

STUDIES ON THE FAUNA OF CURAÇAO AND OTHER
CARIBBEAN ISLANDS: No. 73.

COPEPODA ASSOCIATED WITH WEST INDIAN
INVERTEBRATES - III

The genus *Anthessius* (Cyclopoida, Myicolidae)

by

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For the identification of certain of the mollusks with which the copepods to be described were associated we wish to thank Dr. RUTH D. TURNER, Museum of Comparative Zoölogy, Harvard College, Cambridge, and Mr. C. J. VAN EEKEN, Zoölogisch Museum, Amsterdam. We also express our appreciation to Mr. J. A. VAN DREVELDT (Amsterdam) for his assistance in the preparation of the drawings of the last two species.

This study has been supported by grants from the Netherlands Foundation for the Advancement of Research in Surinam and the Netherlands Antilles (WOSUNA), Amsterdam, and from the National Science Foundation of the United States, Washington.

The material covered in this paper comprises:

- Anthessius varidens* n. sp., from Jamaica, Barbados, and Curaçao (figs. 1-5);
- Anthessius proximus* n. sp., from Barbados and Curaçao (fig. 6);
- Anthessius sensitivus* n. sp., from Bonaire (figs. 7-11);
- Anthessius ovalipes* n. sp., from Curaçao (figs. 12-16);
- Anthessius concinnus* (A. Scott), from the Malay Archipelago (fig. 16).

All figures were drawn with the aid of a camera lucida.

Paper number II in this series appeared in *Studies* 15, 1963.

Anthessius Della Valle, 1880

Following the suggestion of ILLG (1960) we have assigned this genus to the family Myicolidae Yamaguti, 1936. In this paper, the

most recent review of the genus, ILLG lists 17 species. TANAKA (1961) has added *A. pectinis*. We propose to transfer *Lichomolgus brevicaudis* Leigh-Sharpe, 1934 (from *Pinna* sp. in the East Indies) to *Anthessius*, since a reexamination of the type specimens has shown that it clearly belongs here. With the 4 new species to be described in this paper, the total number of described species attributed to *Anthessius* is thus 23.

Since the hosts of *Anthessius* are usually marine mollusks, it is not surprising that the new West Indian species are from tectibranchs (*Notarchus*, *Aplysia*, *Dolabrifera*, and *Petalifera*), an aceole opisthobranch (*Pleurobranchus*), and possibly a prosobranch (*Vasum*). (One specimen of *A. sensitivus* came from washings of simple ascidians).

The addition to the genus of the 6 species already mentioned has made a new key desirable. This is based on the external morphology of the adult female, but includes *A. investigatoris* Sewell, 1949, of which only the male is known. In many instances where males have been sufficiently well described this key also proves satisfactory for distinguishing them. During the preparation of the key one of us (JHS) has restudied the type specimens of *A. concinnus* (A. Scott) and *A. brevicauda* (Leigh-Sharpe).

ARTIFICIAL KEY TO THE GENUS *Anthessius*

- | | |
|---|------------------------------------|
| 1. Armature of 3rd exopod segment of P ₄ : II, I, 5 | 2 |
| Armature of 3rd exopod segment of P ₄ : III, I, 5 | 10 |
| 2. P ₅ less than twice as long as wide, ovate, widened | 3 |
| P ₅ more than twice as long as wide, linear or clavate,
narrow | 4 |
| 3. Caudal rami about as long as the anal segment; A ₂ with 4
terminal claws | <i>A. navanacis</i> (Wilson, 1935) |
| Caudal rami much longer than the anal segment; A ₂ with 2
terminal claws | <i>A. pinnae</i> Humus, 1959 |
| 4. Caudal rami longer than anal segment and at least 3 times
as long as wide | 5 |
| Caudal rami about the same length or shorter than the
anal segment and less than 2.5 times as long as wide | 7 |

5. A_2 with 4 terminal articulated claws. 6
 A_2 with 3 terminal articulated claws *A. dilatatus* (Sars, 1918)
6. Ratio of body length to width about 2 : 1 . *A. nortoni* Illg, 1960
 Ratio of body length to width about 2.7 : 1
A. leptostylis (Sars, 1916)
7. Terminal segment of A_2 at most $1\frac{1}{2}$ times as long as wide;
 free outer margin of P_5 without spinules 8
 Terminal segment of A_2 more slender, 2 to 3 times as long
 as wide; free outer margin of P_5 with a row of spinules 9
8. Body 1.67×0.84 mm; P_5 with well-developed rows of spinules
 at bases of all 3 spines; ratio of length to width of caudal rami
 $1.83 : 1$ *A. varidens* n. sp.
 Body 1.42×0.63 mm; P_5 with extremely minute spinules at
 bases of 2 distal spines, none at lateral spine; ratio of length to
 width of caudal ramus $2.14 : 1$ *A. proximus* n. sp.
9. Terminal segment of A_2 about 3 times as long as wide
A. investigatoris Sewell, 1949
 Terminal segment of A_2 about 2 times as long as wide
A. sensitivus n. sp.
10. Caudal ramus as long as wide, or wider than long 11
 Caudal ramus much longer than wide 12
11. Caudal ramus much wider than long; P_5 ovate, reaching back
 to middle of genital segment
A. brevicauda (Leigh-Sharpe, 1934)
 Caudal ramus as long as wide; P_5 clavate, reaching back to end
 of genital segment *A. brevifurca* Sewell, 1949
12. Body habitus very modified; cephalosome much expanded in
 outline; thoracic segments with expanded wing-like epimera;
 caudal rami laminate; body size 5.8×2.1 mm
A. fitchi Illg, 1960
 Body in general approaching the typical cyclopooid habitus 13

13. P₅ linear in shape, at least 3 times as long as wide 14
 P₅ more or less elliptical in outline, less than 3 times as
 long as wide 18
14. Distal end of mx₂ with more than 10 teeth
A. pleurobranchae Della Valle, 1880
 Distal end of mx₂ with at most 6 teeth 15
15. Inner margin of P₅ bearing a distal group of slender spinules at
 the distal third of the segment and a second group of slender
 spinules in the middle of the segment
A. arenicola (Brady, 1872)
 Inner margin of P₅ bearing only the distal group of slender
 spinules at the distal third 16
16. Caudal ramus about 2.6 times as long as wide
A. lighti Illg, 1960
 Caudal ramus about 4 times as long as wide 17
17. Ventral surface of anal segment with 2 proximal rows of stout
 spinules; furcal setae not modified
A. solecurti Della Valle, 1880
 Ventral surface of anal segment with 2 proximal rows of hardly
 discernible spinules; the 2 longer furcal setae modified (basal
 part inflated like the handle of a whip)
A. teissieri Bocquet & Stock, 1958
18. Mx₂ with low apical sclerotized portion, not inclining anteriorly
 in a marked angle to the remainder of the appendage
A. hawaiiensis (Wilson, 1921)
 Mx₂ with apical portion erect, large, sharply angled 19
19. Free outer margin of P₅ without setules or spinules
A. groenlandicus (Hansen, 1923)
 Free outer margin of P₅ with a row of setules or spinules 20
20. Free outer margin of P₅ bearing only about 5 short, stout,
 conical spinules. *A. minor* Stock, 1959
 Free outer margin of P₅ bearing more than 10 slender
 spinules or setules. 21

21. Caudal ramus about 8 times as long as wide
A. pectinis Tanaka, 1961
 Caudal ramus about 2 times as long as wide 22
22. P₅ less than twice as long as wide; ventral surface of anal
 segment with 2 proximal rows of spinules . . . *A. ovalipes* n. sp.
 P₅ more than twice as long as wide; ventral surface of anal
 segment without proximal spinules
A. concinnus (A. Scott, 1909)

***Anthessius varidens* n. sp.**

(Figs. 1-5)

Type material. — JAMAICA: 42 females, 23 males, and 1 copepodid (probably stage V) from washings of 28 tectibranchs, *Notarchus pleii* Rang (det. Dr. Ruth D. Turner) on muddy bottom in about 1 meter depth in bay surrounded by mangroves, east of Boat Channel, 17°56'27" N, 76°49'20" W, near Port Royal; collected by AGH and RUG September 10, 1959. The holotype female, allotype male, and 16 paratypes (11 females and 5 males) have been deposited in the United States National Museum, Washington; the same number of paratypes in the Zoölogisch Museum, Amsterdam, and in the British Museum (Natural History), London; and the remaining paratypes in the collection of A. G. Humes.

Other specimens. — BARBADOS: 4 females and 2 males from 7 *Aplysia dactylomela* Rang (det. Ruth D. Turner) under coral at low tide at point just north of Sandy Lane Bay, Holetown, June 25, 1959; 1 male from 58 *Aplysia dactylomela* collected at night in the same locality, July 20, 1959; 6 females and 1 male from 33 *Aplysia dactylomela* in the same locality, July 24, 1959. All three collections by AGH and RUG. — CURAÇAO: 1 female and 2 males from 3 *Aplysia dactylomela* (det. C. J. van Eeken) in 2 meters, Piscadera Bay; collected by JHS October 16 and 20, 1958.

Female. — The general aspect (figs. 1a and 1b) resembles that of other species in the genus. The length of the body is 1.67 mm (1.60–1.79 mm), based on 10 specimens; the greatest width, just in front of the segment bearing leg 1, is 0.84 mm (0.80–0.88 mm). The prosome is rather broad, not unusually inflated, the ratio of length to width being 1.3 : 1. The first pedigerous segment is separated dorsally and laterally from the head. The posterolateral areas of the metasomal segments are rounded, with the segment of leg 2 slightly overlapping the segment next posterior; and with the segment of leg 3 similarly overlapping the segment of leg 4. The segment of leg 5 has a well-developed tergal plate.

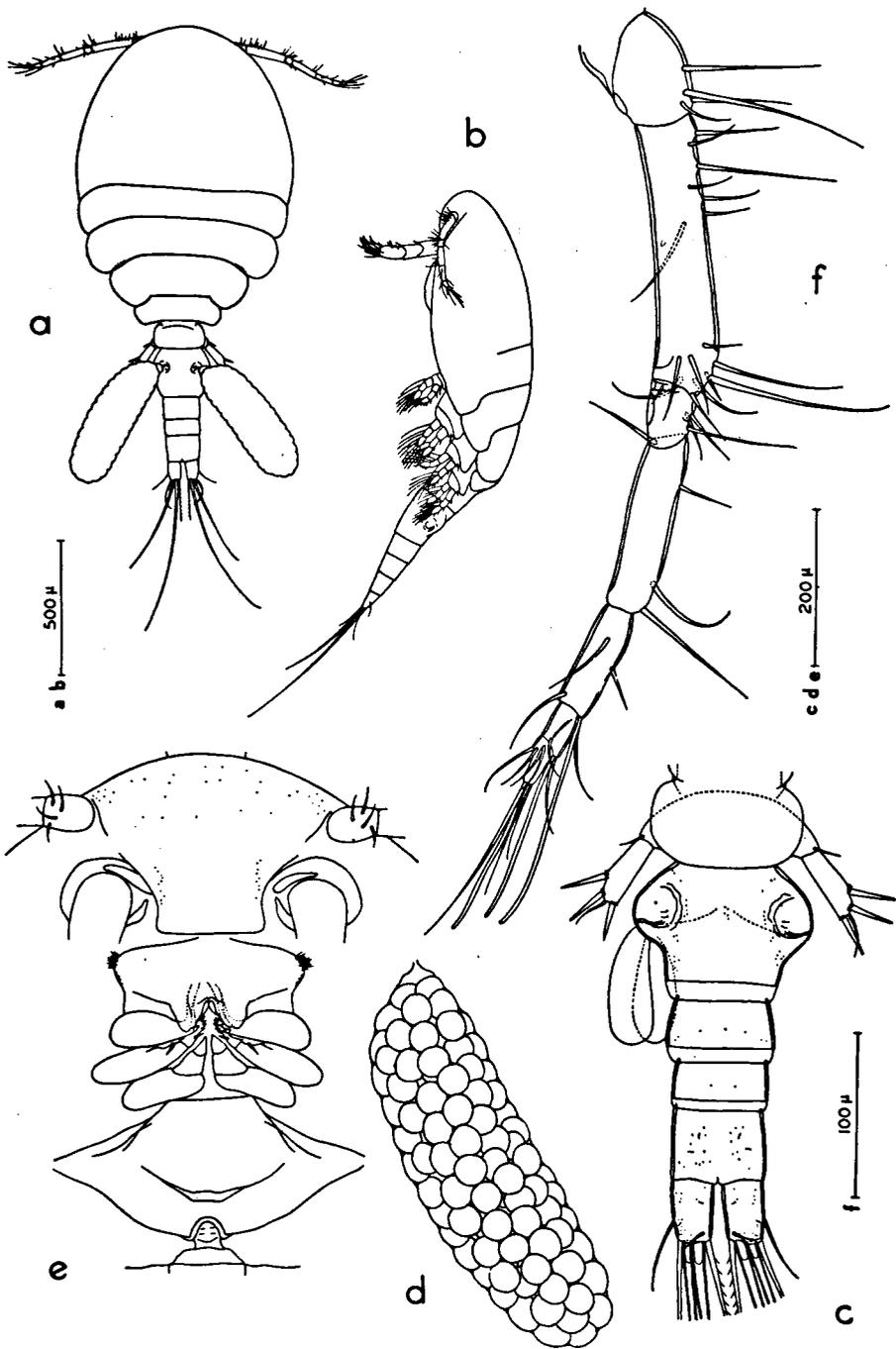


Fig. 1. *Anthessius varidens* n. sp., female. — *a*, habitus, dorsal; *b*, habitus, lateral; *c*, urosome, dorsal; *d*, egg sac, dorsal; *e*, median part of cephalosome, ventral; *f*, first antenna, posteroventral.

The genital segment (fig. 1c) is large, somewhat projected laterally in the region of the genital openings, a little narrower in the posterior half. These expansions each cover in dorsal view a depression into which the necks of the spermatophores extend (when such structures are present) and which thus presumably contains the opening of the receptaculum seminis on that side. The post-genital region is 3-segmented. The genital and succeeding segments show scattered refractile points and a few minute hairs as indicated in the figure. (These are visible only in very clear specimens and are present also on the dorsal and ventral sides of the anterior part of the body). The anal segment has a ventral row of minute spinules near the origin of the caudal rami.

The egg sacs are attached dorsolaterally, and reach beyond the caudal rami. Each sac is elongate, about $526 \times 168 \mu$, and contains many small eggs (fig. 1d).

The rostral area is neither well-developed nor particularly well-defined, and bears scattered refractile points (fig. 1e).

The first antenna (fig. 1f) is 7-segmented, but the pattern of the sclerotization between the second and third segments, particularly ventrally, suggests the presence of another partial segment in this region (fig. 2a). The total length of the first antenna without the setae is 446μ and its greatest width at the level of the distal part of the second segment 35μ , the ratio of length to width being about $12.7 : 1$ ($12.2-13.2 : 1$) based on 5 individuals. As shown in the figure, the first segment bears 4 setae, the second a proximal group of 7 setae and a distal group of 9 setae, the third 5 setae, the fourth 3 setae, the fifth 4 setae and an aesthete, the sixth 2 setae and an aesthete, and the seventh a proximal group of 4 setae and a distal group of 3 setae and an aesthete. The bases of the 2 proximal aesthetes are isolated; the terminal aesthete and one of the adjacent setae arise from a common shaft. The sixth segment shows on the ventral surface a somewhat diagonal sclerotized band.

The second antenna (fig. 2b), although 3-segmented, shows clearly by its pattern of sclerotization that the last segment represents a complex of two original segments. The appendage is short and robust. Each of the subcylindrical first two segments bears a single inner naked seta. The terminal segment bears on its ventro-

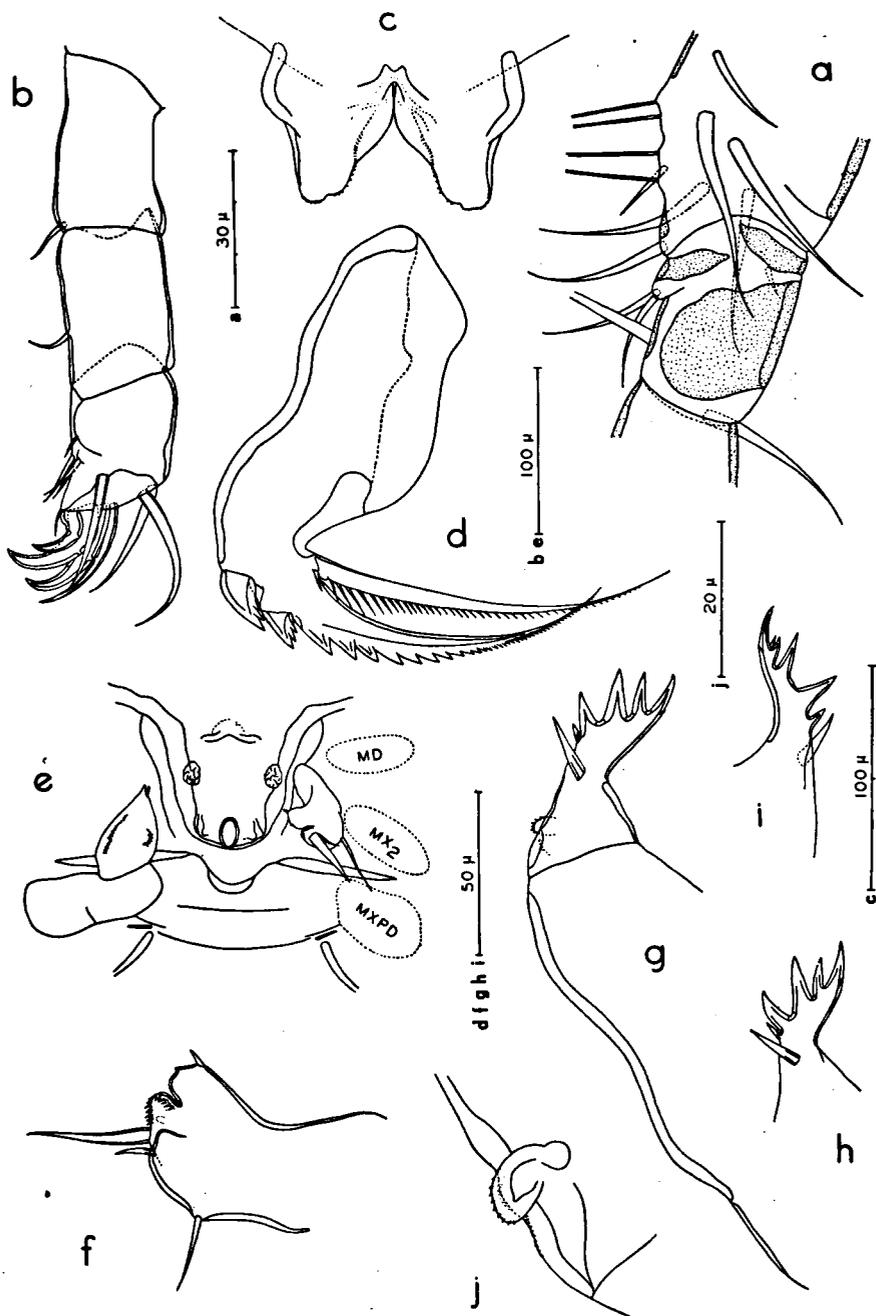


Fig. 2. *Anthesius varidens* n. sp., female, continued. — a, third segment of first antenna *in situ*, anterodorsal; b, second antenna, posteroventral; c, labrum, ventral; d, mandible, ventral; e, metastomal area showing positions of surrounding appendages, with lobes of labrum omitted, ventral; f, first maxilla, anterior; g, second maxilla, anterior; h, distal part of second maxilla of another female, anterior; i, distal part of second maxilla (drawn from a female not of the type lot), posterior; j, protuberance on distal segment of second maxilla, ventral.

medial margin a group of 4 short setae (representing the armature of the original third segment) and distally 4 claws, 3 long setae, and a small hyaline seta near the base of the innermost claw. The 3 inner claws are angularly hooked and rather strongly sclerotized. The outermost claw is more weakly unguiform, but, like the other three, it is 2-segmented and has a slit-like interruption in the sclerotization of the inner side near the tip.

The arrangement of the appendages on the cephalosome is shown in fig. 1e. It will be noted that the lateral edges of the area immediately in front of the labrum are ornamented with a cluster of long slender setules.

The labrum (fig. 2c), which projects from the posteroventral surface of the region immediately anterior to it, has a deeply incised posterior margin as shown in the figure.

The mandible (fig. 2d) has, as usual, an apical lash, at whose base on the medial side are two ornamented toothlike elements articulated at the base and a long outer setiform structure. This last structure, although delimited proximally by a sharp break in the sclerotization, does not appear to be articulated. There is a minute setule at its base (possibly comparable with the similarly placed larger structure in *A. ovalipes* – see below). The lateral setules along the proximal part of this setiform structure are relatively long, about twice the width of the structure from which they arise.

Paragnaths are probably absent, although a pair of roughened projections at the level of the first maxillae and mandibles suggests such structures (see fig. 2e).

A metastomal area, which lies between the mouthparts and thus is not shown in fig. 1e, is tongue-shaped, delimited laterally by heavy sclerotizations and posteriorly by a slightly separate area. The latter may represent the original intercoxal plate of the maxillipeds fused to the ventral body surface. Just in front of this latter area there is an ovoid prominence (fig. 2e).

The first maxilla (fig. 2f) is a flat bilobed plate. The outer, larger lobe bears a slender smooth seta, an articulated spine, and between them a small spiniform process; the inner angle of this lobe bearing a second small spiniform process and a circlet of small spinules. The smaller inner lobe bears a small spine (whose articulation is obscure) and a minute denticulation.

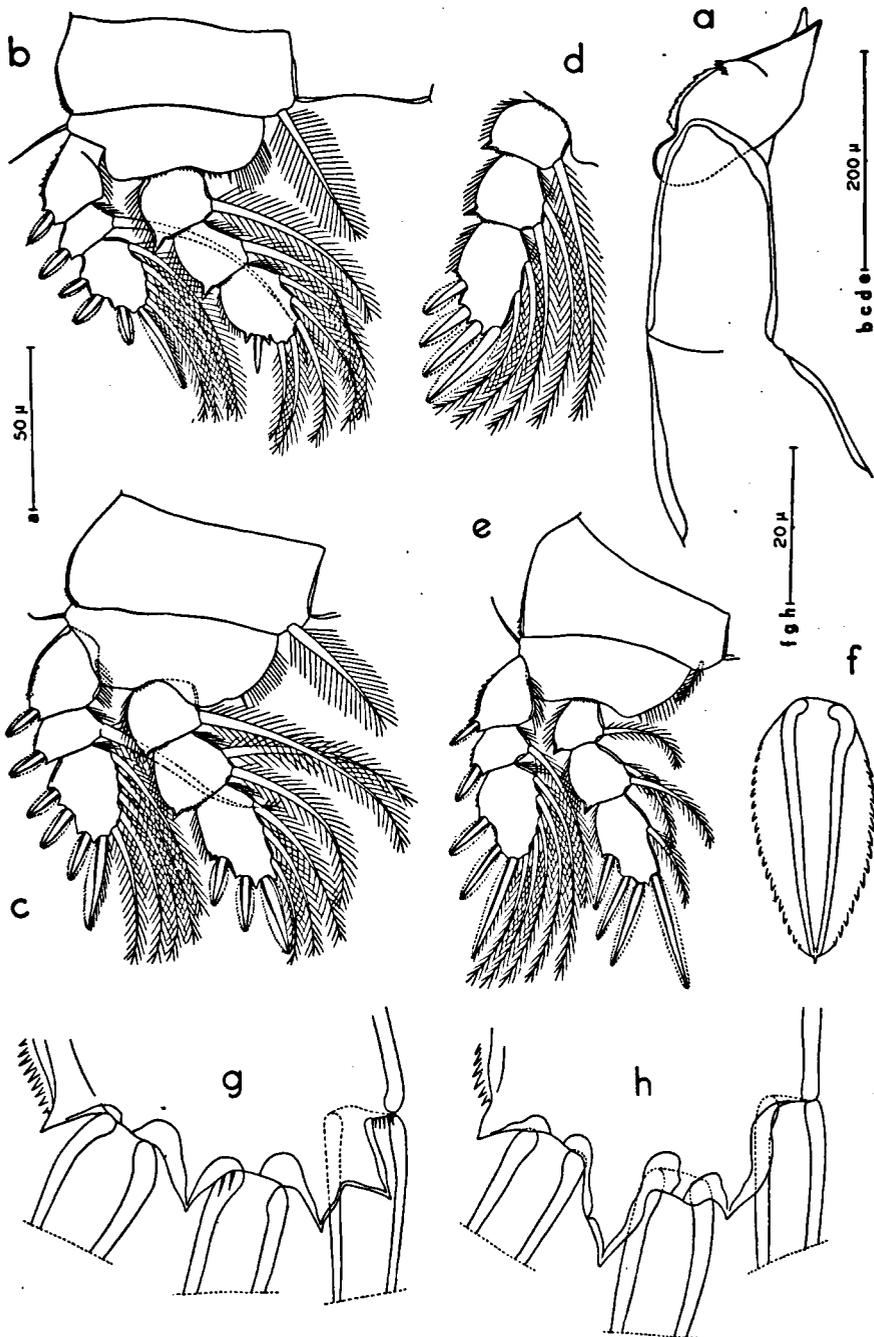


Fig. 3. *Anthesius varidens* n. sp., female, continued. — *a*, maxilliped, ventral; *b*, leg 1 and part of intercoxal plate, anterior; *c*, leg 2, anterior; *d*, endopod of leg 3, anterior; *e*, leg 4, posterior; *f*, proximal spine on exopod of leg 1; *g*, distal margin of endopod of leg 3, anterior; *h*, distal margin of endopod of leg 2, anterior.

The second maxilla (fig. 2g) has a large proximal segment and a smaller distal segment. The latter extends into a short process whose median margin is provided with several coarse irregular teeth. There are usually 6 teeth, the first small, the next 2 large, the fourth variable (compare fig. 2g with fig. 2h), the fifth large, and the distalmost small. Occasionally there are 7 teeth (fig. 2i), a small tooth being added between the fourth and fifth teeth. An accessory spine (often rather hyaline) occurs on the posterior surface of the distal segment. On the proximal median surface of the distal segment there is a small rounded well-sclerotized protuberance armed with minute spinules (fig. 2j) and an adjacent row of similar spinules.

The maxilliped (fig. 3a) is obscurely 3-segmented. The last segment bears terminally 2 small processes; proximally on the median surface there is a weak spinose protuberance and more laterally a narrow irregular hyaline lamella.

The postoral protuberance is prominent and well-defined. Its shape in ventral view is indicated in fig. 1e. Between the postoral protuberance, partly surrounded by its posterior edge and the intercoxal plate of leg 1 there is a small tongue-shaped sclerite. The similar arrangement of a large triangular sclerite followed by a small sclerite, the articulation between them being an intimate one, occurs between each pair of legs 1-4.

Legs 1-4 (figs. 3b, 3c, 3d, and 3e) are biramous, with each ramus being trimerous. They present no unusual characters, though the terminal segments of both the exopods and endopods of all the legs seem to be less elongate than in most other species. The chaetotaxy of these legs is:

	leg 1		leg 2		leg 3		leg 4	
	exp	end	exp	end	exp	end	exp	end
1st segment	I:0	0:1	I:0	0:1	I:0	0:1	I:0	0:1
2nd segment	I:1	0:1	I:1	0:2	I:1	0:2	I:1	0:2
3rd segment	III,I,4	I,5	III,I,5	III,3	III,I,5	IV,2	II,I,5	IV,1

The fine ornamentation of the legs is shown in the figures. The proximal spine on the exopod of leg 1 bears a minute terminal setule

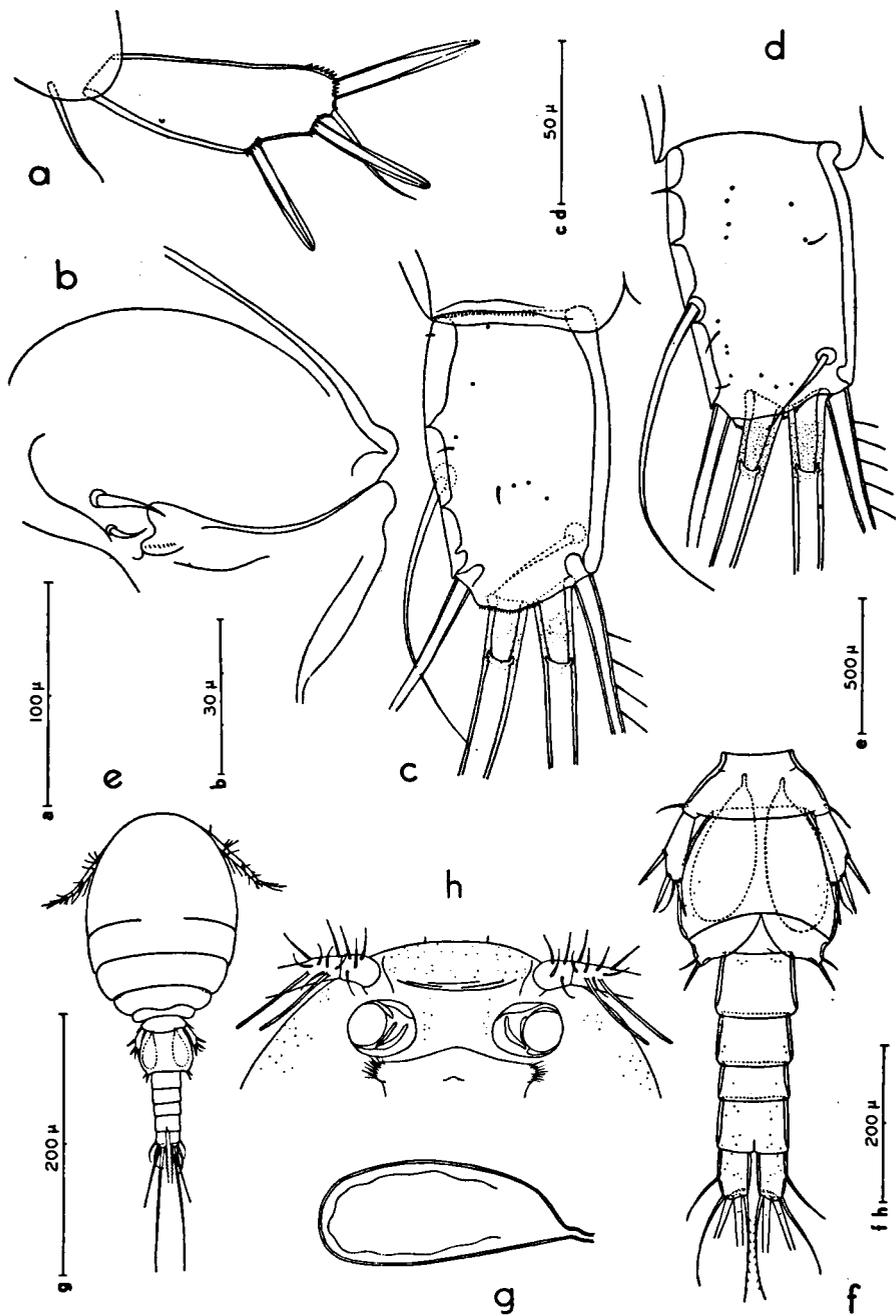


Fig. 4. *Anthessius varidens* n. sp., female, continued (a-d), and male (e-h). — a, leg 5, ventral; b, leg 6, dorsal; c, caudal ramus, ventral; d, caudal ramus, dorsal; e, habitus, dorsal; f, urosome, ventral; g, spermatophore, attached to female; h, anterior part of cephalosome, ventral.

(fig. 3f). The innermost spinous process distally on the third endopod segment of leg 3 may be bifurcate (fig. 3g); the similar process on leg 2 is not strongly so (fig. 3h).

Leg 5 (fig. 4a) has a single free segment which is elongate, about $101 \times 39 \mu$, or nearly 3 times longer than wide. There are 1 lateral and 2 terminal spines (one of which could possibly be considered as lateral), all being rather short (the inner terminal spine 66μ long, or a little more than half the length of the segment). The ratio between the inner edge length of the free segment and the length of the inner distal spine is 1.5 : 1 (1.48–1.60 : 1), based on 5 specimens. At the bases of these 3 spines there are ventral rows of spinules. A slender seta arises between the 2 terminal spines. The outer and inner margins of the free segment of leg 5 are devoid of additional ornamentation, but there is a small refractile knob on the ventral surface near the outer margin halfway between the lateral spine and the base of the segment. A seta is borne dorsally on a protuberant region of the body segment lying below the lateral edge of the tergal plate.

Leg 6 (fig. 4b) is probably represented by 2 small setae near the oviducal opening.

The caudal ramus (fig. 4c and 4d) is almost twice as long as wide, $90 \times 49 \mu$ (measured ventrally), and bears the usual 6 setae, all naked except for the innermost terminal seta which has an inner row of slender setules. The ratio of length to width of the ramus, measured ventrally, is 1.83 : 1 (1.76–1.92 : 1), based on 5 individuals. The dorsal seta is short, not extending much beyond the margin of the ramus in most preparations. Each of the long terminal setae (593μ and 381μ respectively) shows a finely punctate band near the base. The distal margin of the ramus overlaps ventrally and less prominently dorsally the insertion of the two long terminal setae and is provided along its ventral edge with a row of minute spinules. Both dorsal and ventral surfaces of the ramus show a few refractile points and hairs.

Coloration under reflected light (based on a specimen from *Aplysia* in Barbados): Eye red, gonad gray, intestine (with 2 transverse diverticula in the cephalothorax) brown, cephalothorax colorless, urosome light brown.

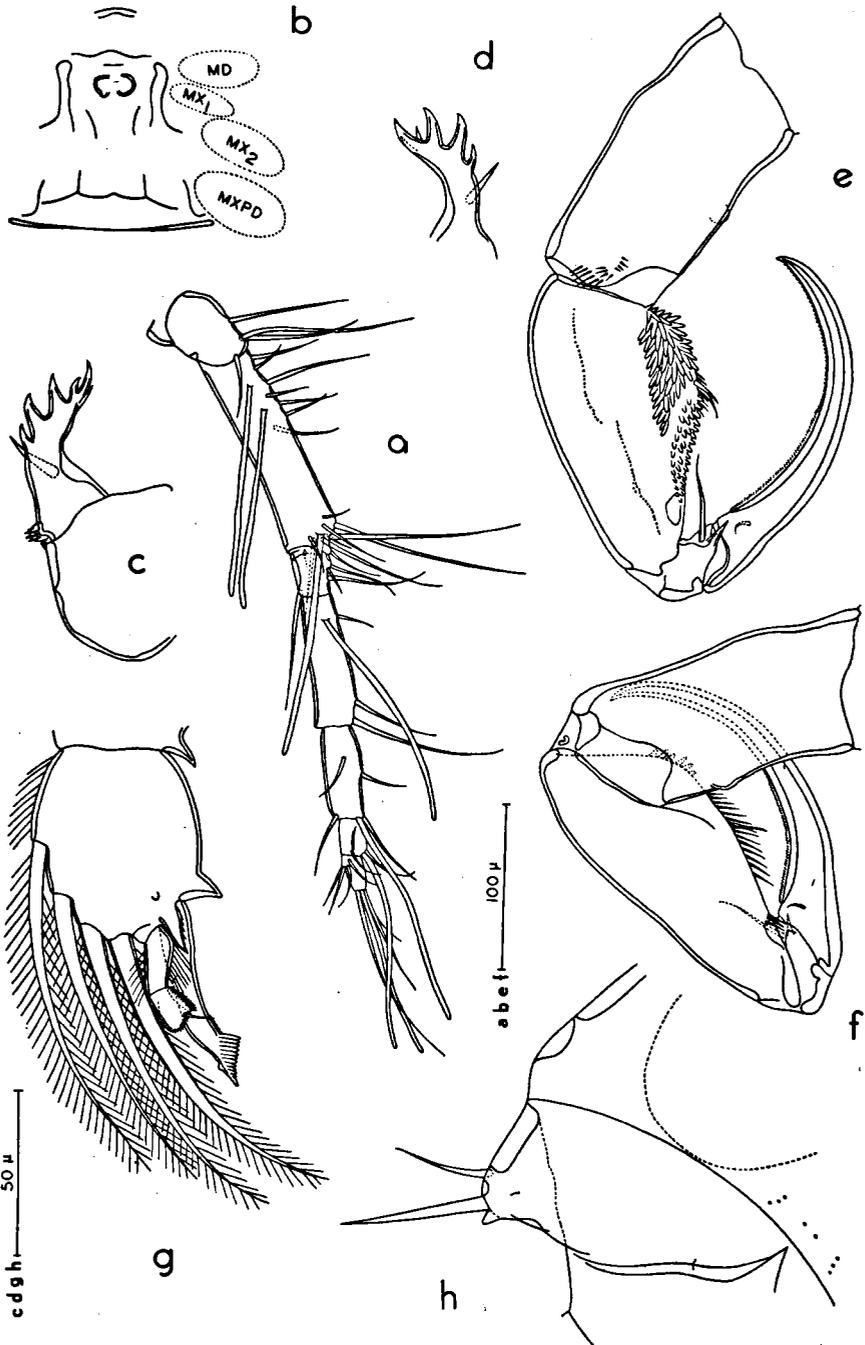


Fig. 5. *Anthesius varidens* n. sp., male. — *a*, first antenna, ventral; *b*, metastomal area, showing insertions of left appendages, ventral; *c*, second maxilla, posterior; *d*, distal part of second maxilla on opposite side of same individual, posterior; *e*, maxilliped, posteroventral; *f*, maxilliped, anterodorsal; *g*, third endopod segment of leg 1, anterior; *h*, leg 6, ventral.

Male. — The length of the body (fig. 4e) is 1.35 mm (1.23–1.44 mm), based on 10 specimens; the greatest width, at the posterior part of the cephalosome, 0.59 mm (0.56–0.63 mm). The prosome is not as broad as in the female, the ratio of length to width being 1.15 : 1. The first pedigerous segment appears to be separated on the sides from the head. In dorsal view the lateral areas of the second, third, and fourth pedigerous segments are not as expanded as in the female.

The genital segment (fig. 4f) is widest in its posterior half. The postgenital region is 4-segmented. As in the female, the genital and succeeding segments have scattered refractile points. The anal segment has a posterior ventral row of minute spinules as in the female.

The spermatophore (fig. 4g), attached to the female, is elongate, measuring $190 \times 83 \mu$ (based on one specimen), not including the neck.

The rostral area is similar to that of the female, but shows a crescentic line (fig. 4h) between the bases of the first antennae.

The first antenna (fig. 5a) resembles that of the female in segmentation, number and arrangement of setae, and ornamentation. However, the second segment has 2 long aesthetes proximally and a third aesthete distally, and the fourth, fifth, sixth, and seventh segments each have 1 aesthete, making 7 aesthetes in all. The additional aesthetes on the second and fourth segments are thus developments *de novo* rather than modified setae.

The second antenna is like that of the female, but the seta on the first segment is relatively larger and has a row of spinules along its proximal edge.

The area in front of the labrum, the labrum itself, mandibles, and first maxillae are like those of the female. There is no paragnath. No area in the metastome is particularly well-differentiated; the lateral limits are poorly defined. There is a pair of oval prominences (fig. 5b) medially at the level of the mandibles (rather than a single prominence further back) and a line between the maxillipeds, but very little indication of a possible intercoxal plate. The second maxilla (figs. 5c and 5d) resembles that of the female, with 6 distal teeth of somewhat variable form, the third tooth from the end being usually smaller and the sixth tooth larger than in the female.

The maxilliped (figs. 5e and 5f) is elongate and 4-segmented, assuming part of the claw to represent a modified fourth segment. The first segment is subcylindrical, with a distal group of setules and with a slight knob on the anterior margin. The second segment is only moderately expanded. It is provided on its dorsomedial surface with the usual 2 setae, with a row of setules lateral to the bases of these setae, and with 2 conspicuous patches of rather blunt, somewhat digitiform spines. Near the medial distal angle there is a group of slender setules. In addition, there is a narrow interrupted line of minute denticles along the middle of the posteroventral surface of the segment. The third segment is very short, and is armed with a single seta and a spiniform process. The claw is gently arcuate, slender, about 208 μ long (based on one specimen and measured from the base to the tip, not around the curvature), with a small seta near its base on the anterodorsal and inner side; it has on its concave margin proximally a fringe of minute setules which grades distally into a row of very small spinules.

Legs 1-4 are similar to those of the female and have the same chaetotaxy, except for the last segment of the endopod of leg 1 (fig. 5g). Here the outer terminal spine is slightly bent and twisted and bears along its distal outer edge a series of rather blunt slender projections. The spiniform process corresponding to the one on the inner side of this spine in the female is much larger, ornamented on its outer face, and lies anterior to the base of the outer terminal spine. The outermost of the 5 setae is modified to a short curved spine with a distal hyaline pectinate fringe and a slender hyaline tip. The remaining 4 inner setae are unmodified. The formula for this segment thus becomes II,4.

Leg 5 resembles that of the female.

Leg 6 (figs. 4f and 5h) is represented posterolaterally on the genital segment by a ventral flap which bears 2 short unequal setae and a minute dentiform process terminally.

The caudal ramus is like that of the female.

The name *varidens*, from Latin, *varius*, varying, not uniform, and *dens*, tooth, refers to the rather variable nature of the teeth on the second maxilla.

This species is discussed in relation to the following one, on p. 21.

***Anthessius proximus* n. sp.**

(Fig. 6)

Type material. — BARBADOS: 68 females, 54 males, and 7 copepodids from washings of 115 tectibranchs, *Dolabrifera ascifera* Rang (det. Dr. Ruth D. Turner) found crawling on rocks covered with water at low tide at the point north of Sandy Lane Bay, Holetown, 13°10'40" N, 59°38'36" W; collected by AGH and RUG June 25, 1959. The holotype female, allotype male, and 29 paratypes (16 females and 13 males) have been deposited in the United States National Museum, Washington; the same number of paratypes in the Zoölogisch Museum, Amsterdam, and in the British Museum (Natural History), London; and the remaining paratypes in the collection of A. G. Humes.

Other specimens. — BARBADOS: 1 male from 3 *Dolabrifera ascifera* under intertidal rocks at River Bay, June 21, 1959; 9 females and 4 males from 39 of the same host under dead intertidal coral at the point north of the Colony Club, St. James, June 23, 1959. Both collections by AGH and RUG. — CURAÇAO: 1 female from 1 specimen of the tectibranch *Petalifera petalifera* (Rang) (det. C. J. van Eeken) found at the water-line under a stone at Piscadera Bay, collected by JHS December 20, 1958.

Female. — The form of the body (fig. 6a) is much like that in *A. varidens*. The body length is 1.42 mm (1.32–1.51 mm), based on 10 specimens; the greatest width, in the posterior part of the cephalosome, 0.63 mm (0.55–0.69 mm).

Except for the following points the external morphology of this species resembles that of *A. varidens*.

The first antenna is very slightly stouter, having a length to width ratio of 13.2 : 1 (13.1–13.4 : 1), based on 5 individuals (the width being taken at the broad distal part of the second segment).

The mandible resembles that of *A. varidens*, but the setule at the base of the long outer setiform structure is absent, and instead at that point there is a hyaline, partly divided lamella (fig. 6b). The lateral setules along the proximal part of the long outer setiform structure are relatively short, only about as long as the width of the structure from which they arise.

The second maxilla usually has 6 teeth (figs. 6c and 6e), but occasionally has 7 (fig. 6d). The third tooth from the distal end is usually distinctly smaller than the 2 adjacent teeth.

Leg 5 (fig. 6f) resembles that of *A. varidens*, but the free segment is $77 \times 26 \mu$, or 2.9 times longer than wide, and the distalmost spine is 47μ long. The ratio between the inner edge length of the free segment and the length of the inner distal spine is 1.6 : 1

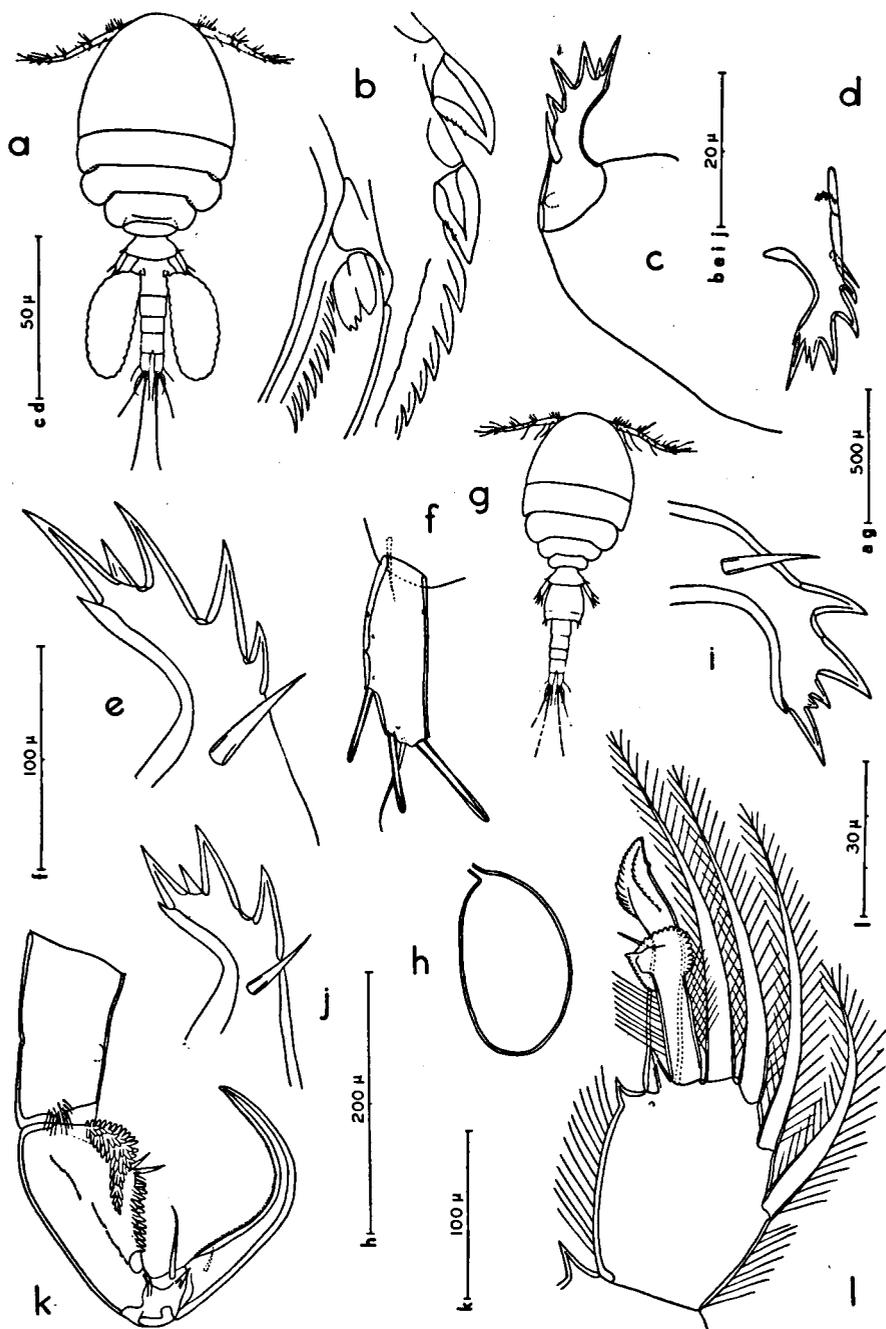


Fig. 6. *Anthesius proximus* n. sp., female (a-f), male (g-l). — a, habitus, dorsal; b, median part of mandible; c, second maxilla, anterior; d, distal part of second maxilla of another female, posterior; e, distal part of second maxilla of still another female, anterior; f, leg 5, ventral; g, habitus, dorsal; h, spermatophore, attached to female; i, distal part of second maxilla, anterior; j, distal part of second maxilla on opposite side of same individual, anterior; k, maxilliped, posteroventral; l, third endopod segment of leg 1, anterior.

(1.55–1.71 : 1), based on 5 specimens. The rows of spinules at the bases of the 2 distal spines are very inconspicuous and seen only with high magnification (oil immersion, 1455 \times); the spinules at the base of the third spine are absent.

The caudal ramus, very similar to that of *A. varidens*, measures ventrally $82 \times 38 \mu$, the length to width ratio being 2.14 : 1 (2.03–2.25 : 1), based on 5 individuals. The 2 long terminal setae are 315 and 187 μ in length respectively.

Coloration (based on the specimen from *Petalifera* in Curaçao): body translucent, intestine brown red, egg sacs and ovaries white, eye pale red; color under reflected light of a specimen from *Dolabrifera* in Barbados: eye red, body colorless.

Male. — The body (fig. 6g) is of the usual form, its length 1.02 mm (0.91–1.11 mm), based on 10 specimens; the greatest width, at the posterior part of the cephalosome, 0.41 mm (0.39–0.44 mm).

Details of its structure resemble *A. varidens* except for the following features.

The spermatophore (fig. 6h) is less elongate and more spherical in outline, measuring $133 \times 83 \mu$ (based on one specimen), not including the neck.

The first antenna resembles that of *A. varidens*, but in one male the first antenna of one side lacked the long proximal aesthete on the fourth segment and the more proximal of the 2 distal setae of this segment was transformed into an aesthete.

The teeth of the second maxilla generally resemble those of *A. varidens*, but the form of the teeth may vary (figs. 6i and 6j).

The maxilliped (fig. 6k) has a claw 140 μ long (based on one specimen and measured as before), more arcuate than in *A. varidens*.

The last segment of the endopod of leg 1 (fig. 6l) bears modified armature as in *A. varidens*. The outer terminal spine is similarly bent and twisted, and bears 2 rows of denticles, instead of a single row. The modified seta next to the spine is very similar to that of *A. varidens*.

Leg 6 in some specimens lacks the minute dentiform process near the base of the larger seta.

The name *proximus* alludes to the close resemblance of this species to *A. varidens*.

TABLE 1.

	<i>A. varidens</i>	<i>A. proximus</i> from <i>Dolabriera</i>	<i>A. proximus</i> from <i>Petalifera</i>
Female size	1.67 × 0.84 mm (1.60–1.79 × 0.80–0.88 mm)	1.42 × 0.63 mm (1.32–1.51 × 0.55–0.69 mm)	1.27 × 0.72 mm
A ₁ ratio of length to width mandible	12.7:1 (12.2–13.2:1) a setule at base of long outer setiform structure; setules on edge of this structure about twice the width of the structure	13.2:1 (13.1–13.4:1) hyaline, partly divided lamella at base of long outer setiform structure; setules shorter, about equal to width of structure	9.3:1 as <i>Dolabriera</i> specimens
F ₆ ratio of length of free segment to inner distal spine	1.5:1 (1.48–1.60:1)	1.6:1 (1.55–1.71:1)	1.60:1
F ₆ spinules	well-developed rows of spinules at bases of all 3 spines	extremely minute spinules at bases of 2 distal spines; none at lateral spine	no well-developed spinules
caudal ramus, ratio of length to width	1.83:1 (1.76–1.92:1)	2.14:1 (2.03–2.25:1)	2.17:1
Male size	1.35 × 0.59 mm (1.23–1.44 × 0.56 × 0.63 mm)	1.02 × 0.41 mm (0.91–1.11 × 0.39–0.44 mm)	male unknown
spermatophore	190 × 83 μ	133 × 83 μ	
maxilliped claw	208 μ, gently arcuate	140 μ, more strongly arcuate	
P ₁ end, spine on last segment	with 1 row of denticles	with 2 rows of denticles	

The above description is based on specimens associated with *Dolabriifera* found on Barbados. The specimen associated with *Petalifera* in Curaçao is very similar, but differs in the markedly less slender A_1 and also in the dimensions of the body. The differences between the Barbados and Curaçao specimens, as well as the characteristics of the new species *A. varidens* described above, are summarized in Table 1.

Provisionally we consider the associates of *Dolabriifera* and *Petalifera* identical, but treat the material from *Notarchus* and *Aplysia* as a different species, *A. varidens*. We do not think that *varidens* and *proximus* can easily be considered subspecies on the present evidence since

(a) they are sympatric over a considerable part of their range (Barbados to Curaçao, about 700 miles); in one locality in Barbados hosts of the two forms occurring even within a few feet of each other; (b) there is little overlap or intergradation in the characters used to separate them (see Table 1).

Similarly, categories such as the biological race appear to be ruled out by the fact that each form was associated with two host species (the four hosts belonging to separate genera).

A similar pair of closely related species is seen in *Anthessius arenicola* and *A. teissieri* (cf. BOCQUET & STOCK, 1958). A third such pair is discussed later in this paper, namely *A. ovalipes* and *A. concinnus*.

It is interesting to note that *A. varidens* and *A. proximus* morphologically resemble closely *A. lighti* in some respects despite their separation in the key. *A. lighti* is also associated with a tectibranch, *Aplysia californica* Cooper, in California (ILLG, 1960).

***Anthessius sensitivus* n. sp.**

(Figs. 7-11)

Type material. — BONAIRE: (a) 1 ovigerous female from washings of various simple ascidians in a depth of 2 meters at Paloe (= Playa) Lechi, 12°10'20" N, 68°15'50" W; collected by JHS December 24, 1958. This holotype female has been deposited in the Zoölogisch Museum, Amsterdam, Co. 100.653. (b) 1 female in washings of 40 specimens of the snail *Vasum capitellum* (L.) in a depth of about 1½ meters near Punt Vierkant; collected by JHS December 23, 1958. This paratype female has been deposited in the Zoölogisch Museum, Amsterdam, Co. 100.654.

Female. — The total length of specimen (a) is 1.28 mm, of specimen (b) 1.65 mm. The greatest width of specimen (a) is 0.57 mm. The shape of the body is shown in fig. 7b. The cephalosome and first pedigerous segment are separated laterally by furrows (segmentation lines only). The urosome is elongate. The genital segment is much longer than wide, and of a characteristic shape. The ventral surface of the anal segment (fig. 7c) bears, near its

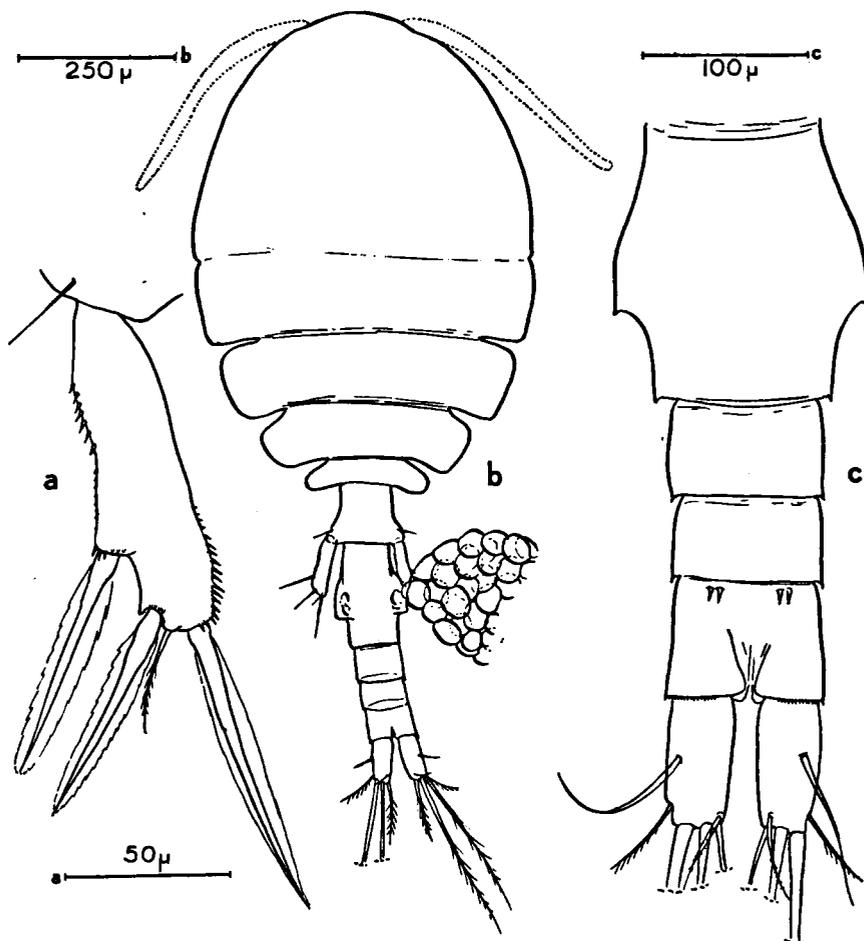


Fig. 7. *Anthessius sensitivus* n. sp., female. — a, leg 5, dorsal; b, habitus, dorsal; c, part of urosome (slightly depressed by cover glass), ventral.

anterior articulation, 2 groups of 2 spines each, and along its posterior margin, a row of minute spinules which extend laterally and dorsally.

The holotype bears a fragment of an egg sac, but the shape of it remains uncertain. The eggs are relatively large.

The rostral area is like that of *A. varidens*.

The first antenna (fig. 9c) is 7-segmented, but shows evidence of another partial segment between segments 2 and 3 as in *A. varidens*. The appendage appears to be very richly provided with aesthetes or aesthete-like setae as follows (numbers of them in parentheses):

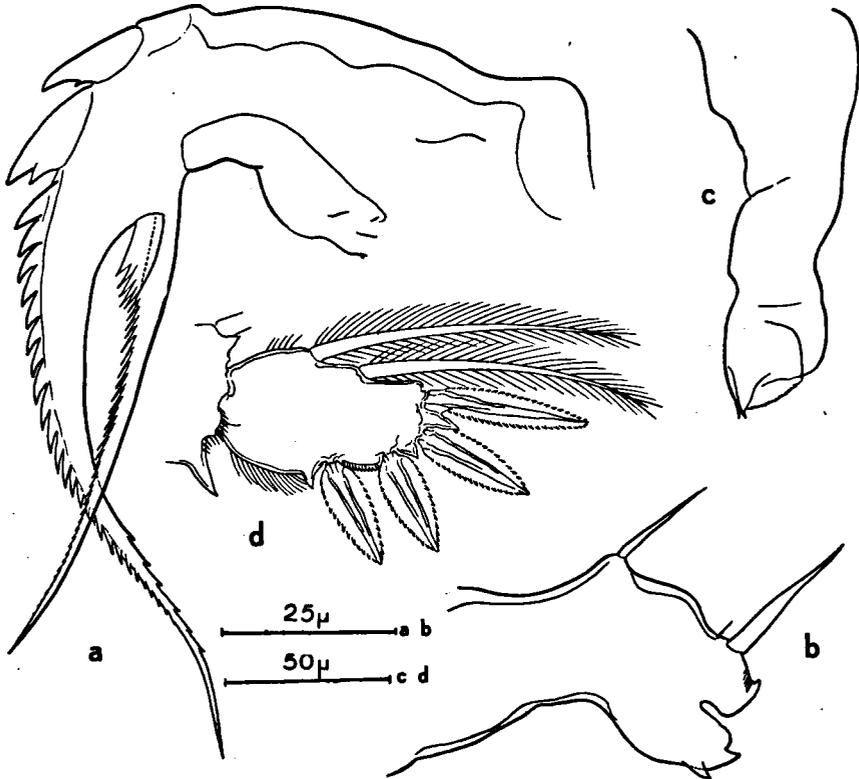


Fig. 8. *Anthessius sensitivus* n. sp., female. — *a*, mandible; *b*, first maxilla; *c*, maxilliped; *d*, third endopod segment of leg 3, anterior.

segment 1 (2), segment 2 (7), segment 3 (2), segment 4 (2), segment 5 (3), segment 6 (1), segment 7 (3). (These numbers should not be taken as absolute, since the difference between a seta and an

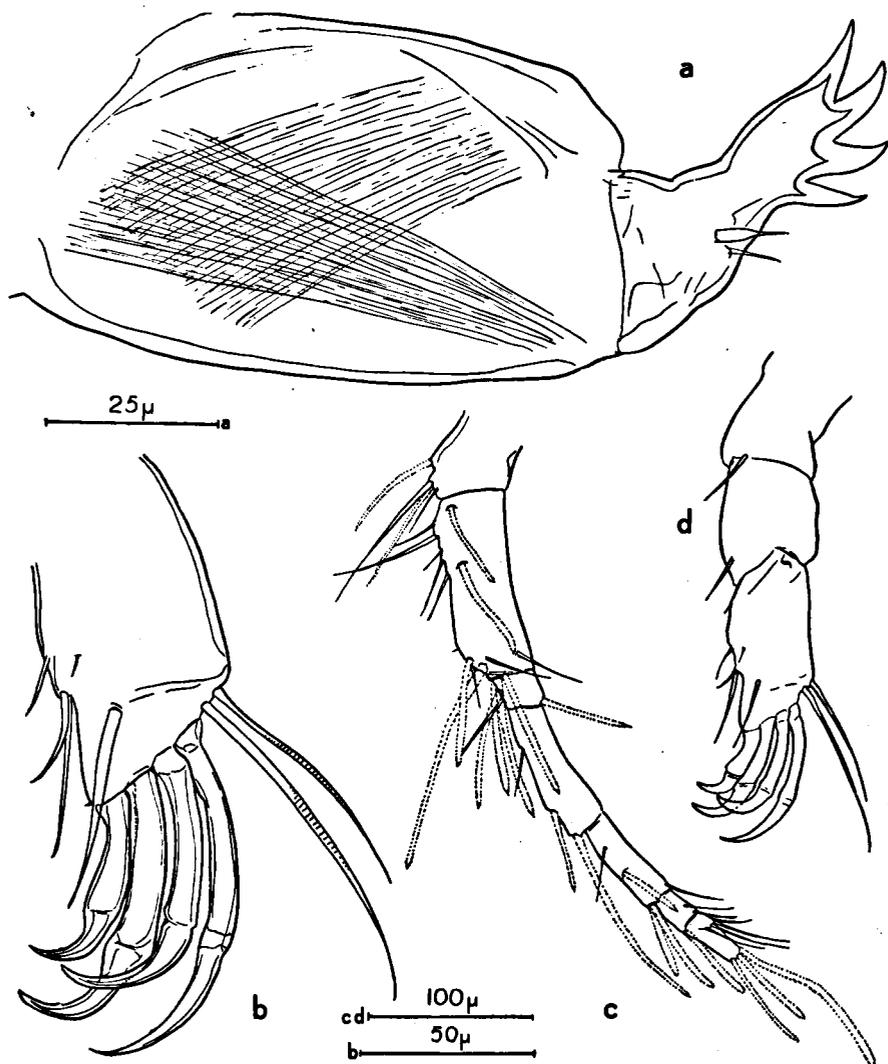


Fig. 9. *Anthessius sensitivus* n. sp., female. — *a*, second maxilla, anterior; *b*, distal part of second antenna; *c*, first antenna; *d*, second antenna.

aesthete is not always clear in mounted specimens). The total armature is the same as in *A. varidens*.

The second antenna (fig. 9d) consists of 3 functional segments. The first 2 segments each bear 1 ventral smooth seta. The distal armature of segment 3 is shown in fig. 9b. There are 4 distal claws.

The region immediately in front of the labrum, the labrum itself, and the metastomal area are like those of *A. varidens*.

The structure of the mandible (fig. 8a) is basically like that of *A. varidens*. The apical lash has a coarsely serrated margin. The 2 articulated tooth-like elements at its base each bear an auxiliary tooth. The outer setiform structure is finely serrated. A third small piece, leaf-shaped and hardly discernible, arises at the base of the setiform structure.

The first maxilla (fig. 8b) is bilobed; the inner lobe bears 2 tooth-like projections; the outer one bears a tooth-like projection, a robust smooth seta, a very small hair, and a slender smooth seta placed at some distance from the other 2 setae.

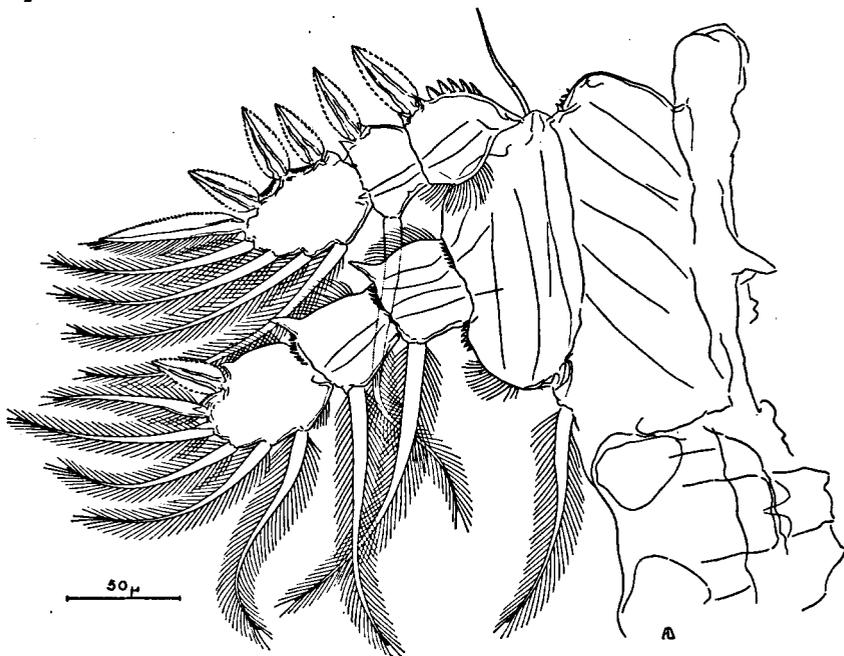


Fig. 10. *Anthesius sensitivus* n. sp., female. — leg 1, anterior.

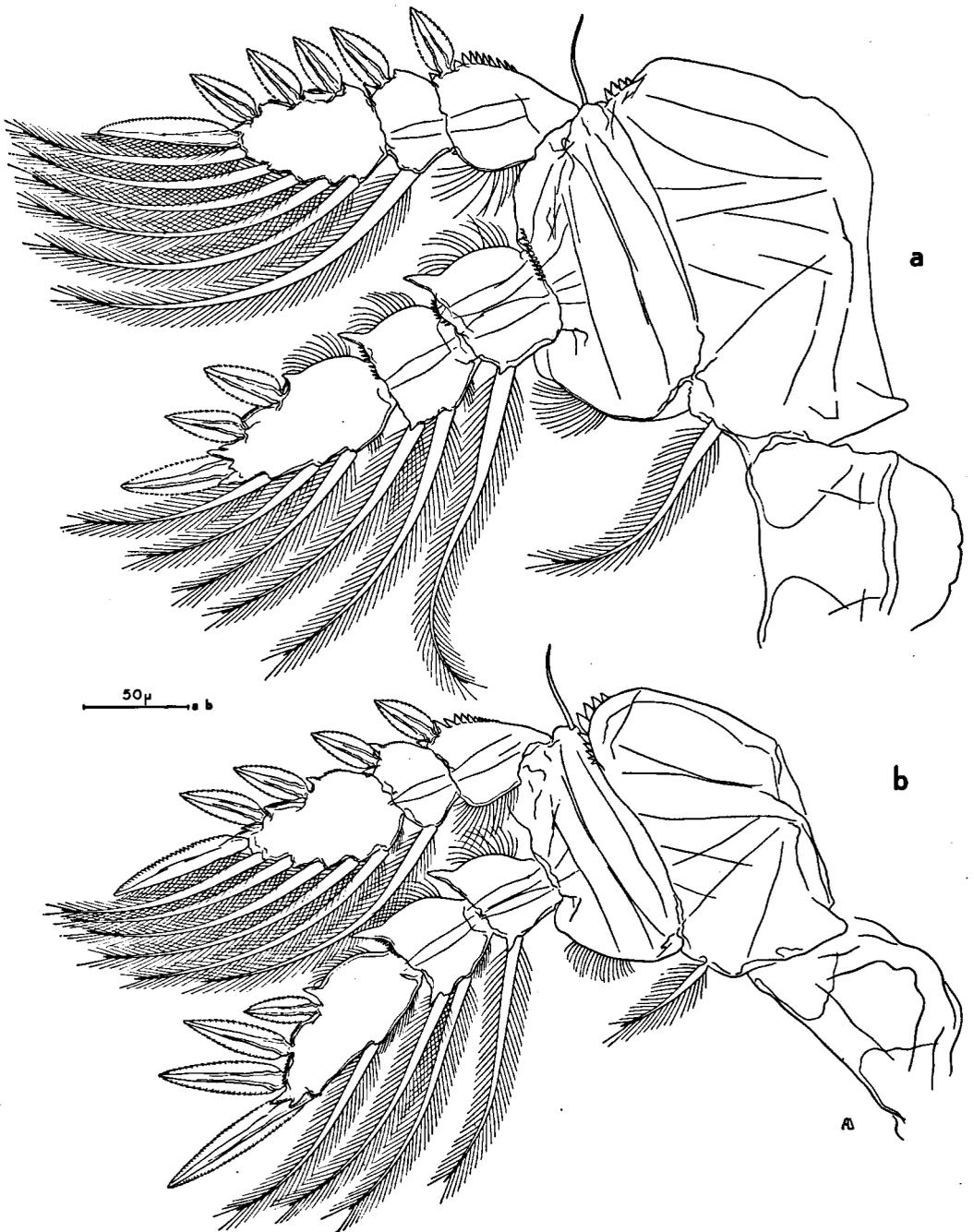


Fig. 11. *Anthessius sensitivus* n. sp., female. — a, leg 2, anterior; b, leg 4, anterior.

The second maxilla (fig. 9a) has a strong basal segment and an apical process armed with only 4 strong, slightly curved teeth. A spine is borne at the base of the process.

The maxilliped (fig. 8c) is phallus-shaped and obscurely 3-segmented; the distal margin is crenulated and armed with 2 small spiniform projections.

The postoral protuberance resembles that of *A. varidens*.

Legs 1, 2, and 4 are as illustrated (figs. 10, 11a, and 11b). The third leg is nearly identical with the second, except for a slightly different armature of the third endopod segment (fig. 8d). The chaetotaxy of the legs is like that of *A. varidens*.

A seta arises dorsally near the base of the fifth leg (fig. 7a). The free segment of this leg is very slender ($3\frac{1}{2}$ times as long as wide). Its lateral margin bears a proximal row of about 7 short but robust spinules. Six spinules arise at the base of the lateral spine. The 2 distal spines (between which a plumose seta is borne) have a few basal spinules. The inner distal margin of the segment bears a row of about 18 short, conical spinules.

The caudal rami (fig. 7c) are a little longer than the anal segment, and twice as long as wide; in specimen (a) about $83 \times 40 \mu$. A long smooth seta arises at approximately the middle of the lateral margin of the ramus. There are 3 feathered terminal setae, the central one being the longest, the median one the shortest; furthermore there is one subterminal lateral seta (feathered on one side only) and a subterminal medial dorsal seta.

Coloration: In life the specimens were semitransparent, white to colorless. The ovaries shone pale yellowish, and the intestine dark chestnut brown, through the body wall. The egg sac was yellowish gray.

Male. — Unknown.

The name *sensitivus*, from mediaeval Latin, alludes to the large number of aesthete-like structures on the first antenna.

This species may be differentiated from others of the genus in the key above.

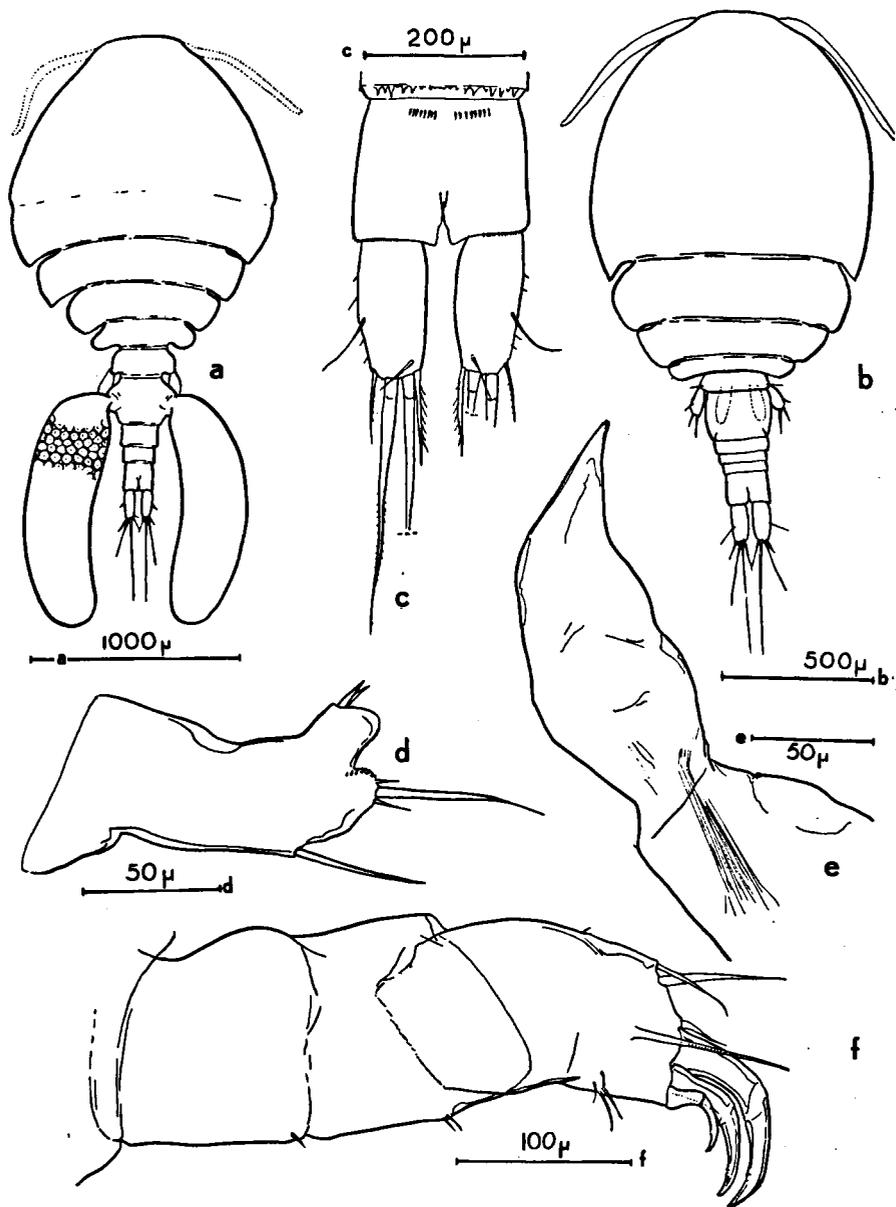


Fig. 12. *Anthesius ovalipes* n. sp., female and male. — *a*, habitus of female, dorsal; *b*, habitus of male, dorsal; *c*, anal segment and caudal rami of female, ventral; *d*, first maxilla of female; *e*, maxilliped of female; *f*, second antenna of female.

Anthessius ovalipes n. sp.

(Figs. 12-16)

Type material. — CURAÇAO: 3 females, 2 males, and 1 copepodid from the gills of 1 specimen of an acoele opisthobranch, *Pleurobranchus areolatus* Mitch. (det. C. J. van Eeken) under a stone in about 2 meters depth, Piscadera Bay, 12°08' N, 68°59' W; collected by JHS October 16, 1958. The holotype female, allotype male, paratype female, and copepodid have been deposited in the Zoölogisch Museum, Amsterdam, Co. 100.627a-d.

Female. — The total length (excluding the setae of the caudal rami) of 3 specimens is 2.43, 2.50, and 2.58 mm. The prosome (fig. 12a) is fairly large, oval in outline. The cephalosome is fused with the first pedigerous segment, though their limits remain visible by an indistinct furrow in the lateral margin of the cephalothorax and by a trace of an intersegmental line dorsally and laterally (no functional articulation). The urosome consists of 5 segments, of which the genital segment is the widest. The posterior margin of urosomal segments 2, 3, and 4 bears, on the animal's ventral side, irregular sclerotized denticulations or serrations (fig. 12c). The ventral surface of the anal segment (fig. 12c) bears, near its anterior margin, 2 rows of 7 or 8 spinules each, separated in the median line of the body; at its posterior margin, at the lateral areas of the implantation of the caudal rami, a row of minute spinules is found.

The egg sacs are sausage-shaped, extending even beyond the setae of the caudal rami and containing numerous small eggs in multi-serial arrangement.

The rostral area is like that of the preceding species.

The first antenna (fig. 13b) is 7-segmented. The second segment is very elongate, about as long as segments 3, 4, 5, and 6 combined. The setae on the first antenna are short and their number is the same as in the other species. An aesthete occurs on each of segments 5, 6, and 7.

The second antenna (fig. 12f) is very short and robust, consisting of 3 functional segments. Segments 1 and 2 bear 1 and 2 ventral spinules respectively. Segment 3 has a group of 4 short setae near the middle of the outer margin. The distal armature consists of 2 outer subterminal smooth setae; 1 long, posterior, subterminal,

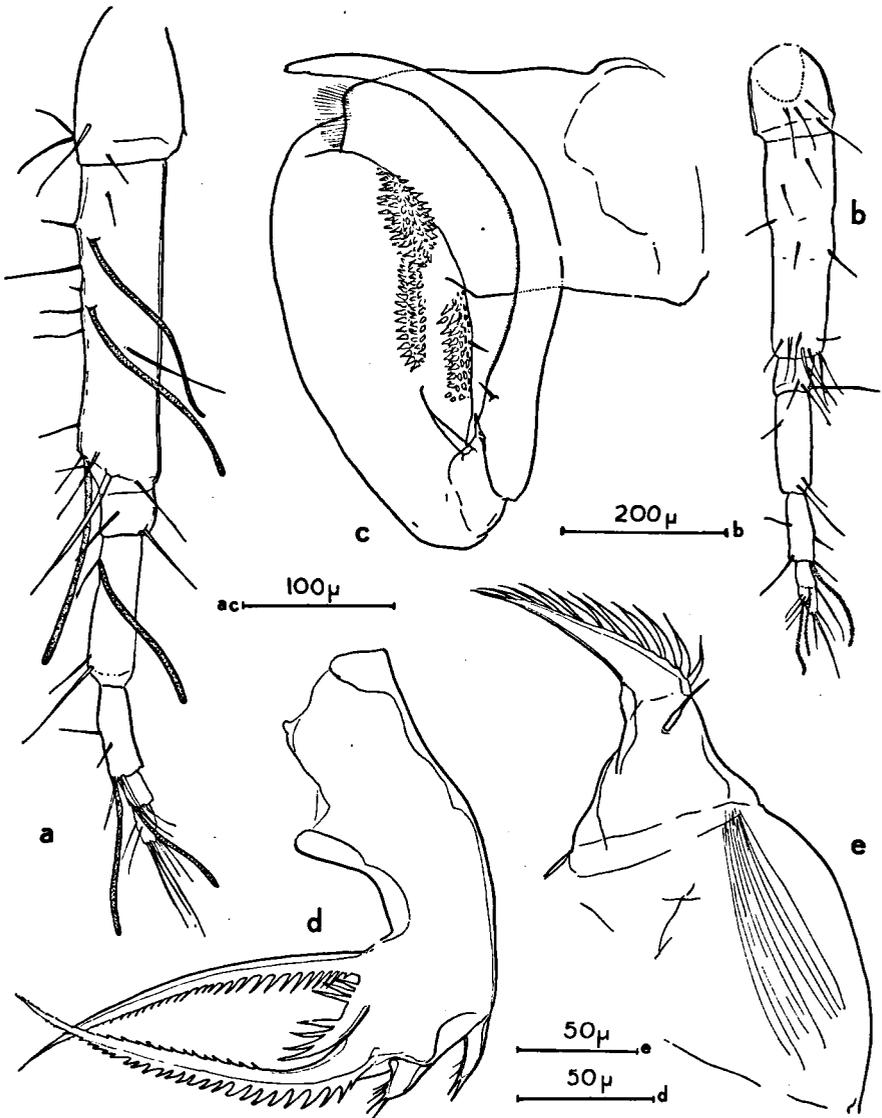


Fig. 13. *Anthessius ovalipes* n. sp., female and male. — *a*, first antenna of male; *b*, first antenna of female; *c*, maxilliped of male; *d*, mandible of female; *e*, second maxilla of female.

annulated seta; 1 short, terminal, smooth seta (perhaps homologous with a fourth claw); 3 terminal claws of decreasing lengths, each with an articulation or pseudo-articulation in its middle.

The region immediately in front of the labrum, the labrum itself, and the metastomal area are like those of the preceding species.

The structure of the mandible (fig. 13d) is basically like that of the preceding species, but there is a short, dentate lash armed with 6 long teeth at one side only implanted between the apical lash and the setiform structure. This shorter lash is particularly interesting in view of the presence of a well-developed element at this point in *Katanthessius delamarei* Stock, 1960. The 2 articulated tooth-like elements at the base of the apical lash are very prominent; both bear about 5 needle-shaped denticulations.

The first maxilla (fig. 12d) is of the typical bilobed pattern. The inner lobe bears 2 spinules only. The outer lobe bears a long, smooth seta and 2 much smaller additional setae; moreover, a row of about 6 spinules form part of its armature. A long, smooth seta is placed at some distance from the tip of the outer lobe.

The second maxilla (fig. 13e) is of the normal lichomolgid pattern. The teeth on the distal process, about 10 in number, are long, more slender than in the preceding species, sharp, and somewhat recurved.

The maxilliped (fig. 12e) is indistinctly 3-segmented as in the preceding species, but somewhat more reduced. The elongate, pointed distal segment is unarmed.

The postoral protuberance is similar to that of the preceding species.

Legs 1-4 (figs. 14d, 14c, 15b, and 15a) are biramous, each ramus being 3-segmented. The chaetotaxy of these legs is the same as in *A. varidens*, except for the last exopod segment of leg 4 which has the formula III,I,5 (instead of II,I,5 as in that species).

Spiniform projections are strongly developed on segments 1 (1 projection), 2 (1 projection), and 3 (2 projections) of the endopod of leg 1 (fig. 14d). Comparable spiniform projections are present on the endopods of legs 2-4, but they are (with the exception of the large projection on endopod segment 2 of leg 2, cf. fig. 14c) not unusually large. The part of leg 2 not illustrated in fig. 14c is similar to the corresponding part of leg 3.

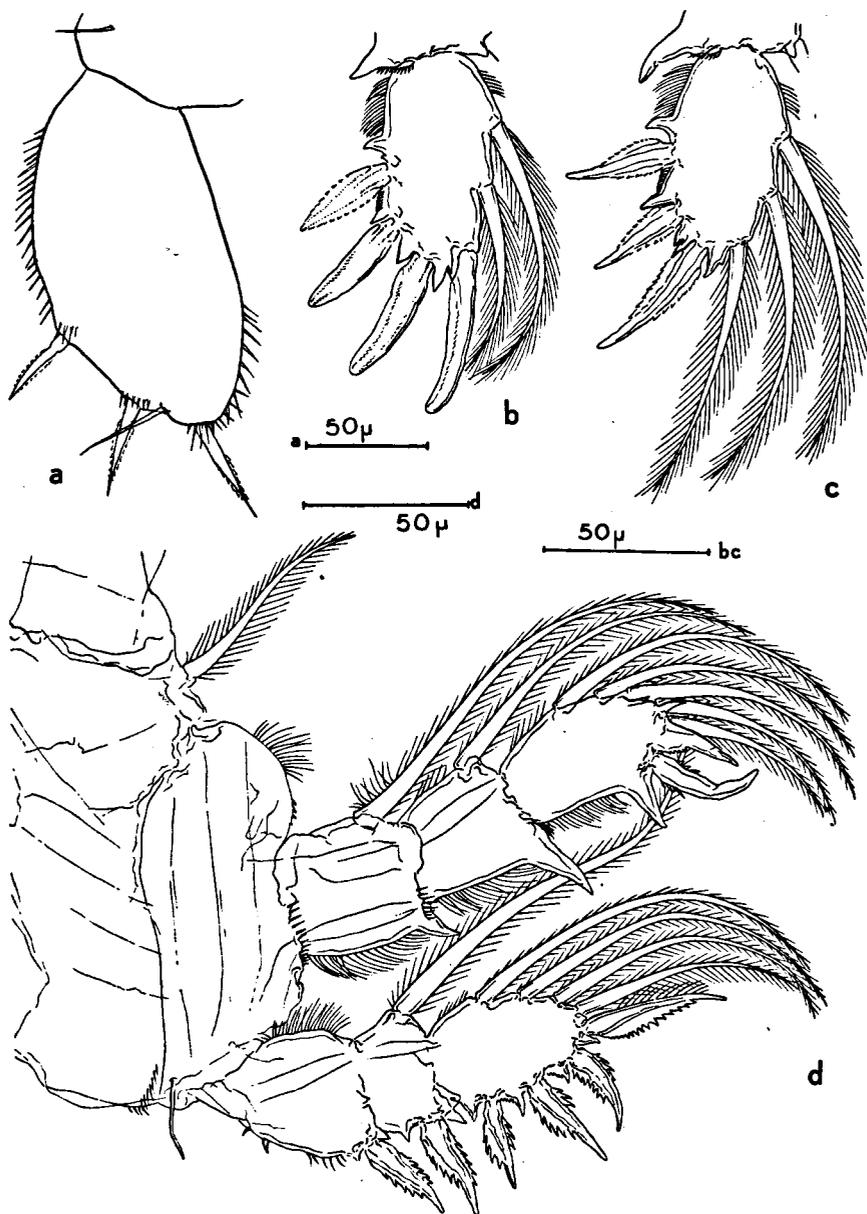


Fig. 14. *Anthessius ovalipes* n. sp., female and male. — *a*, leg 5 of female, dorsal; *b*, third endopod segment of leg 3 of male; *c*, third endopod segment of leg 2 of female; *d*, leg 1 of female.

The basal segment of leg 5 (fig. 14a) is completely fused with the 5th pedigerous segment. Only a seta indicates its former existence. The free segment is elliptical or oval in outline, distinctly less than twice as long as wide. The lateral margin bears a row of needle-shaped spinules (14 to 21 in number), proximal to the lateral denticulated spine. The latter has a small number (4 or 5) spinules at its base. The distal armature of leg 5 consists of 2 denticulated spines, between which a smooth seta, directed laterally, is implanted. The more lateral of these spines has a few spinules at its base. At the base of the more median (and distal) of these spines there is a row of spinules, which continues along the distal inner margin of the segment.

The caudal rami (fig. 12c) are a little longer than the anal segment, and about twice as long as wide. Their surfaces bear scattered hairs. A long lateral seta inserts at about 58 per cent of the length. There are 3 terminal setae; the 2 outer ones, which are the longest (inner 381 μ , outer 224 μ), bear an ornamentation of short cilia on both margins; the shorter, innermost seta is ciliated only on its inner margin. The short subterminal outer seta is also ciliated only on its inner margin. This seta appears to insert on a basal peg as do the 2 long terminal setae. A dorsal seta is implanted not far from the distal margin of the ramus.

Coloration: The body is gray-white. The egg sacs are white.

Male. — The total length (excluding the setae of the caudal rami) of both specimens examined is 1.82 mm. The external shape (fig. 12b) presents the usual sexual dimorphism. The ventral surface of the anal segment bears only 3 or 4 spinules in each of the proximal rows. The first antenna (fig. 13a) is fundamentally built in the same way as that of the female, but bears 3 aesthetes on segment 2, 1 on segment 4, 1 on segment 5, and 1 on segment 6. The second antenna and the mouth parts are essentially similar to those of the female. The maxilliped (fig. 13c) is of the usual form.

Leg 1 is similar to that of the female, with the exception of the spiniform projections on endopod segments 2 and 3, which are somewhat shorter and less curved. The terminal spine (modified seta) of endopod segment 3 which stands nearest to the outer spine is shorter than in the other sex.

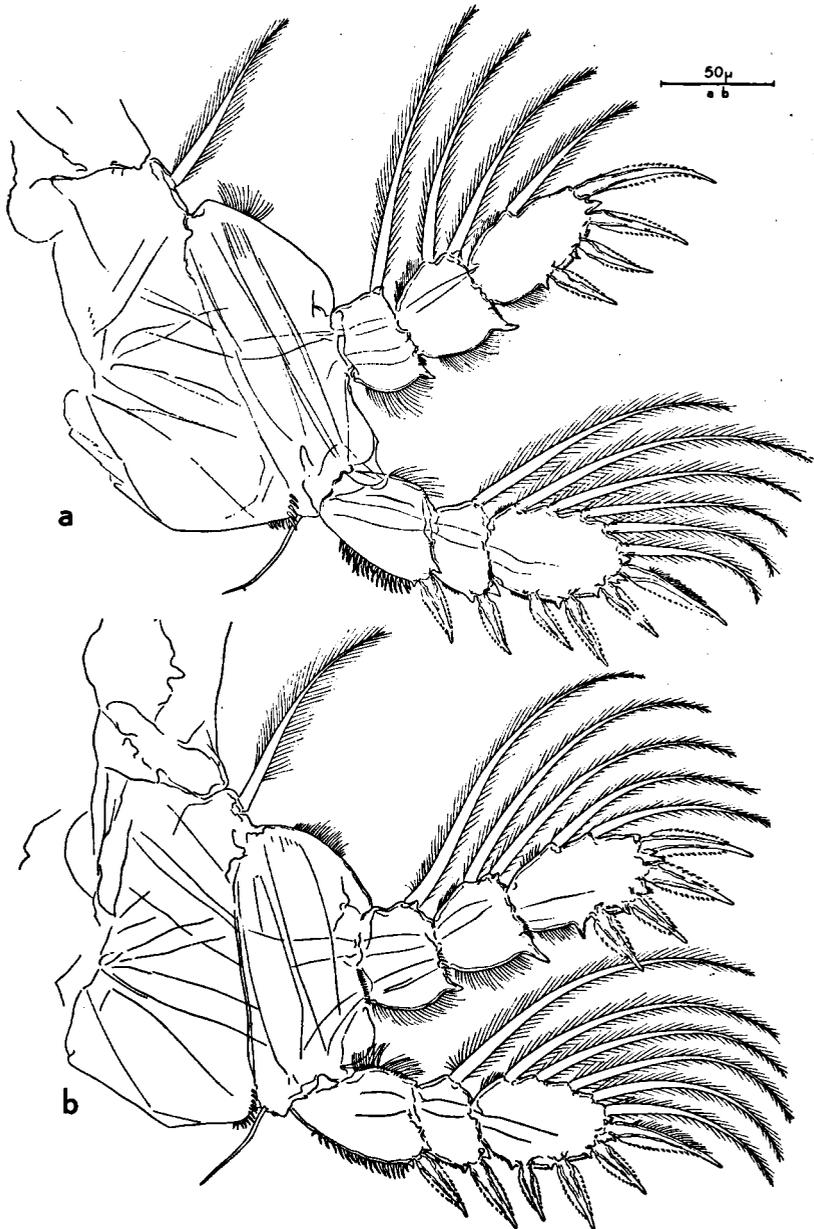


Fig. 15. *Anthessius ovalipes* n. sp., female. — a, leg 4; b, leg 3.

The second and third legs of the male differ in the armature of the distal segment of the endopod from those of the female. The spines on this segment, which are normally denticulated and pointed in the female, are smooth and obtuse in the male. The most basal spine in the male is intermediate between the normal crenulated and the transformed smooth type (fig. 14b).

Leg 5 (fig. 16a) is similar to leg 5 of the female, but the spinules are shorter and (especially on the distal inner margin of the leg) less numerous.

The name *ovalipes*, from Latin, *ovalis*, oval, and *pes*, foot, refers to the shape of the fifth leg.

Within the group of *Anthessius* species with III,I, 5 as the armature of the third exopod segment of leg 4, the new species comes nearest to *A. concinnus* (A. Scott, 1909), an East Indian species. Judging from SCOTT'S data alone, the West Indian form could quite well be considered identical with the East Indian one. Reexamination of SCOTT'S type specimens, a dissected female and 6 undissected males, proved that they are different, although perhaps closely related. The following differences were found:

(1) The East Indian species, *A. concinnus*, is slightly larger than the West Indian form:

A. concinnus – female, 2.90 mm; 6 males, 2.12, 2.31, 2.43, 2.48, 2.52, and 2.55 mm;

A. ovalipes – 3 females, 2.43, 2.50, and 2.58 mm; 2 males, 1.82 and 1.82 mm.

(2) The fifth leg of both sexes of *A. concinnus* is more slender (more than twice as long as wide) than that of *A. ovalipes* (less than twice as long as wide). In figs. 16a and 16b the fifth legs of the male of both species are illustrated on the same scale. The larger size and the more slender outline of that of *A. concinnus* are quite evident.

(3) The anal segment of both sexes of *A. concinnus* bears no spines on the anterior half of the ventral surface.

(4) The shortest of the three main mandibular elements (both sexes) bears about 10 teeth in *A. concinnus*, 6 in *A. ovalipes*.

(5) The teeth of the apical process of the second maxilla of both sexes appear a little longer in *A. concinnus* than in *A. ovalipes*.

(6) The proximal outer spine of endopod segment 3 on the second

leg of the male is completely transformed (smooth, obtuse) in *A. concinnus*; hardly transformed in *A. ovalipes*.

(7) The same holds true for the proximal outer spine of the third endopod segment on leg 3 of the male.

(8) The spines of endopod segment 3 on leg 4 of the male are normally developed (denticulated, pointed) in *A. ovalipes*; they are all transformed (smooth, obtuse) in *A. concinnus*.

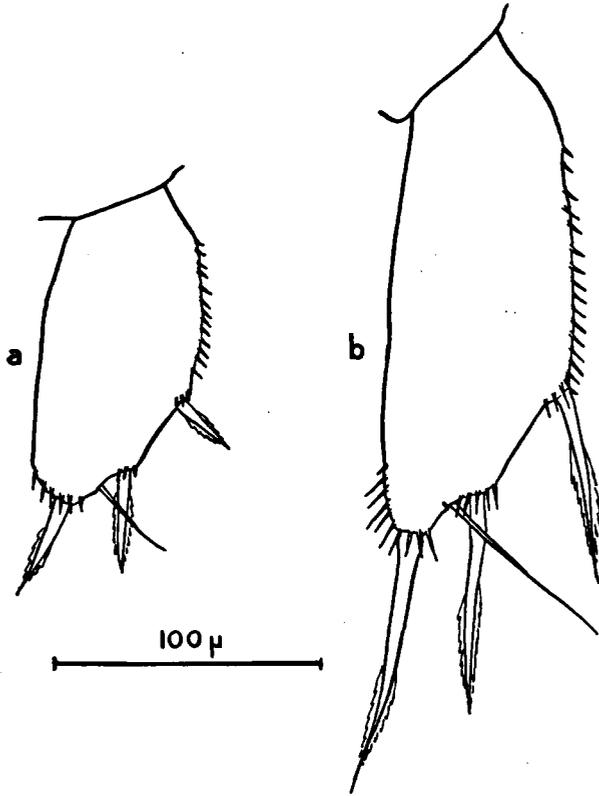


Fig. 16. Male leg 5 of *Anthessius ovalipes* n. sp. (a) and *A. concinnus* (A. Scott) (b).

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