NEW SPECIES OF THE GENUS *ANTHESSIUS* (COPEPODA, CYCLOPOIDA) ASSOCIATED WITH MOLLUSKS IN MADAGASCAR

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and

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Four species of *Anthessius* are already known from Madagascar, all of them from pelecypods at Nosy Bé. They comprise *Anthessius pinnae* Humes, 1959, from *Pinna muricata* L., and three other species from *Tridacna* whose descriptions are currently in press (Humes and Stock).

This report deals with three new species of *Anthessius*, two from opisthobranchs and one from a pelecypod. These were collected at Nosy Bé by the first author during 1963-64 as part of the work of the U.S. Program in Biology of the International Indian Ocean Expedition.

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ANTHESSIUS DOLABELLAE n. sp. Figs. 1-34

Type materials. 17 females, 42 males, and 17 copepodids washed from 29 tectibranchs, *Dolabella scapula* (Martijn), under rocks in 0.5 m at Tany Kely, near Nosy Bé, Madagascar. Collected by AGH on March 29, 1964. Holotype female, allotype, and 40 paratypes (10 females and 30 males) deposited in the United States National Museum, Washington, and the remaining paratypes in the collection of A.G. **Humes**.

Other specimens (all from *Dolabella scapula*). 2 females, 2 males, and 5 copepodids from 4 hosts, under intertidal rocks at Ambariotelo, between Nosy Bé and Nosy Komba, August 9, 1960; 1 male and 1 copepodid from 1 host, under intertidal rock at Nosy N'Tangam, near Nosy Bé, October 5, 1960; 1 male from 4 hosts, on an intertidal flat on the west side of Nosy Faly, near Nosy Bé, October 21, 1960; 3 copepodids from 2 hosts, under intertidal rocks at Nosy N'Tangam, March 17, 1964; 1 female and 1 male, from 2 hosts, under dead coral in 1 m, Pte. Ambarionaomby, Nosy Komba, September 11, 1964; and 1 female from 2 hosts, under rocks in 0.5 m, Tany Kely, September 23, 1964.

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Female. The body (fig. 1) resembles that of other species in the genus. The length (not including the setae on the caudal rami) is 1.67 mm (1.58-1.76 mm) and the greatest width, just in front of the segment bearing leg 1, is 0.78 mm (0.73-0.85 mm), based on 7 specimens. The prosome is rather broad, not unusually inflated, the ratio of length to width being 1.3 : 1. The segment of leg 1 is separated from the head dorsally and laterally by a furrow. The epimeral areas of the metasomal segments are rounded.

The segment of leg 5 (figs. 2 and 3) has a swelling on its midlateral margins and is widest posteriorly. The fifth legs arise slightly dorsally. The segment measures 221 × 226 μ in its greatest dimensions, and the width at the lateral swellings is 198 μ. The genital segment (fig. 4) is somewhat wider than long, measuring 169 × 192 μ. On its lateral margins there are slight identations at the beginning of the posterior third. These indentations are posterior to the areas of attachment of the egg sacs (fig. 5), which are dorsal in position and show two small unequal spines 20 μ and 11 μ in length respectively. The three postgenital segments are 64, 55 and 69 μ in length from anterior to posterior. The anal segment bears ventrally on each posterior outer margin a row of minute spinules.

The caudal ramus (fig. 6) is moderately elongate, 70 × 45 μ (the length taken along its outer margin), the ratio of the length to the greatest width being about 1.55 : 1. On the outer basal margin there is a small hyaline setule (hair ?). The outer lateral seta is inserted dorsally slightly beyond the midregion of the ramus. It measures 234 μ in length and is naked. The pedicellate dorsal seta, 62 μ long, bears a few lateral hairs. The outer subterminal seta, 146 μ, bears hairs along its inner margin. The inner terminal seta, 258 μ, bears prominent lateral hairs. The two long terminal setae, 582 and 874 μ in length respectively, bear lateral hairs; the basal portion of these two setae proximal to the «joint» is finely punctate, and the two setae are inserted somewhat dorsally on the ramus between two flaps, the ventral one of which bears a marginal row of minute spinules. There are refractile points on the dorsal and ventral surfaces of the ramus as indicated in figs. 4 and 6.

The dorsal surface of the prosome bears scattered refractile points and hairs. The dorsal and ventral surfaces of the urosome bear refractile points as shown in the figures. The ratio of the length of the prosome to that of the urosome is about 1.9 : 1.

The egg sacs (fig. 1) reach a little beyond the setae on the caudal rami. Each sac measures about 1187 × 336 μ (in one female) and contains many small eggs 65 μ in diameter.

The rostral region (fig. 7) is not strongly delimited ventrally, and bears refractile points as shown in the figure.

The seven segments of the first antenna (fig. 8) have the following lengths (measured along their posterior non-setiferous margins) : 21 (65 μ along the anterior margin), 164, 39, 127, 94, 36, and 42 μ respectively. The first segment bears 4 setae; the second a basal group of 7 setae and a distal group of 9 setae (the distalmost one bearing hairs along its posterior margin); the third 5 setae; the fourth a basal haired seta and 2 distal setae; the fifth 2 centrally located haired setae and 2 terminal setae plus 1 aesthete; the sixth 2 setae and 1 aesthete; and the seventh 7 setae and 1 aesthete. The formula thus is 4, 16 (7 + 9), 5, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Except for those specified, all the setae are naked. The dorsal surface of the first antenna bears a few refractile points as indicated in the figure. The sixth segment has a sclerotized groove on its ventral surface in which the aesthete of the fifth segment may fit closely.

The second antenna (fig. 9) is apparently 4-segmented and relatively slender. Its entire length, including the claws, is about 390 μ and its width 56 μ. Each of the first two segments bears a small naked seta. The third segment bears 4 small, slender setae, three of them in a row (one of these with an interruption in the sclerotization suggesting a claw) and the fourth adjacent but separate from the row. The fourth segment is short and rather poorly delimited from the third; it bears one inner seta, 2 unequal outer setae, and 4 claws, one of which is more sclerotized and unguiform than the others. A row of minute spinules occurs on the proximal outer area of this segment.

The labrum (fig. 7) bears lateral groups of long slender setules; its posterior edge is bifurcated, each lobe having a short distal marginal row of minute spinules. The ventral surface of the labrum bears refractile points and hairs as shown in the figure.

The mandible (fig. 10) has the usual apical lash, at whose base there are two inner ornamented articulated tooth-like spines and an outer long setiform element, on whose inner basal area there are two hyaline lamellate lobes. The paragnath (fig. 11) is probably represented by a small sclerotized lobe seen in ventral view under the inner edge of the lobe of the labrum at the level of the mandibles and first maxillae. The first maxilla (fig. 12) consists of a single flattened segment with a bilobed margin and bearing a smooth slender seta, a prominent spine, four small hyaline spinules, and a crescentic row of still smaller spinules. The smaller of the two lobes shows a distinct marginal notch. The second maxilla (fig. 13) is 2-segmented. The distal segment has five teeth on the distal median margin (the second and third large, the first and fourth small, and the distalmost intermediate in size), a hyaline spine on the posterior surface, and on the proximal median surface a small protuberance (fig. 14) armed with small spinules and with an adjacent row of minute spinules. The maxilliped (fig. 15) appears to be 3-segmented, with distally a minute spiniform process and a hyaline spine (?), in addition to rows of minute spinules as shown in the figure.

The area between the maxillipeds and the first pair of legs is not produced ventrally. A transverse line extends between the bases of the maxillipeds (fig. 16).

The rami of legs 1-4 (figs. 17, 18, 20 and 21) are 3-segmented, with the spine and setal formula as follows:

P1	protopod	0:1	1:0	exp	I:0	I:1	III,I,4
				end	0:1	0:1	I,5
P2	protopod	0:1	1:0	exp	I:0	I:1	III,I,5
				end	0:1	0:2	III,3
P3	protopod	0:1	1:0	exp	I:0	I:1	III,I,5
				end	0:1	0:2	IV,2
P4	protopod	0:1	1:0	exp	I:0	I:1	II,I,5
				end	0:1	0:2	IV,1

All four coxae bear a feathered inner seta, but the seta on the fourth coxa is much smaller (26 μ in length) than the others. The basis of each leg bears an outer seta, a row of hairs on the rounded inner margin, and between the rami (except on leg 4) a row of spinules. The basis of leg 1 has an additional row of spinules adjacent to the row of hairs. The detailed ornamentation of the rami may be seen in the figures. The distal end of the endopod in legs 2-4 shows a bifurcated spinous process, illustrated for leg 2 in fig. 19. The last segment of the endopod of leg 4 is 96 μ in length, the inner seta 78 μ, and the four spines from inner to outer 95, 62, 55, and 44 μ.

Leg 5 (fig. 22) has a free segment measuring 130 $\times$ 46 μ in greatest dimensions, being about 2.8 times longer than wide. The three fringed spines are of nearly equal length (57, 52, and 61 μ from proximal to distal) and the slender naked seta is 91 μ long. Rows of spinules occur ventrally on the segment near the insertions of the spines. The seta arising from the body near the insertion of the free segment is 60 μ long and naked.

Leg 6 is probably represented by the two spines near the attachment of the egg sacs (see fig. 5).

The color in life in transmitted light is translucent to light tan, with the eye red, the intestine brown, and the egg sacs gray.

Male. The body (fig. 23) is similar in form to that of the female, but the prosome is relatively less broadened, the ratio of length to width being 1.44:1. The length (not including the setae on the caudal rami) is 1.13 mm (1.01-1.25 mm) and the greatest width 0.51 mm (0.45-0.57 mm), based on 10 specimens. The segment of leg 5 (fig. 24) is more bell-shaped than in the female and lacks the midlateral swellings. The genital segment is subrectangular and only slightly swollen, measuring 122 μ in length by 138 μ in width. The four postanal segments are 56, 49, 38, and 49 μ in length respectively, the third being the shortest.

The caudal ramus (fig. 25) resembles that of the female but is smaller, 44 × 39 μ, and relatively shorter, the ratio being 1.13:1.

The surface ornamentation of the prosome and urosome resembles that of the female. The ratio of prosome to urosome is about 1.6:1.

The rostral area is like that of the female. The first antenna resembles that of the female, but three more setae are added on the second segment (fig. 26), so that the formula becomes 4, 19 (9 + 10), 5, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete.

The second antenna resembles that of the female, but the seta on the first segment is large (88 μ in length) and spiniform (fig. 27) with a row of hairs along the inner margin.

The labrum, mandible, paragnath, and first maxilla resemble those in the female. The second maxilla (fig. 28) shows sexual dimorphism in having a distinct outer gibbosity on the first segment. There are only four teeth on the distal segment, the first small tooth being absent in the specimens dissected.

The maxilliped (fig. 29) is 4-segmented, assuming that part of the claw represents the fourth segment. The first segment bears a distal group of long spinules. The second segment bears on its posterior and inner surface a longitudinal row of minute spinules, a seta, and two dense patches of spines; and on its anterior and dorsal surface a seta and a row of slender spinules. A hyaline lamella protrudes like a crest along the ventral margin of the segment, and the dorsal margin of the segment shows two processes. The third segment is relatively very short and bears a spiniform seta 40 μ long and an adjacent smaller spiniform process. The claw (fig. 30) is 216 μ in length (measured along its greatest axis and not along the curvature), is rather strongly recurved, and bears a hyaline fringe along part of its concave margin, distal to which there is a row of hairs. Near the base of the claw on the anterodorsal surface there is a small setule.

The ventral area between the maxillipeds and the first pair of legs (fig. 31) is not produced, and shows a sclerotized area joining the bases of the maxillipeds.

Legs 1-4 resemble those of the female, except for the last segment of the endopod of leg 1 (fig. 32) where the outermost of the five setae is transformed to a spine, the formula for that segment being I,I,4.

Leg 5 resembles that of the female.

Leg 6 (fig. 33) is represented by a posterolateral flap on the ventral surface of the genital segment; it bears a spiniform seta 44 μ in length and a slender and somewhat shorter seta 27 μ long.

The spermatophore (fig. 34), seen only inside the body of the male, is elongate, 159 × 57 μ (not including the neck of 6 μ).

The color in life is similar to that of the female.

(The specific name *dolabellae* is derived from *Dolabella*, the generic name of the host.)

REMARKS : This species differs from all known species of *Anthessius* which also have the formula II,I,5 on the third segment of the exopod of leg 4. In the female of *A. navanacis* (**Wilson**, 1935) the free segment of leg 5 is relatively shorter (1.8:1), the caudal ramus is of different proportions (2.5:1), and the genital segment appears to be relatively shorter and wider. In the male the second segment of the maxilliped apparently lacks the two processes and the lamella seen in *A. dolabellae*. (Part of the information for this comparison is taken from Illg, 1960.)

In the female of *A. varidens* **Stock, Humes & Gooding**, 1963, the genital segment is of a different form, the egg sacs are relatively shorter, and the two hyaline lamellae between the apical elements of the mandible are absent. The male is somewhat larger, and the two spines on the last segment of the endopod of leg 1 are peculiarly modified. The male also lacks the two processes and the lamella on the second segment of the maxilliped.

In the female of *A. proximus* **Stock, Humes & Gooding**, 1963, the spinules ornamenting leg 5 are inconspicuous and occur only at the bases of the spines. In the male the two spines on the last segment of the endopod of leg 1 are modified as in *A. varidens*.

In *A. sensitivus* **Stock, Humes & Gooding,** 1963, the female is smaller (the male is unknown), and the first antenna bears numerous aesthetes.

In *A. nortoni* **Illg,** 1960, the female has a more elongate caudal ramus (3:1), and the accessory ornamentation with spinules on leg 5 is less conspicuous. In the male there is slight sexual dimorphism in the proximal outer spine on the third segment of the endopod of leg 3, and the second segment of the maxilliped lacks the two processes and the lamella.

In the male of *A. investigatoris* **Sewell,** 1949 (the female is unknown), the free segment of leg 5 is clavate, and, as illustrated in Sewell's fig. 18 A, is longer than the genital segment. The caudal ramus is about 1.5 times longer than wide, being somewhat longer than in *A. dolabellae*.

In *A. dilatatus* (**Sars,** 1918) the female is somewhat smaller (the male is unknown). The caudal rami are more elongate (longer than the anal segment), the second antenna appears to be shorter and more robust and has three terminal claws, and the free segment of leg 5 has almost parallel sides rather than being as in *A. dolabellae*.

In *A. leptostylis* (**Sars,** 1916) the female is larger, and the caudal rami are very elongate.

In *A. pinnae* **Humes,** 1959, the female is somewhat smaller, the caudal rami are more elongate (much longer than the anal segment), the egg sacs reach only to the midpoint of the caudal rami, the free segment of leg 5 is only 1.7 times longer than wide and rather ovoid, and of the terminal claws on the second antenna two are strong and two are very weakly developed and setiform. (The distal armature of the second antenna of *A. pinnae* has been verified by us in freshly dissected paratypic material. The armature is seen to be similar to that in other species, namely, four delicate setae on the third segment and three stronger setae and four more or less claw-like elements on the fourth segment.) The male is also smaller, has prominent aesthetes on the first antenna, and shows a modified spine on the last segment of the endopod of leg 1.

In *A. saecularis* **Stock,** 1964, the caudal ramus is more elongate (3.5 times longer than wide, and 1.5 times longer than the anal segment), on the free segment of leg 5 in the female the lengths of the three spines and the details of the spinular ornamentation are somewhat different, and the second segment of the maxilliped in the male lacks the two processes and the lamella seen in *A. dolabellae*.

Other detailed differences may be found between these 10 species and *A. dolabellae*, but the comparisons made serve to indicate some of the major dissimilarities. *A. dolabellae* seems to be unique in the form of the second segment of the maxilliped in the male, with its two processes and its lamella.

ANTHESSIUS STYLOCHEILI n. sp. Figs 35-62

Type material. 24 females, 21 males, and 5 copepodids washed from 58 tectibranchs, *Stylocheilus longicauda* (**Quoy & Gaimard**), exposed on intertidal sand on the eastern side of Ankify, on the mainland of Madagascar opposite Nosy Komba. Collected by AGH on October 4, 1963. Holotype female, allotype, and 30 paratypes (16 females and 14 males) deposited in the United States National Museum, Washington, and the remaining paratypes in the collection of A.G. **Humes**.

Other specimens (all from *Stylocheilus longicauda* in the same locality as the types): 16 females, 4 males, and 3 copepodids from 150 hosts, November 2, 1963; 11 females and 9 males from 53 hosts, August 8, 1964; and 11 females and 8 males from 400 small hosts, September 9, 1964.

Female. The body (fig. 35) is similar to that in the preceding species but is a little less broadened. The length (excluding the setae on the caudal rami) is 1.82 mm (1.60-2.04 mm), and the greatest width is 0.73 mm (0.61-0.85 mm), based on 10 specimens. The prosome is moderately broad, the ratio of length to width being 1.4:1. The segment of leg 1 is separated from the head by a dorsal transverse furrow. The rounded epimeral area of the segments of legs 2 and 3 slightly overlap posteriorly the succeeding segments. The tergum of the segment of leg 4 is not indented posteriorly as in the preceding species.

The segment of leg 5 (figs. 35 and 36) is inserted under the tergum of the last prosomal segment; here the segment has nearly parallel sides. The segment expands laterally behind this point. Its dorsal posterior margin slightly overlaps the genital segment. On the ventral surface of the segment there are two crescentic lines. Between the segment of leg 5 and the genital segment there is seen ventrally a short intersegmental sclerite. The genital segment is wider than long, 205 $\times$ 300 μ. It is widest at its middle, where it is abruptly idented and constricted posteriorly. The areas of attachment of the egg sacs (fig. 37) are dorsal in position just in front of the indentation, and have two small setae 13 μ and 9 μ in length. The three postgenital segments are 117, 78 and 161 μ in length from anterior to posterior. The anal segment bears on each outer posterior ventral margin a short row of minute spinules.

The caudal ramus (fig. 38) is elongate, about equal in length to the anal segment; its greatest length is 180 μ, its length along the inner margin 156 μ, and its greatest width 61 μ, the ratio of length to width being about 2.8:1. The arrangement of the setae is similar to that in the preceding species. The naked outer lateral seta, 55 μ in length, is inserted somewhat dorsally about halfway on the outer margin. The short naked pedicellate dorsal seta is 30 μ long. The naked outer terminal seta is 66 μ; the inner terminal seta is 108 μ in length and bears lateral hairs. The two long median terminal setae, 140 and 247 μ in length respectively, are less attenuated than usual and naked. The ramus is inserted dorsally on the anal segment. The terminal setae are inserted somewhat dorsally and the distal ventral margin of the ramus bears a row of minute spinules. There are refractile points and hairs on the dorsal and ventral surfaces of the ramus as indicated in figs. 36 and 38.

The dorsal surface of the prosome and the dorsal and ventral surfaces of the urosome bear scattered refractile points and hairs. The ratio of the length of the prosome to that of the urosome is about 1.3:1.

The egg sacs extend to the end of the setae on the caudal rami. Each sac (fig. 39) is about 896 $\times$ 325 μ (in one female) and contains many small eggs 57 μ in diameter.

The rostral area is similar to that of *A. dolabellae*.

The seven segments of the first antenna (fig. 40) have the following lengths (measured along their posterior non-setiferous margins): 24 (65 μ along the anterior margin), 162, 31, 81, 73, 20, and 21 μ respectively. The formula for the armature is the same as in the preceding species. The setae are relatively shorter than in *A. dolabellae* and all are naked.

The second antenna resembles that of the preceding species, except that the second segment is less slender.

The labrum resembles that of *A. dolabellae*, but the fine ornamentation of the two lobes is rather different (fig. 41), with minute marginal spinules and a submarginal row of larger hyaline spinules.

The mandible (fig. 42) resembles that of *A. dolabellae*, but the hyaline lobes at the inner basal area of the setiform element are of a different form. The paragnaths are probably represented by two small sclerotized lobes (fig.43) between the insertions of the first maxillae. The first maxilla is like that of the preceding species. The second maxilla (fig. 44) resembles in general form that of *A. dolabellae*, but the distal segment usually has six teeth, as in the specimen illustrated. (The second maxilla on the opposite side of the same individual had seven teeth as in fig. 45.) In other females there may be five teeth (fig. 46). The maxilliped resembles that of *A. dolabellae*.

The area between the maxillipeds and the first pair of legs (fig. 47) is produced ventrally in a balloon-like swelling, which in lateral view of the animal is rather prominent. A transverse line connects the bases of the maxillipeds.

The segmentation of the legs and the form of the intercoxal plates are in major respects similar to the preceding species. The spine and setal formula is also similar except that for the exopod of leg 4 the arrangement is I,0; I,1; III,I,5. Leg 1 (fig. 48) shows only minor differences from that of *A. dolabellae*. The last segment of the endopod of leg 2 (fig. 49) shows a distal bifurcation (present also in leg 3). The exopod of leg 4, with three outer spines on the last segment (instead of two as in *A. dolabellae*), is illustrated in fig. 50.

Leg 5 (fig. 51) has a free segment measuring 117 μ (the length along the inner margin) $\times$ 41 μ (the greatest width), the ratio being about 3:1. The three spines, each with smooth lateral lamellae, are nearly equal in length (39, 36, and 42 μ from proximal to distal) and the slender naked seta is 36 μ long. There are rows of spinules ventrally near the insertions of the spines, but these rows tend to be shorter than in the preceding species. The seta arising from the body near the insertion of the free segment is relatively short, only 28 μ in length.

Leg 6 is probably represented by the two setae near the attachment of the egg sacs (see fig. 37).

The color in life in transmitted light is pale amber, nearly translucent, with the eye red, the egg sacs opaque gray. A few females had a slight pink color.

Male. The body (fig. 52) has a general form similar to that of the female. The ratio of the length of the prosome to its width is about 1.5:1. The length (without the setae on the caudal rami) is 1.70 mm (1.57-1.83 mm) and the greatest width 0.63 mm (0.58-0.68 mm), based on 10 specimens. The segment of leg 5 (figs. 52 and 53) is not inserted under the tergum of the last prosomal segment as it is in the female. The genital segment is about as long as wide (177 $\times$ 172 μ), with its sides very slightly swollen. The four postgenital segments are 99, 104, 72, and 130 μ in length respectively, the third being the shortest.

The caudal ramus (fig. 53) resembles that of the female, but is somewhat longer and narrower, being a little longer than the anal segment. There is some variation in its length; in one male the ramus was 156 $\times$ 44 μ (ratio of 3.54:1) and in another 143 $\times$ 41 μ (ratio of 3.49:1), in both cases the length being measured along the inner margin.

The surface ornamentation of the prosome and urosome is much like that of the female. The ratio of prosome to urosome is 1.28:1.

The rostral area resembles that of the female.

The first antenna (fig. 54) resembles that of the female except for the addition of four long aesthetes (three on segment 2 and one on segment 4), so that the formula becomes 4, 16 (7 + 2 aesthetes and 9 + 1 aesthete), 5, 3 + 1 aesthete, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete.

The second antenna resembles that of the female, but the seta on the first segment (fig. 55) is spiniform (44 μ in length) with a row of hairs along its inner margin.

The labrum, mandible, and paragnath are like those in the female. The first maxilla also resembles that in the female except that the seta seems to be a little shorter than the spine. The second maxilla (fig. 56) has a distinct outer gibbosity on the first segment as in the male of *A. dolabellae*. There are five teeth (three large and two small) on the distal segment; the hyaline spine on that segment has a finely dentate lamella along the distal margin (fig. 57).

The maxilliped (fig. 58) has 4 segments, assuming part of the claw to represent the fourth segment. There is a pronounced, rather angular projection on the mid-inner margin of the first segment. The second segment is rather slender (lacking the ventral lamella and the irregularities of the dorsal margin seen in the preceding species), and the row of slender spinules on its anterior and dorsal surfaces is short. The seta on the third segment is rather long and slender (68 μ in length). The arcuate claw is 242 μ in length (measured along its greatest axis and not along its curvature). Otherwise the armature and ornamentation is similar to that in the preceding species.

The ventral area between the maxillipeds and the first pair of legs (fig. 59) is less produced than in the female. In preserved specimens the concave surfaces of the claws of the maxillipeds often rest against the anterior part of the swollen area. A sclerotized line joins the bases of the maxillipeds as in the female.

Legs 1-4 resemble those of the female, except for the last segment of the endopod of leg 1 (fig. 60), where the outermost of the five setae is transformed to a spine as in the preceding species. The formula for that segment is I,I,4.

Leg 5 (fig. 61) is relatively longer and more slender than in the female, measuring 130 $\times$ 31 μ in greatest dimensions, with a ratio of about 4.2:1.

Leg 6 (fig. 62) consists of a posterolateral flap on the ventral surface of the genital segment. This is extended posterolaterally into a subconical projection bearing a distal seta 48 μ in length and a more proximal, smaller, and less sclerotized seta 21 μ long.

Spermatophores were not observed.

The color in life is similar to that in the female.

(The specific name *stylocheili* is derived from *Stylocheilus*, the generic name of the host.)

REMARKS : *A. stylocheili* belongs to the group of species of *Anthessius* which have the formula III,I,5 on the third segment of the exopod of leg 4. It thus should be compared with each of the 17 species in this group. From these *A. stylocheili* may be distinguished on the basis of a combination of three characters: the relatively short apical setae on the caudal ramus (only about 1.4 times longer than the ramus), the abruptly indented genital segment in the female, and the angular projection on the inner margin of the first segment of the maxilliped in the male.

In addition, *A. fitchi* **Illg**, 1960, has a very different body form, is much larger, the caudal rami in the female are elongate and about 2 times the length of the anal segment, and the free segment of leg 5 is 2 times longer than wide and of a different form.

Each of the three species of *Anthessius* from *Tridacna* at Nosy Bé (**Humes & Stock**, in press) have a marked lateral indentation of the cephalosome near the level of the maxillipeds.

A. lighti **Illg**, 1960, and *A. hawaiiensis* (**Wilson**, 1921) are much larger.

In *A. brevifurca* **Sewell**, 1949, the caudal rami in the female are short, but little longer than wide, and less than the length of the anal segment (the male is unknown).

In *A. arenicola* (**Brady**, 1872) and *A. teissieri* **Bocquet & Stock**, 1958, the first antenna has six segments, and the anal segment has two ventral rows of spines *(arenicola)* or spinules *(teissieri)*.

In *A. minor* **Stock**, 1959, the female is much smaller in size, and there are two ventral rows of spines on the anal segment.

A. solecurti **Della Valle**, 1880 (based on **Stock**, 1959) is larger; the female shows two rows of spinules on the ventral surface of the anal segment, and the caudal rami are 3.5-4 times longer than wide.

A. ovalipes **Stock, Humes & Gooding**, 1963, is larger; the free segment of leg 5 is elliptical or oval in outline, less than two times as long as wide.

A. concinnus (**A. Scott**, 1909) is larger, has a more rounded prosome (in dorsal view), and leg 5 is of a somewhat different outline.

In *A. pleurobrancheae* **Della Valle**, 1880, the female is much larger, and the genital segment is more elongate. The distal end of the second maxilla has more than 10 teeth.

A. pectinis **Tanaka**, 1961, is much larger; the caudal rami are very elongate (in the female 12 times longer than wide).

A. groenlandicus (**Hansen**, 1923) has in the female a shorter genital segment, of quite different form than in *A. stylocheili*.

A. brevicauda (**Leigh-Sharpe**, 1934) has in the female a very short caudal ramus and the fifth leg is irregularly elliptical, nearly 1.5 times longer than wide.

ANTHESSIUS DISTENSUS n. sp. Figs. 63-88

Type material. 24 females, 44 males, and 11 copepodids from the mantle cavity of 19 pelecypods, *Pteria macroptera* Lamarck, attached to coral in 6 m, east of Pte. Ambarionaomby, Nosy Komba, near Nosy Bé, Madagascar. Collected by AGH on September 21, 1964. Holotype female, allotype, and 50 paratypes (15 females and 35 males) deposited in the United States National Museum, Washington, and the remaining paratypes in the collection of A.G. **Humes**.

Other specimens (all from *Pteria macroptera)*. 1 male from 1 host, in 2 m, west of Ambariotelo, between Nosy Bé and Nosy Komba, August 24, 1960; 2 females and 3 males from 1 host, in

20 m, Tany Kely, December 20, 1963; 13 females, 3 males, and 3 copepodids from 3 hosts, in 4-10 m, off Ampombilava, Nosy Bé, December 21, 1963; 4 females, 13 males, and 13 copepodids from 1 host, in 10 m, Pte. Lokobe, Nosy Bé, December 27, 1963; 9 females and 3 males from 4 hosts, in 7 m, Ambariotelo, August 18, 1964; 3 females and 1 male from 2 hosts, in 3 m, east of Pte. Ambarionaomby, Nosy Komba, September 18, 1964; and 1 female and 4 males from 3 hosts, Ambariobe, between Nosy Bé and Nosy Komba, September 19, 1964.

Female. The body (fig. 63) has a form somewhat different from either of the two preceding species. The length (not including the setae on the caudal rami) is 1.52 mm (1.26-1.77 mm) and the greatest width is 0.67 mm (0.55-0.79 mm), based on 10 specimens. The prosome in dorsal view is elongate rather than suboval, the ratio of length of width being 1.6:1. The segment bearing leg 1 is set off from the head by a dorsal transverse furrow. The epimeral areas of the segments bearing legs 2 and 3 are rather acute posteriorly.

The segment of leg 5 (figs. 64 and 65) is inserted slightly under the tergum of the last prosomal segment. The sides of the segment are somewhat swollen in the anterior half (the width here being 244 μ) but nearly parallel in the posterior half (203 μ). The length of the segment is 155 μ. In ventral view there is a lightly sclerotized line between the bases of the fifth legs. Between the segment of leg 5 and the genital segment a narrow intersegmental sclerite may be seen on the ventral surface. The genital segment is longer than wide, 231 $\times$ 203 μ. It is widest in its posterior half, at the level of the areas of attachment of the egg sacs. Behind this area the segment is indented laterally and the sides are nearly parallel (the width here being 138 μ). The egg sacs are attached dorsally, and each area of attachment (fig. 66) shows two setae, one 29 μ in length and bent, the other 7 μ, hyaline, and rather obscure. The three postgenital segments are 65, 49, and 60 μ in length from anterior to posterior (the last segment being measured along its outer margin rather than in the midline where the length is 75 μ). Ventrally the posterior margins of the genital segment and the first two postgenital segments bear a row of hyaline spinules; the anal segment bears a row of smaller spinules near the insertion of each caudal ramus. Dorsally these margins are unornamented.

The caudal ramus (fig. 67) is nearly quadrate, about half as long as the anal segment. Its greatest length (to the tip of the terminal flap) is 37 μ, and its width is 36 μ. Its length along the outer margin is 27 μ, and along the inner margin 23 μ. The ratio of the greatest length to the width is about 1:1. The setae are arranged as in the preceding species. The outer lateral seta, inserted somewhat dorsally, is 75 μ in length; the pedicellate dorsal seta 52 μ; the outer terminal seta 114 μ; the inner terminal seta 146 μ; and the two long median terminal setae 336 and 550 μ respectively. All the setae are naked except for the innermost terminal one which bears slender spinules along the inner edge. The ramus is inserted on the anal segment between slight dorsal and ventral flaps. The terminal setae are inserted dorsally above a terminal ventral triangular flap which bears a submarginal row of spinules. There are refractile points and hairs on the dorsal and ventral surfaces of the ramus as shown in figs. 64 and 67.

The dorsal surface of the prosome and the dorsal and ventral surfaces of the urosome bear scattered refractile points and hairs. The ratio of the length of the prosome to that of the urosome is about 2.25:1.

The elongate egg sacs extend far beyond the end of the setae on the caudal rami. Each sac (fig. 63) is about 1175 $\times$ 225 μ (in one female) and contains many small eggs 75 μ in diameter.

The rostral area (fig. 68) resembles in general aspects that in *A. dolabellae* and *A. stylocheili*.

The seven segments of the first antenna (fig. 69) have the following lengths (measured along their posterior non-setiferous margins): 18 (55 μ along the anterior margin), 146, 35, 61, 47, 22, and 21 μ respectively. The formula for the armature is the same as in the two preceding species. All the setae are naked. The pattern of sclerotization between the second and third segments (fig. 70) suggests another incomplete segment.

The second antenna (figs. 71 and 72) has the same armature as in the two preceding species. The second segment shows a few rugosities on its postero-inner surface and terminates distally on its antero-inner surface in a small sclerotized process. On the third segment, in addition to the four hyaline setae (the outermost more blunt than the others), there are two rows of spinules as shown in fig. 71. Of the four terminal claws, two are strongly formed, one is short and weak, and the other is long and rather slender.

The two lobes of the labrum (fig. 73) are different from those in either of the two preceding species. Each lobe is rather acute instead of being rounded and bears two smaller hyaline lobes on the median margin.

The mandible (fig. 74) is in general similar to that of *A. dolabellae* and *A. stylocheili*, but the two tooth-like inner spines at the base of the apical lash are more slender and have long spinules rather than denticles, and the hyaline lobes adjacent to the base of the lash resemble those of *A. stylocheili* more closely than those of *A. dolabellae*. The paragnaths are probably represented by two small lobes seen in ventral view under the tips of the lobes of the labrum (see fig. 73, indicated in dashed lines). The first maxilla (fig. 75) has the same general armature and ornamentation as in the two preceding species, but the small inner lobe has no notch and its two hyaline processes are unequal in size. The second maxilla (fig. 76) differs considerably from that in *A. dolabellae* and *A. stylocheili*. The second segment bears on its proximal outer margin a small hyaline process (seta ?) preceded by a minute prominence, and has on its posterior surface two very unequal setae, one long, spiniform, and armed with spinules along one side, the other short (only about 1/4 the length of the first), slender, and naked. The segment is extended distally to form a long blade with a row of 13-14 spines along the outer edge. The maxilliped (fig. 77) is highly modified. Its segmentation is obscure, though there is a suggestion of division into four segments. The area of the second segment is outwardly swollen, so that the appendage in posteroventral view appears to be greatly inflated. The only ornamentation, aside from a few refractile points, consists of a terminal hyaline process (seta ?) 6 μ long and an adjacent small spiniform projection.

The area between the maxillipeds and the first pair of legs (fig. 78) is slightly swollen ventrally, but less so than in *A. stylocheili*. A transverse line connects the bases of the maxillipeds.

The segmentation of legs 1-4 (figs. 79, 80, 81, and 82) is like that in the two preceding species, but the last two segments of the endopods are noticeably longer and slenderer. The spine and setal formula is like that of *A. stylocheili*. On the basis of all four legs the spinules near the insertion of the endopod are unusually prominent, and there is a minute hyaline setule (?) near the outer end of the row of hairs on the rounded inner margin. The last segment of the endopod of leg 4 is 70 μ in length, the outer seta 100 μ, and the four spines from inner to outer 76, 26, 27, and 24 μ.

Leg 5 (fig. 83) has a short free segment measuring 64 $\times$ 48 μ in greatest dimensions, the ratio being about 1.33:1. This segment is attached ventrally on the body. The three prominent fringed spines are of about equal length (33 μ); their narrow hyaline fringes are dentate along the edge, with the tips of the fringes projecting near the extremities of the spines so as to produce a trifid appearance. The naked seta is 56 μ in length. The segment is ornamented with a row of strong spinules along the inner margin and other similar spinules submarginally on the dorsal outer area. The seta arising from the body near the insertion of the free segment is about 80 μ long and naked.

Leg 6 is probably represented by the two setae near the attachment of the egg sacs (see fig. 66).

The color in life in transmitted light is translucent to light tan, with the eye red, the ovary dark gray, and the egg sacs gray.

Male. The body (fig. 84) resembles that of the female, though the cephalosome is somewhat more rounded. The length (not counting the setae on the caudal rami) is 0.91 mm (0.84-0.98 mm) and the greatest width is 0.42 mm (0.37-0.47 mm), based on 10 specimens. The ratio of the length of the prosome to its width is about 1.5:1. The segment bearing leg 5 (fig. 85) is shaped differently from that in the female, being narrowed anteriorly (109 μ wide) and expanded posteriorly (164 μ wide); its length is 78 μ. The genital segment is wider than long (86 × 143 μ), being slightly swollen in front of the sixth legs. The four postgenital segments are 47, 40, 30, and 39 μ in length from anterior to posterior (the last segment being measured along its outer margin rather than in the midline where its length is 43 μ). The posterior ventral margin of the genital segment is unornamented, but those margins of the postgenital segments have rows of hyaline spinules as in the female. Dorsally such spinules are absent.

The caudal ramus, its greatest dimensions being 30 × 29 μ, is much like that of the female.

The surface ornamentation of the prosome and urosome is similar to that in the female. The ratio of the length of the prosome to that of the urosome is about 2.4:1.

The rostral area, first antenna, second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla resemble those of the female.

The maxilliped (fig. 86) has 4 segments, assuming part of the claw to represent the fourth segment. The first segment is rather elongate and bears a distal group of long spinules. The slender second segment shows rugosities or folds in the sclerotization of its outer margin and the row of minute spinules seen in the two preceding species is here apparently absent. The seta on the third segment is 47 μ in length. The gently arcuate claw is 200 μ long (measured along its greatest axis and not along its curvature). Otherwise the armature and ornamentation is similar to that in *A. dolabellae* and *A. stylocheili*.

The ventral area between the maxillipeds and the first pair of legs (fig. 87) is not much produced. The line between the bases of the maxillipeds is somewhat better sclerotized than in the female.

Legs 1-4 resemble those of the female, except that, as in *A. dolabellae* and *A. stylocheili*, the outermost of the five setae on the last segment of the endopod of leg 1 is transformed to a spine, thus creating the formula of I,I,4 for that segment.

Leg 5 resembles that of the female.

Leg 6 (fig. 88) consists of a posterolateral flap on the ventral surface of the genital segment. This flap is slightly produced posterolaterally where it bears a spiniform process and a distal seta 33 μ in length, with nearby another seta 43 μ long.

Spermatophores were not observed.

Several pairs of males and females in amplexus were seen. In these the claws of the maxillipeds were placed around the lateroventral areas of the segment of leg 5, and the surfaces of the second segments of the maxillipeds (those bearing the patches of spinules) were pressed against the dorsolateral areas of this segment.

The color in life resembles that of the female.

(The specific name *distensus*, from Latin, *distendere*, to stretch out, to become swollen, alludes to the tumid form of the maxilliped in the female.)

REMARKS : *A. distensus* belongs to the group of species of *Anthessius* having the formula III,I,5 on the third segment of the exopod of leg 4. It may be distinguished from most of the species of this group by the swollen nature of the maxilliped in the female. In the following species the maxilliped is of the usual elongate and rather slender type: *A. pleurobrancheae* **Della Valle**, 1880, *A. concinnus* (A. **Scott**, 1909), *A. solecurti* **Della Valle**, 1880, *A. arenicola* (**Brady**, 1872), *A. hawaiiensis* (**Wilson**, 1921), *A. brevifurca* **Sewell**, 1949, *A. teissieri* **Bocquet & Stock**, 1958, *A. minor* **Stock**, 1959, *A. fitchi* **Illg**, 1960, *A. lighti* **Illg**, 1960, *A. ovalipes* **Stock, Humes & Gooding**, 1963, and the three species of *Anthessius* from *Tridacna* at Nosy Bé (**Humes & Stock**, in press). In *A. brevicauda* (**Leigh-Sharpe**, 1934) the maxillipeds in the female were described by **Leigh-Sharpe** as having enormous bases, but Stock's (1964) redescription based on paratypic material shows the maxilliped to be of the usual more or less slender form. In *A. groenlandicus* (**Hansen**, 1923) the form of the maxilliped in the female is not described of figured, but this species has a much more elongate caudal ramus and fewer teeth on the end of the second maxilla than in *A. distensus*.

In only one species of this group does the maxilliped of the female approach the swollen condition seen in *A. distensus*. In the large *A. pectinis* **Tanaka**, 1961, the second segment articulates with the following segment almost at a right angle, and the whole appendage is less tumid than in the species from Madagascar. The caudal rami of this Japanese species are very long (12 times longer than wide).

REMARKS ON THE GENUS *ANTHESSIUS*

The genus *Anthessius* is a rather large, fairly homogeneous group. Its species are often recognized on the basis of rather subtle differences. During the last five years (starting with 1960) the fairly complete descriptions of fifteen new species have been published. This equals the number of all previously described species since 1880 when **Della Valle** erected the genus.

Twenty-four species of *Anthessius* are known to be associated with mollusks, either with gastropods (12 species) or with pelecypods (12 species). The remaining six species have been recovered from weed-washings, plankton, or dredged material, but is seems likely that they too may actually be associated with mollusks.

Among the species known from mollusks there seem to be no obvious morphological characters which might serve to distinguish those from gastropods from those from pelecypods. Although the genus may readily be divided into two groups on the basis of the formula of the last segment of the exopod of leg 4 (for example, in the key provided by **Stock, Humes & Gooding**, 1963), this division does not reflect host preferences. Thus, of those with the formula II,I,5, two are known from pelecypods, four from tectibranchs, and two from other gastropods, and of those with III,I,5 ten are known from pelecypods, three from nudibranchs, two from tectibranchs, and one from another gastropod. Other characters, such as the dentition of the second maxilla and the form of the caudal ramus, do not appear to be correlated with host preferences. The three species from *Tridacna* soon to be described by **Humes** and **Stock** (in press) show, however, a surprisingly similar facies, especially in the form of the lateral areas of the cephalosome.

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EXPLANATION OF THE FIGURES

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

PLANCHES

Fig. 1-7 - *Anthessius dolabellae* n. sp., female

1 - Body, dorsal (A)

2 - Segment of leg 5, dorsal (B)

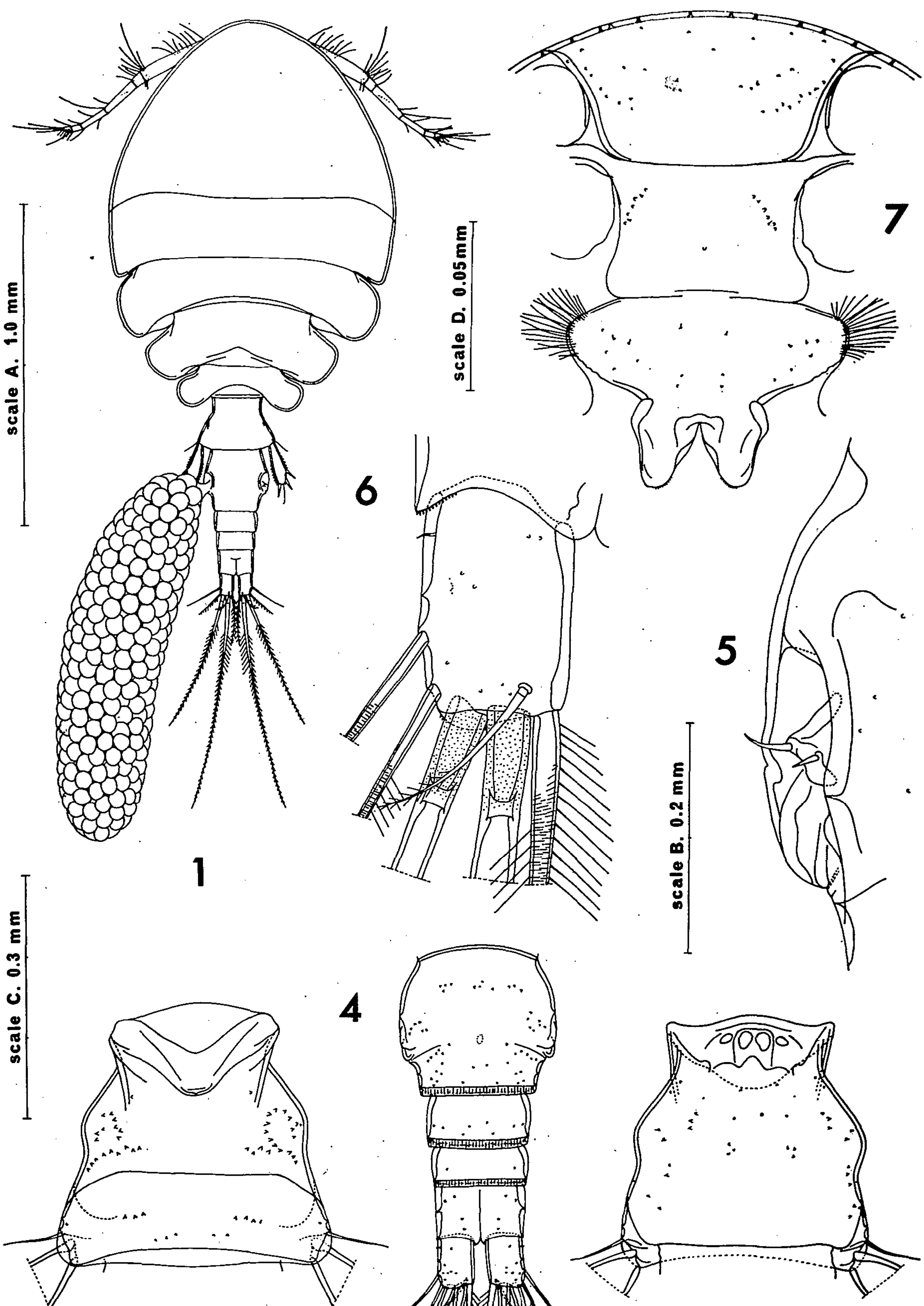
3 - Segment of leg 5, ventral (B)

4 - Genital and postgenital segments, ventral (C)

5 - Area of attachment of egg sac, dorsal (D)

6 - Caudal ramus, dorsal (D)

7 - Rostral area and labrum, ventral (B)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scale B. 0.2 mm
scale C. 0.3 mm
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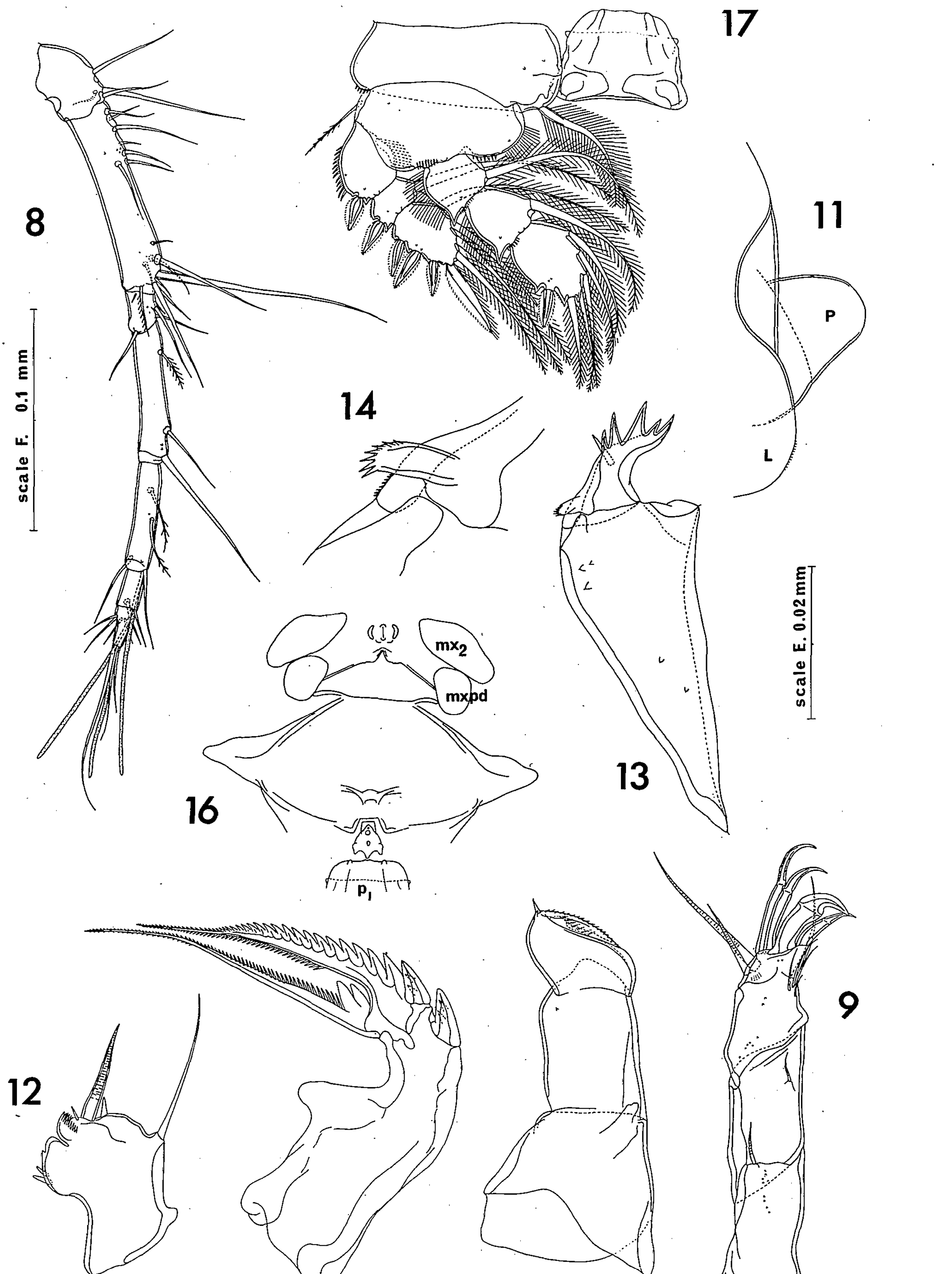
Fig. 8-17 - *Anthessius dolabellae* n. sp., female (continued)

8 - First antenna, dorsal (B)
9 - Second antenna, anterior (B)
10 - Mandible (D)
11 - Paragnath below edge of labrum, ventral (E)
12 - First maxilla, anterior (D)
13 - Second maxilla, posterior (F)
14 - Process on second segment of second maxilla, posterior (E)
15 - Maxilliped, anterior (F)
16 - Area between maxillipeds and leg 1, ventral (C)
17 - Leg 1, anterior (B)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mxpd
p_1

Fig. 18-22 - *Anthessius dolabellae* n. sp., female (continued)

18 - Leg 2, anterior (B)
19 - Tip of endopod of leg 2, anterior (G)
20 - Leg 3, anterior (B)
21 - Leg 4, anterior (B)
22 - Leg 5, ventral (F)

Fig. 23-24 - *Anthessius dolabellae* n. sp., male

23 - Body, dorsal (A)
24 - Urosome, ventral (C)

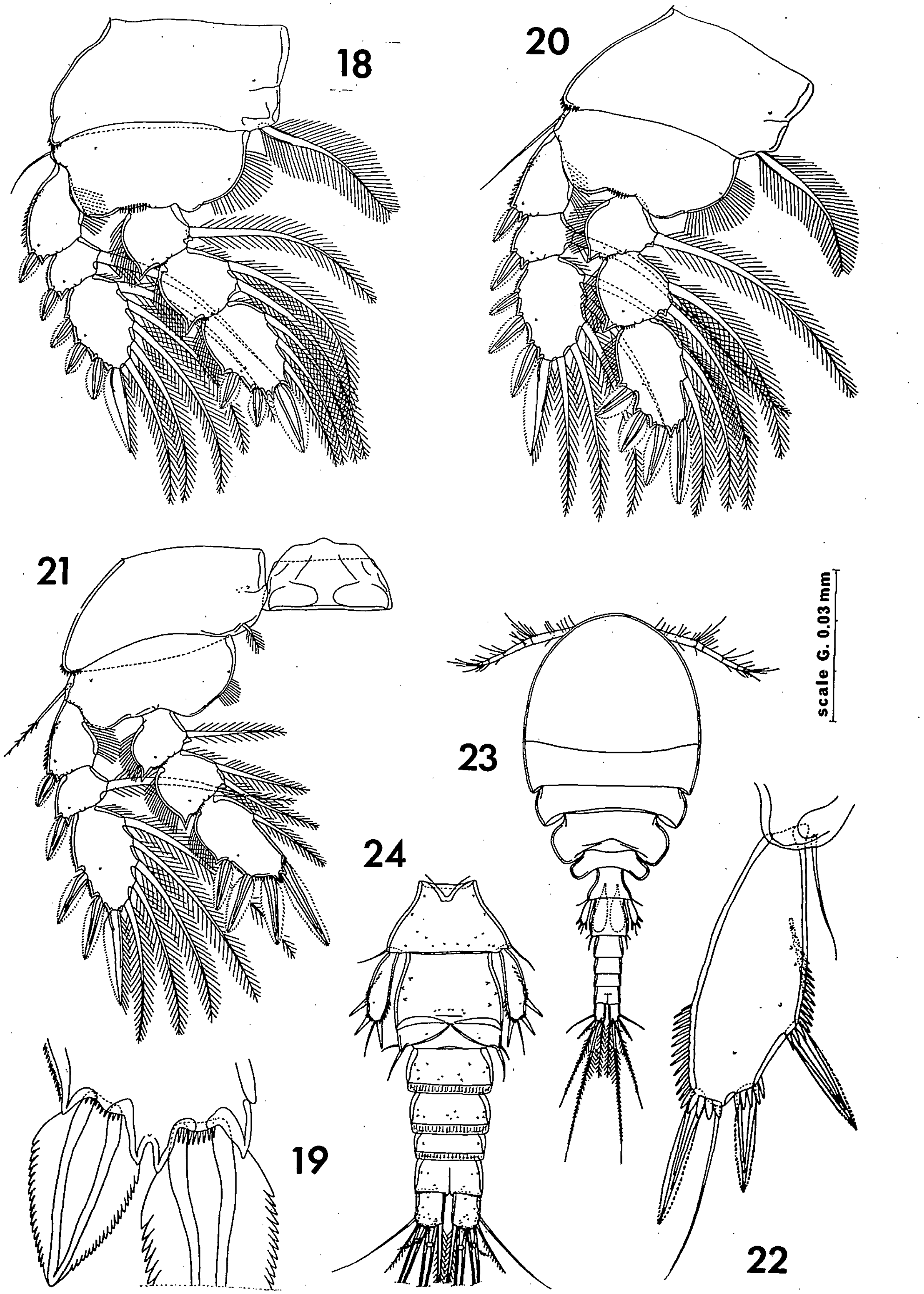
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Fig. 25-34 - *Anthessius dolabellae* n. sp., male (continued)

25 - Caudal ramus, ventral (D)

26 - Second segment of first antenna, ventral (H)

27 - Second segment of second antenna, anterior (F)

28 - Second maxilla, posterior (F)

29 - Maxilliped, posterior and inner (F)

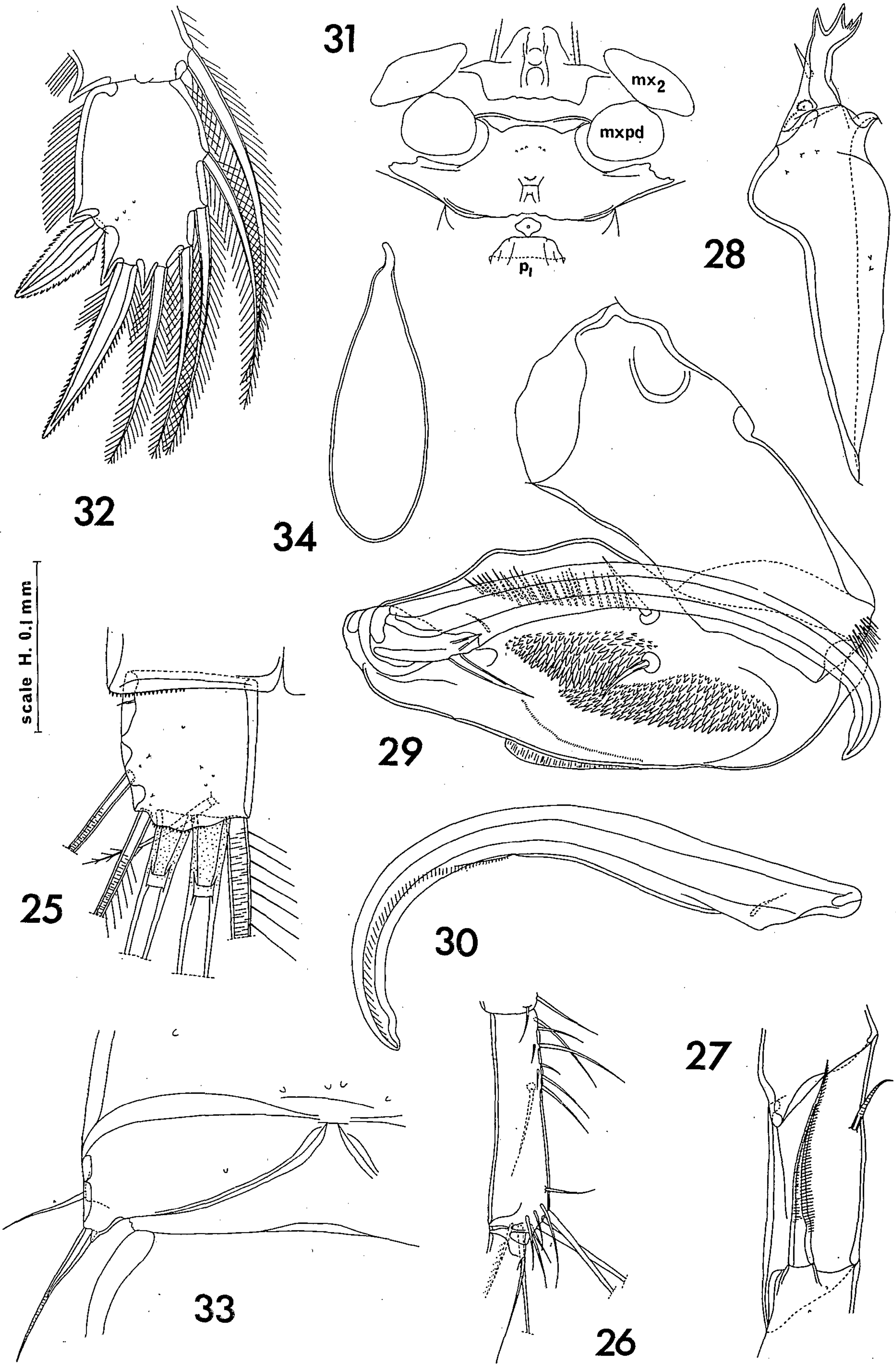
30 - Claw of maxilliped, posterior (F)

31 - Area between maxillipeds and leg 1, ventral (C)

32 - Third segment of endopod of leg 1, anterior (F)

33 - Leg 6, ventral (D)

34 - Spermatophore inside body of male (H)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scale H. 0.1 mm
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Fig. 35-46 - *Anthessius stylocheili* n. sp., female

35 - Body, dorsal (A)

36 - Urosome, ventral (I)

37 - Area of attachment of egg sac, dorsal (D)

38 - Caudal ramus, dorsal (B)

39 - Egg sac (A)

40 - First antenna, ventral (B)

41 - Tip of labrum, ventral (F)

42 - Detail of mandible (G)

43 - Paragnaths, ventral (H)

44 - Second maxilla, anterior (F)

45 - Tip of second maxilla, same individual as in fig. 44 but opposite side, anterior (D)

46 - Tip of second maxilla, anterior (D).

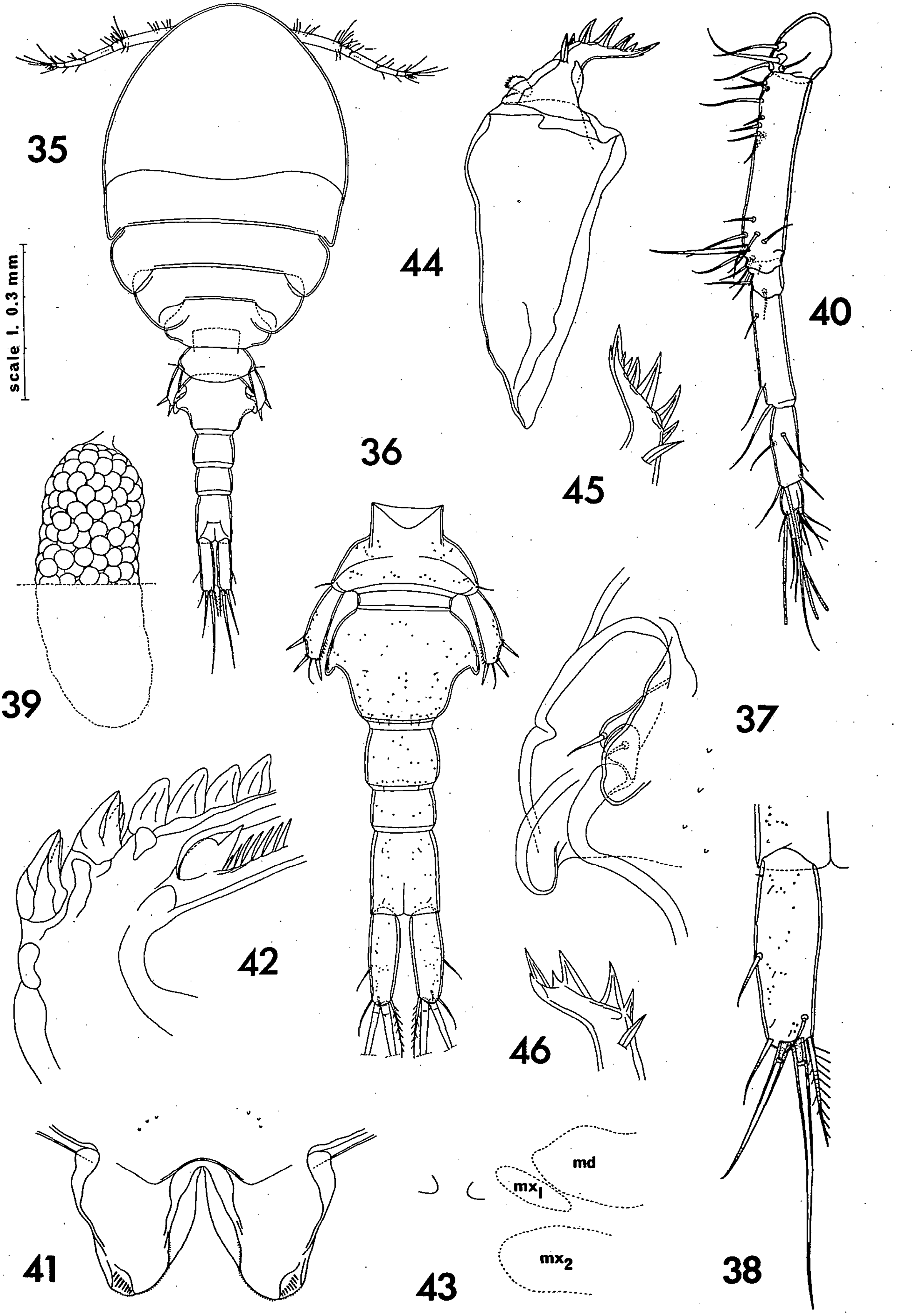
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Fig. 47-51 - *Anthessius stylocheili* n. sp., female (continued)

47 - Area between maxillipeds and leg 1, ventral (C)

48 - Leg 1, anterior (B)

49 - Tip of endopod of leg 2, anterior (G)

50 - Exopod of leg 4, posterior (B)

51 - Leg 5, ventral (F)

Fig. 52-57 - *Anthessius stylocheili* n. sp., male

52 - Body, dorsal (A)

53 - Urosome, dorsal (I)

54 - First antenna, ventral (B)

55 - Second segment of second antenna, anterior (F)

56 - Second maxilla, posterior (H)

57 - Hyaline spine on second segment of second maxilla, anterior (E)

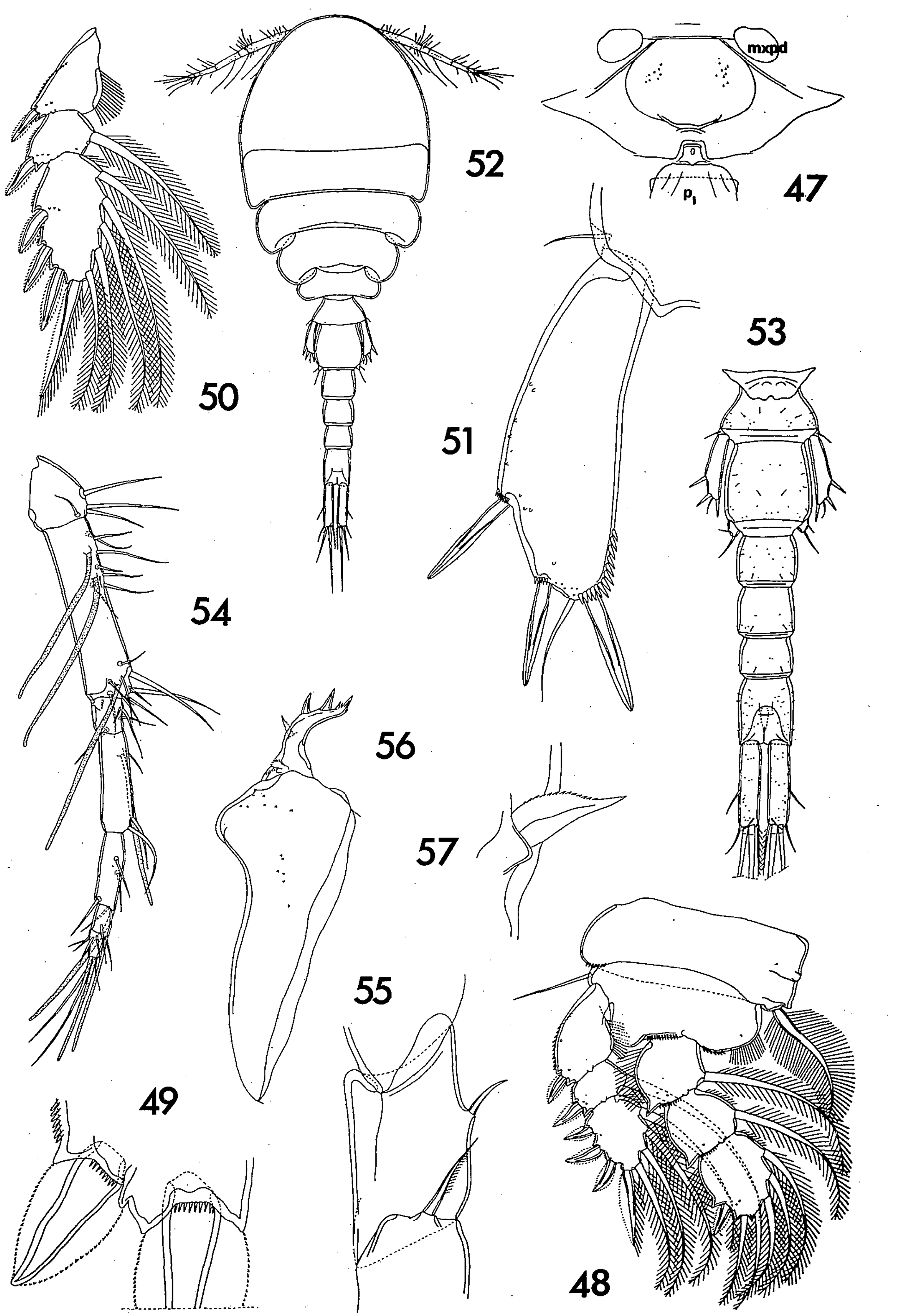

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Fig. 58-62 - *Anthessius stylocheili* n. sp., male (continued)

58 - Maxilliped, posterior and inner (H)

59 - Area between maxillipeds and leg 1, ventral (C)

60 - Tip of last segment of endopod of leg 1, anterior (F)

61 - Leg 5, ventral (F)

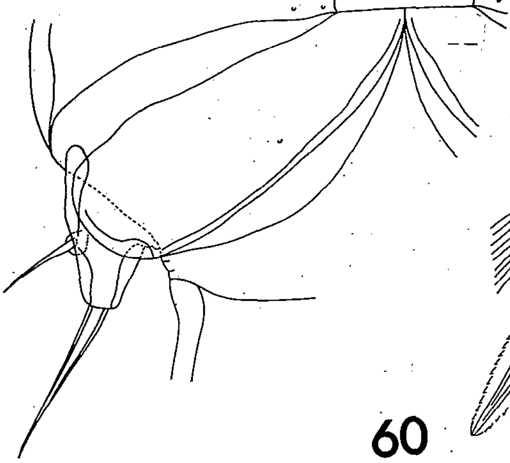
62 - Leg 6, ventral (D)

Fig. 63-64 - *Anthessius distensus* n. sp., female

63 - Body, dorsal (A)

64 - Urosome, dorsal (C)

62



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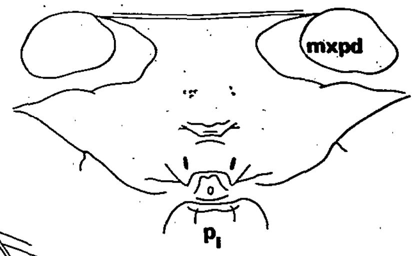

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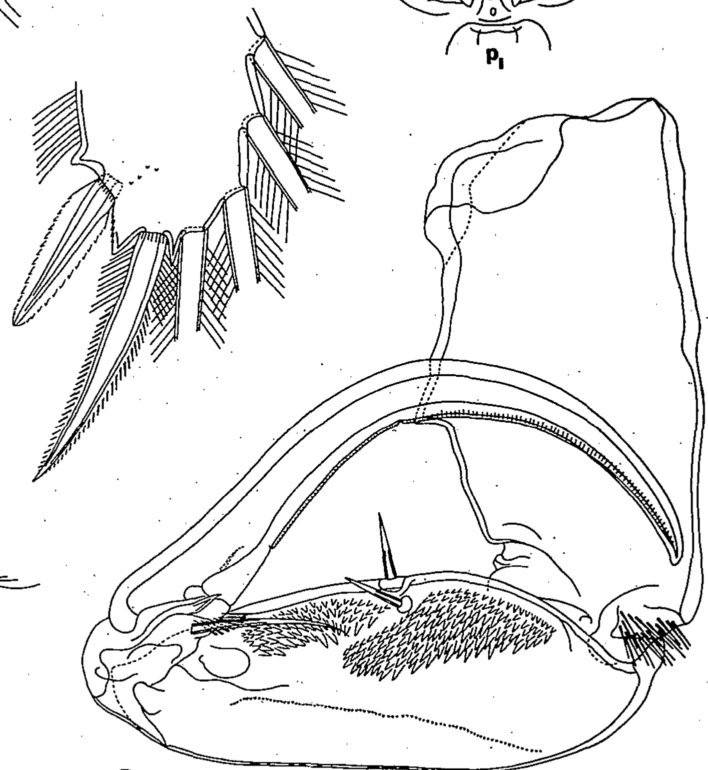

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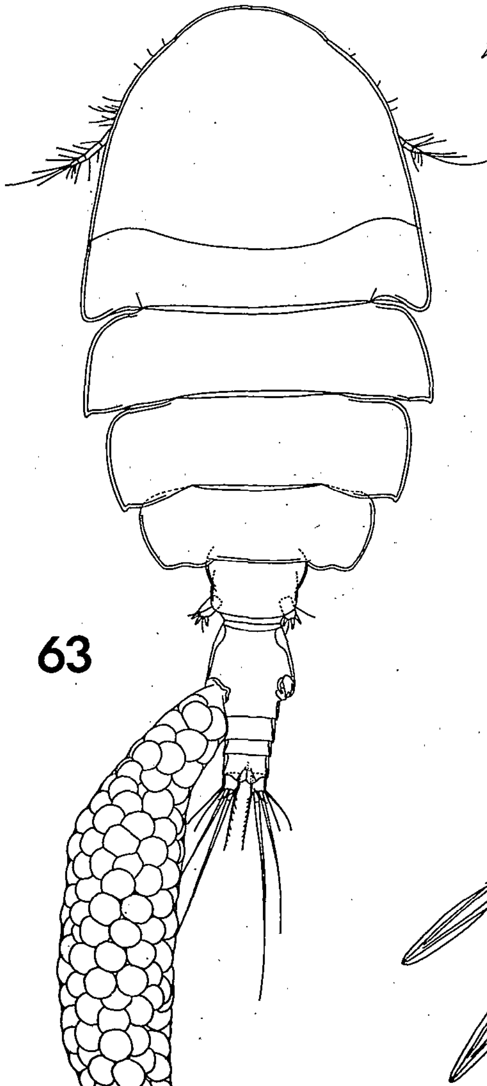

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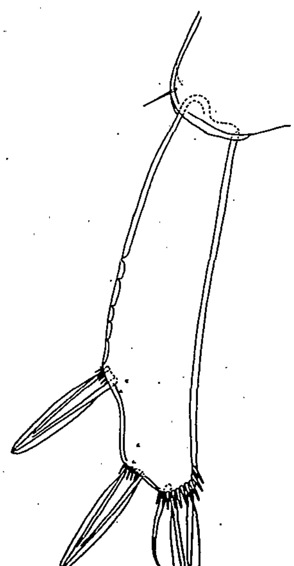

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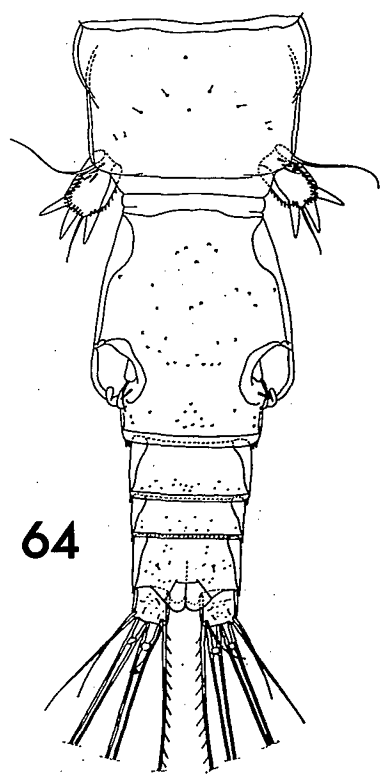

64

Fig. 65-73 - *Anthessius distensus* n. sp., female (continued)

65 - Urosome, ventral (C)

66 - Area of attachment of egg sac, dorsal (D)

67 - Caudal ramus, ventral (G)

68 - Rostral area, ventral (B)

69 - First antenna, ventral (B)

70 - Third segment of first antenna, ventral (G)

71 - Second antenna, posterior (H)

72 - Second antenna, anterior (H)

73 - Labrum, with paragnaths indicated by dashed lines, ventral (H)

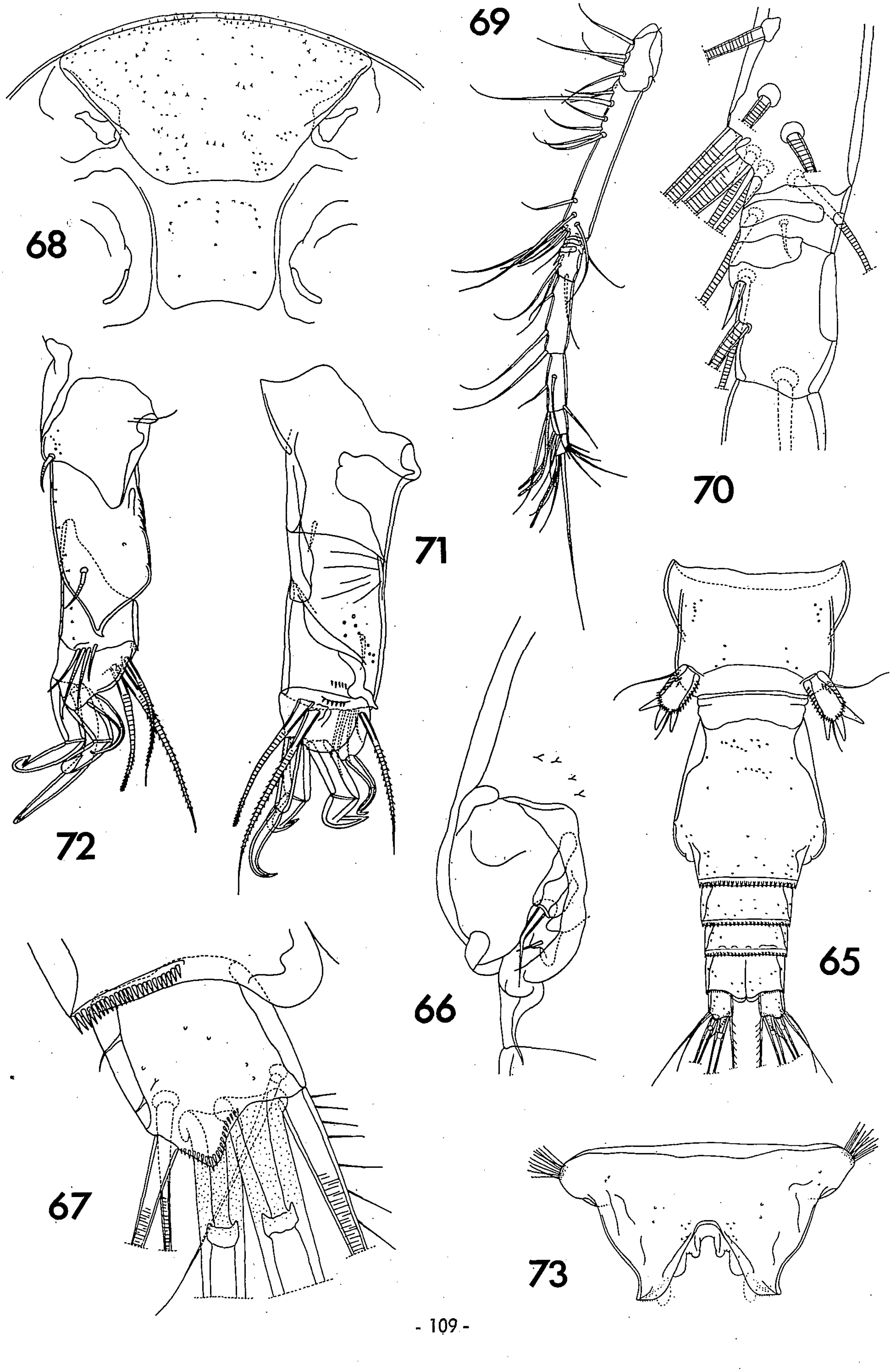
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Fig. 74-81 - *Anthessius distensus* n. sp., female (continued)

74 - Mandible (D)

75 - First maxilla (D)

76 - Second maxilla, anterior (D)

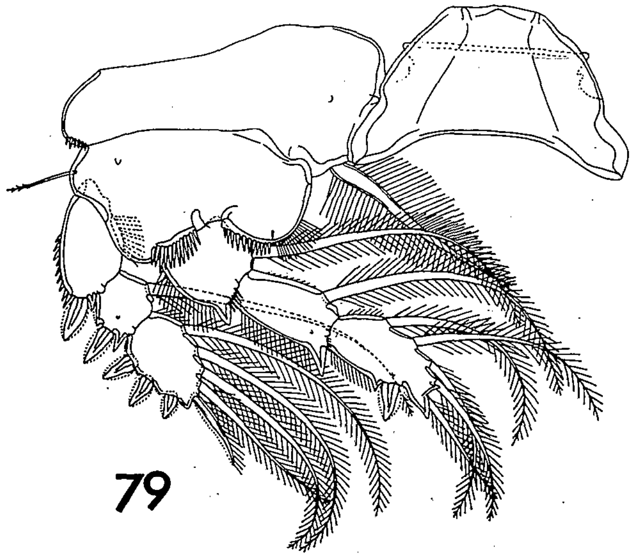
77 - Maxilliped, posteroventral (D)

78 - Area between maxillipeds and leg 1, ventral (C)

79 - Leg 1, anterior (B)

80 - Leg 2, anterior (B)

81 - Leg 3, anterior (B)



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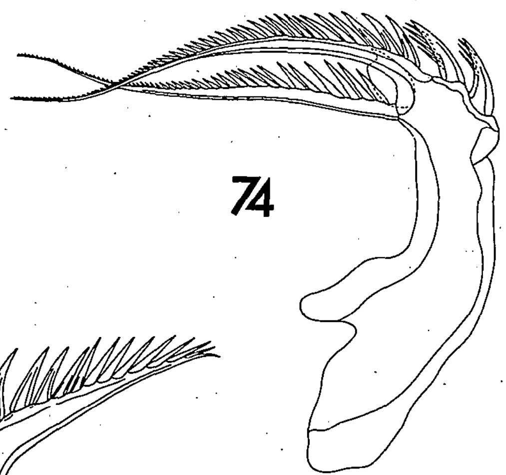

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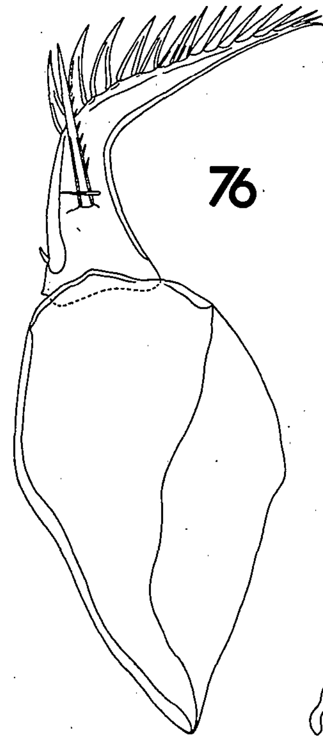

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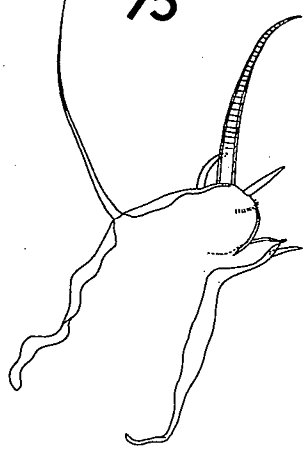

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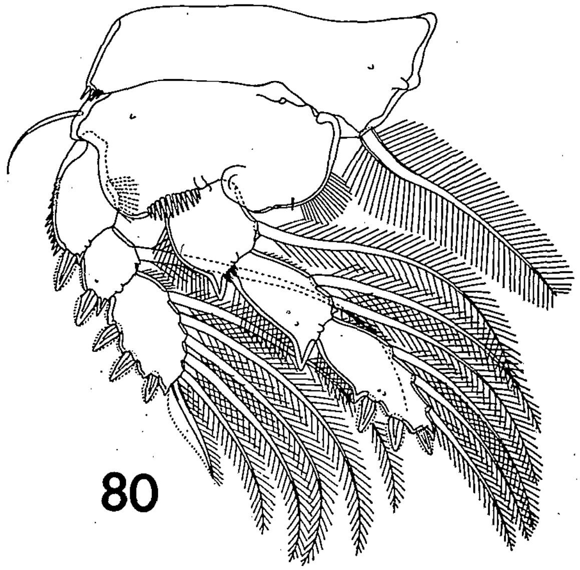

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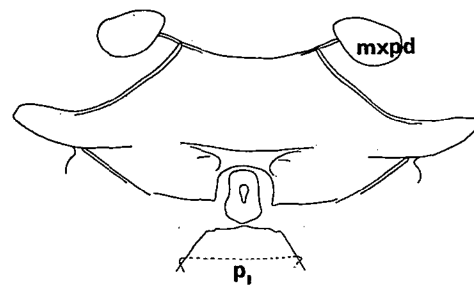

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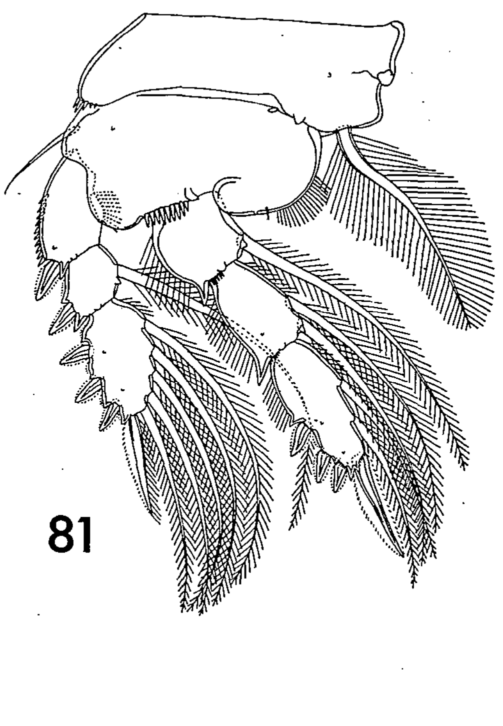

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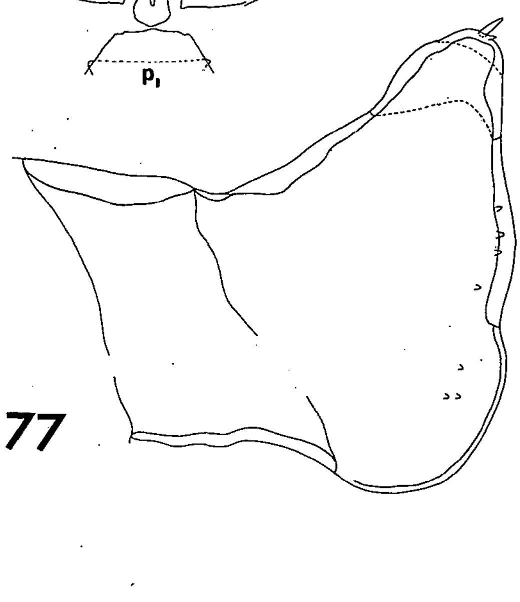

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Fig. 82-83 - *Anthessius distensus* n. sp., female (continued)

82 - Leg 4, anterior (B)

83 - Leg 5, dorsal (D)

Fig. 84-88 - *Anthessius distensus* n. sp., male

84 - Body, dorsal (I)

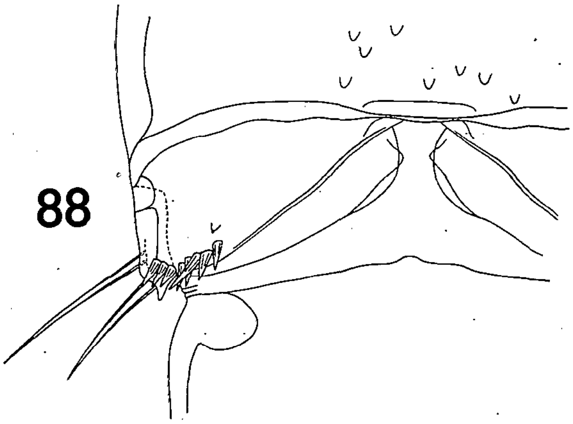
85 - Urosome, ventral (B)

86 - Maxilliped, posterior and inner (F)

87 - Area between maxillipeds and leg 1, ventral (B)

88 - Leg 6, ventral (D)

88



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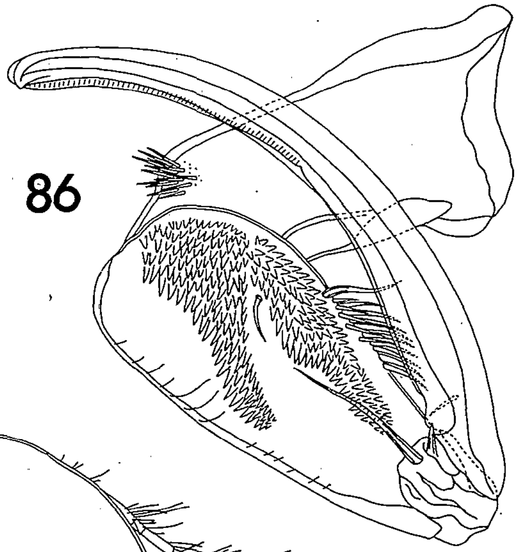

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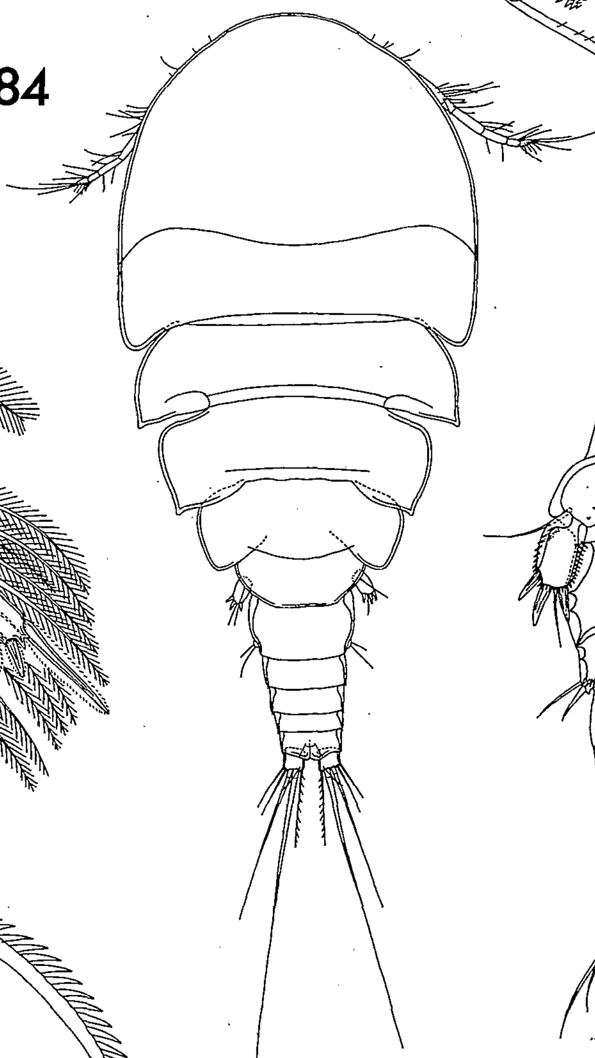

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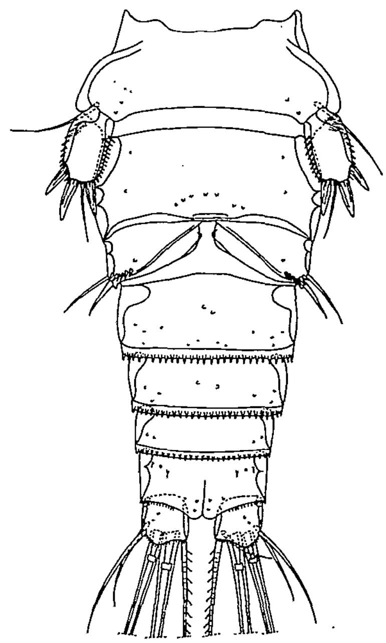

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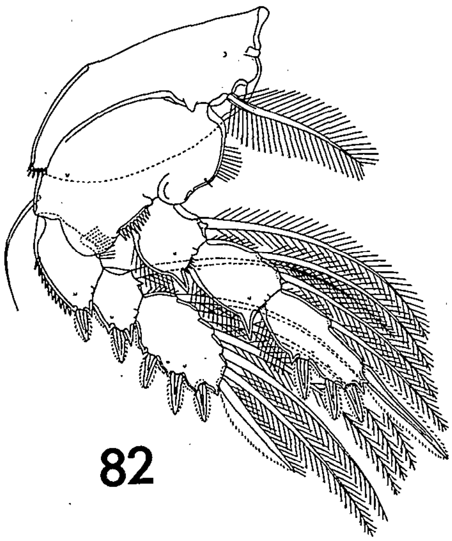

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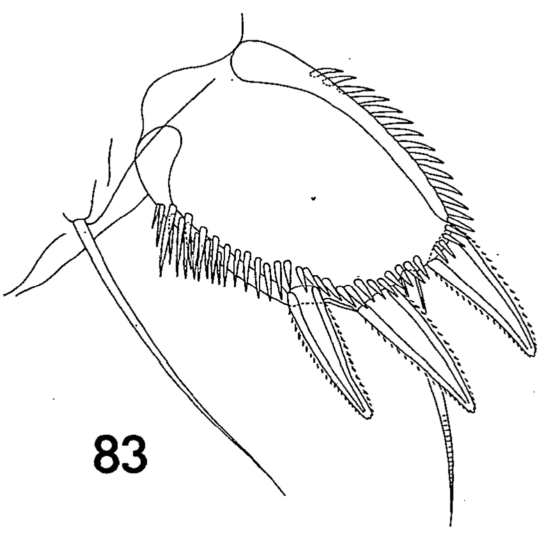

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