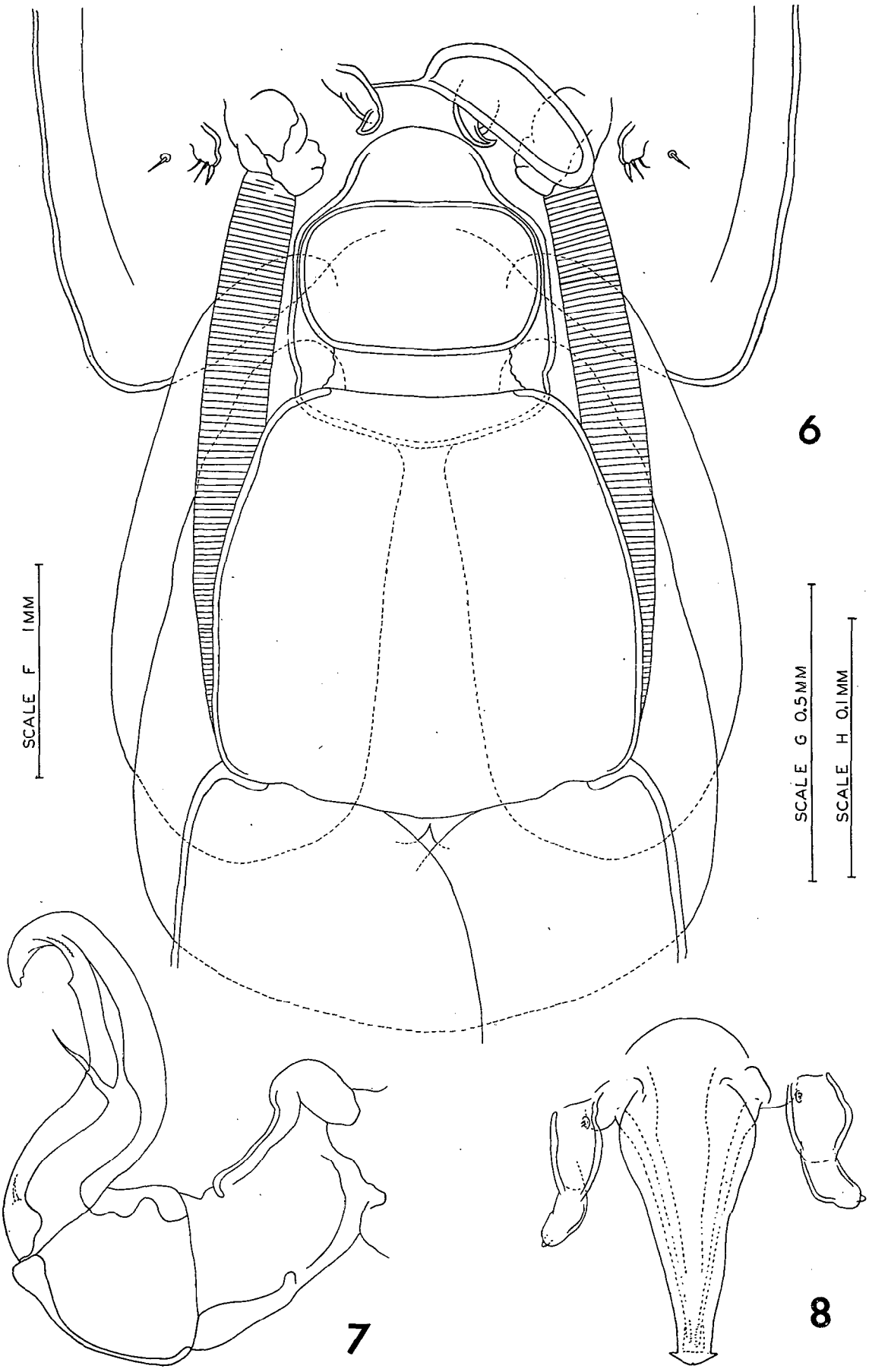
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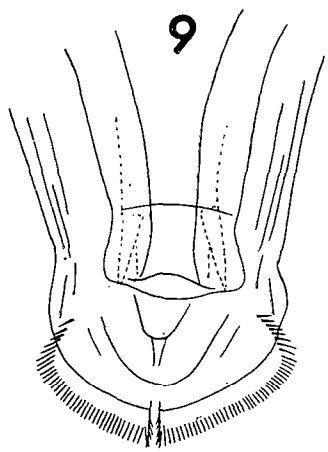
Plate 3

Fig. 9 - Tip of mouth tube, antero-ventral (F)
Fig. 10 - Tip of mandible (G)
Fig. 11 - First maxilla (H)
Fig. 12 - Second maxilla (E)
Fig. 13 - Maxilliped (B)
Fig. 14 - Leg 1 (B)
Fig. 15 - Leg 2 (B)
Fig. 16 - Leg 3 (B)
Fig. 17 - Leg 4 (B)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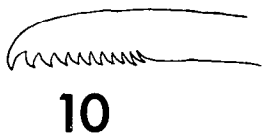
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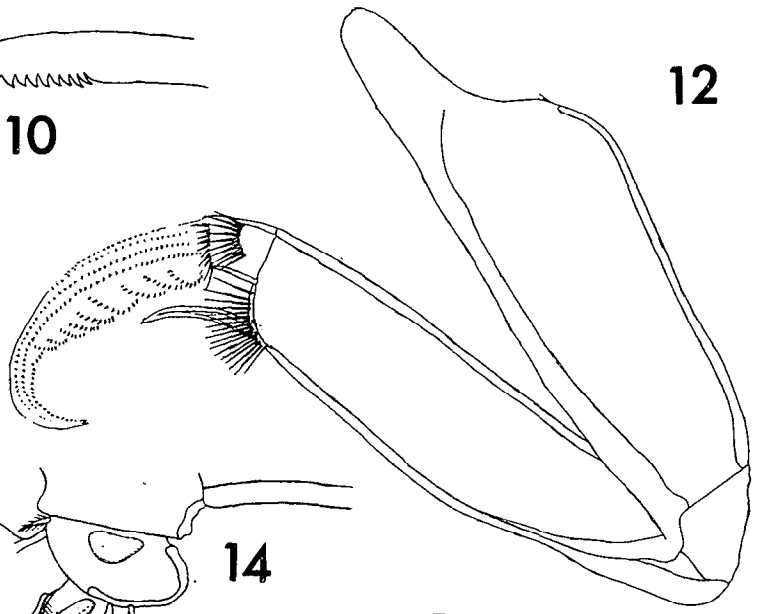
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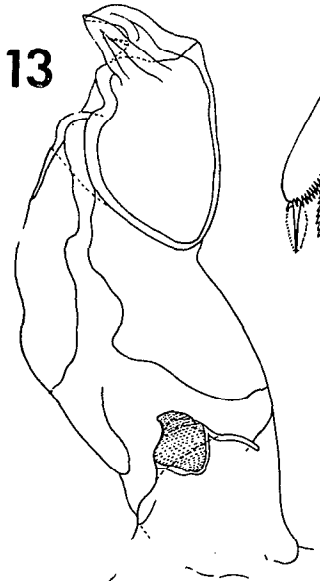
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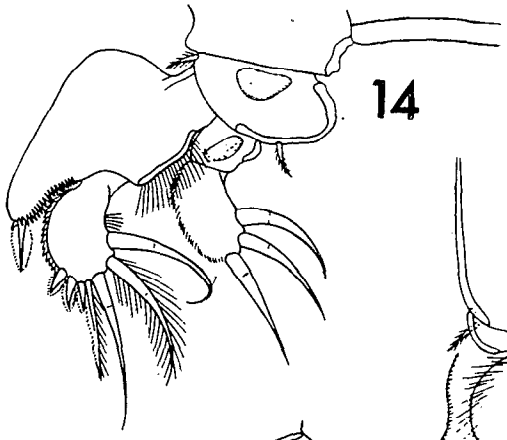
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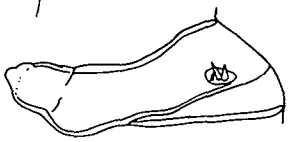
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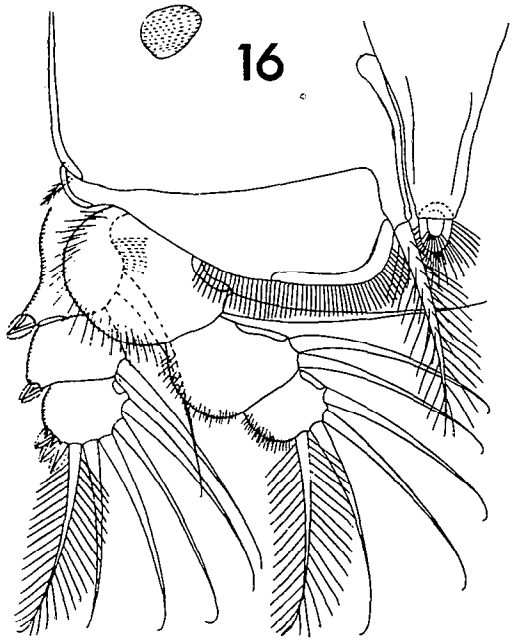
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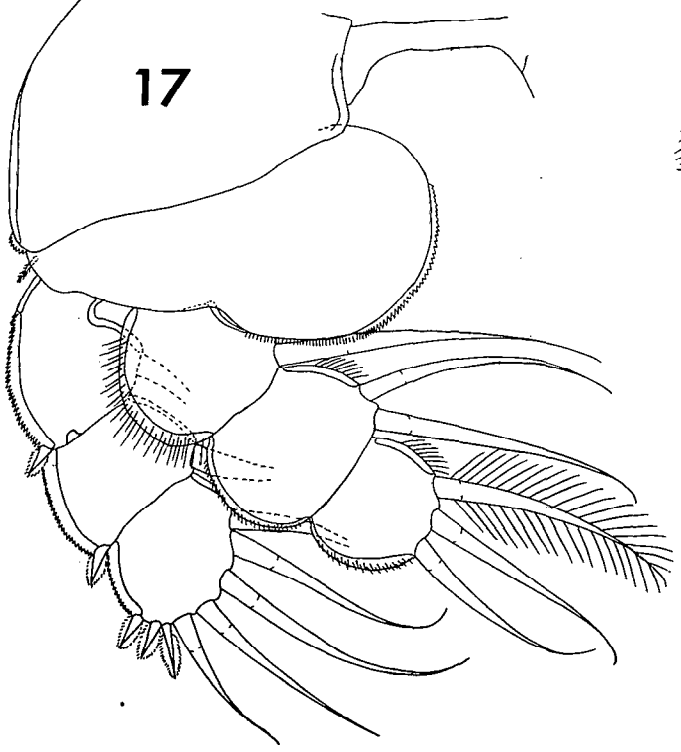
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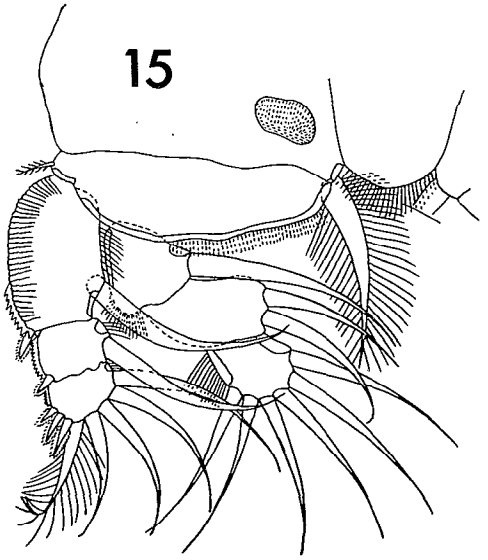
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Plate 4

Pagina tunica n. gen. , n. sp. , male

Fig. 18 - Dorsal (A)

Fig. 19 - Genital segment and abdomen, ventral (C)

Fig. 20 - Second antenna (H)

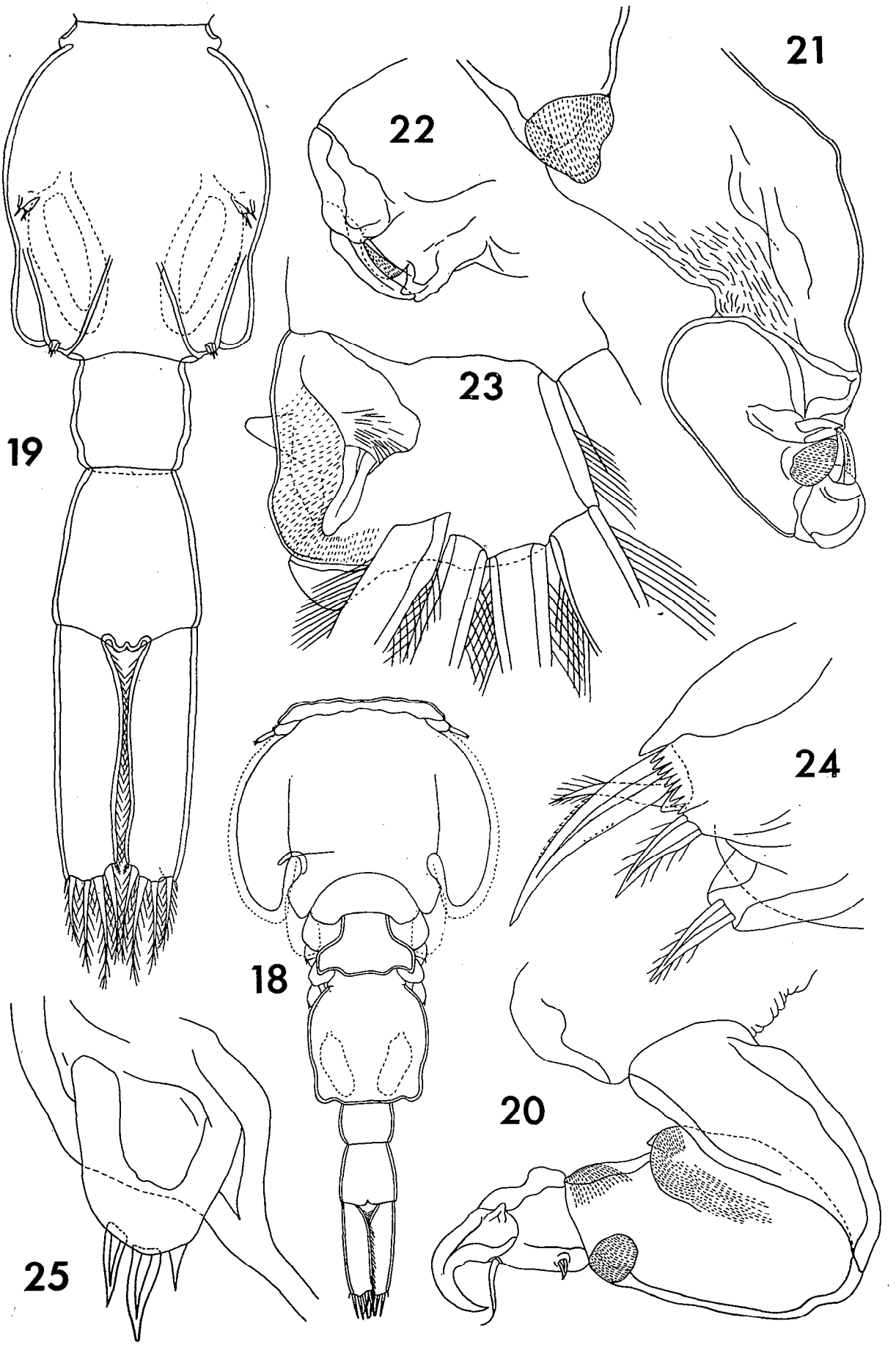
Fig. 21 - Maxilliped, ventral (E)

Fig. 22 - Tip of maxilliped, dorsal (H)

Fig. 23 - Leg 3, endopod, 3rd segment, ventral (F)

Fig. 24 - Leg 5, left side (G)

Fig. 25 - Leg 6 (G)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